THE STAR FORMATION NEWSLETTER

An electronic publication dedicated to early stellar evolution and molecular clouds

No. 185 — 23 Mar 2008 Editor: Bo Reipurth (reipurth@ifa.hawaii.edu)

Call for Contributions to A White Paper on Star Formation Studies with SIM

The Space Interferometer Mission (SIM) is designed to carry out astrometric measurements of objects with brightness levels ranging from $V = -1$ mag to 19 mag with an astrometric accuracy of ~ 4 μas (end of mission) relative to an absolute reference frame and < 0.1 μas (end of mission) for relative measurements between targets and reference stars within a $\sim 1^o$ field of view. Among SIM's goals are searches for planets with masses comparable to that of the Earth in the habitable zones of nearby stars, and for gas and icy giant planets around young stars (Beichman et al 2008, IAU 248, in press; Tanner et al 2007, PASP 119,747). SIM will also carry out observing programs covering many aspects of stellar astronomy, galactic astronomy and even cosmology. SIM's science program is described in Unwin et al. (2008, PASP, 120, 38; **http://www.journals.uchicago.edu/doi/abs/10.1086/525059**) and was endorsed by the 1990 and 2000 NAS/NRC decadal reviews. Most recently, the potential of an astrometric mission with SIM's capabilities for planet detection has been endorsed by the Exo-Planet Task Force of the Astronomy and Astrophysics Advisory Committee (AAAC; **http://www.nsf.gov/mps/ast/aaac/exoplanet_task_force/reports/aaac_draft.pdf**). There remains significant unallocated observing time for which NASA will eventually solicit observing time requests for new Key Projects and/or smaller General Observer programs. More information on SIM is available at **http://planetquest/SIM/sim_index.cfm**.

The projected budget for NASA's Astrophysics program has pushed the start of SIM out to no earlier than 2010 for a launch no earlier than 2015. The SIM project is proceeding with plans for a descoped version of SIM, called "SIM-Lite" which takes advantage of numerous improvements in SIM's basic technology to reduce costs while achieving comparable astrometric performance to the full SIM with the loss of 1 magnitude at the faint end or more generally with a loss of a factor of two in the number of sources that can be observed. Critical to the approval of SIM within the NASA program is a strong recommendation by the forthcoming NAS/NRC decadal review. This note solicits input from the star formation community on possible uses of SIM (or SIM-Lite) for this area of astrophysics. This information will be incorporated into a series of white papers that will assembled by the SIM Science team and forwarded to the appropriate Decadal Review panels.

The use of SIM for star formation studies should be considered in the context of future ground-based activities as well as of the European mission, GAIA, which will be launching around 2012. GAIA will have an end of mission accuracy around 10-25 μas for sources with $8 < V < 15$ mag, falling off at brighter levels due to detection saturation effects and at fainter levels due to photon noise **http://www.rssd.esa.int/index.php?project=GAIA&page=index**). Thus, we envision complementary programs between a survey mission (GAIA) capable of moderate astrometric performance at fixed cadence on large numbers of sources and a pointed mission (SIM) capable of highly precise observations at arbitrary cadence and number of observations on very bright and very faint sources.

I am taking the lead on assembling information on uses of SIM for star formation research. If you would like contribute to this white paper as an author please let me know at your earliest convenience. Also, please note that there may be near-term opportunities to participate in funded studies of new uses for SIM. Subject to approval by NASA Headquarters, these studies will be announced in the next month or so. Monitor the MSC website (**http://msc.caltech.edu**) for details of this forthcoming opportunity. Participation in the white paper activity requested here will not disqualify you in any way from participation in the funded opportunities that may later arise.

Thanking you in advance for your help,

Charles Beichman (chas@pop.jpl.nasa.gov)
Director, Michelson Science Center

Characterization of the magnetic field of the Herbig Be star HD 200775

E. Alecian[1,2], C. Catala[2], G.A. Wade[1], J.-F. Donati[3], P. Petit[3], J.D. Landstreet[4], T. Böhm[3], J.-C. Bouret[5], S. Bagnulo[6], J. Grunhut[1] and J. Silvester[1]

[1] Department of Physics, Royal Military College of Canada, PO Box 17000, Stn Forces, Kingston K7K 7B4, Canada
[2] Observatoire de Paris, LESIA, 5 place Jules Janssen, F-92195 Meudon Principal Cedex, France
[3] Laboratoire d'Astrophysique, Observatoire Midi-Pyrénées, 14 avenue Edouard Belin, F-31400 Toulouse, France
[4] Department of Physics & Astronomy, University of Western Ontario, London N6A 3K7, Canada
[5] Laboratoire d'Astrophysique de Marseille, Traverse du Siphon, BP8-13376 Marseille Cedex 12, France
[6] Armagh Observatory, College Hill, Armagh BT61 9DG, UK

E-mail contact: evelyne.alecian *at* rmc.ca

The origin of the magnetic fields observed in some intermediate-mass and high-mass main-sequence stars is still a matter of vigorous debate. The favoured hypothesis is a fossil field origin, in which the observed fields are the condensed remnants of magnetic fields present in the original molecular cloud from which the stars formed. According to this theory a few per cent of the pre-main-sequence (PMS) Herbig Ae/Be star should be magnetic with a magnetic topology similar to that of main-sequence intermediate-mass stars.

After our recent discovery of four magnetic Herbig stars, we have decided to study in detail one of them, HD 200775, to determine if its magnetic topology is similar to that of the main-sequence magnetic stars. With this aim, we monitored this star in Stokes I and V over more than 2 yr, using the new spectropolarimeters ESPaDOnS at CanadaFranceHawaii Telescope (CFHT), and Narval at Bernard Lyot Telescope (TBL).

By analysing the intensity spectrum we find that HD 200775 is a double-lined spectroscopic binary system, whose secondary seems similar, in temperature, to the primary. We have carefully compared the observed spectrum to a synthetic one, and we found no evidence of abundance anomalies in its spectrum. We infer the luminosity ratio of the components from the Stokes I profiles. Then, using the temperature and luminosity of HD 200775 found in the literature, we estimate the age, the mass and the radius of both components from their HR diagram positions. From our measurements of the radial velocities of both stars we determine the ephemeris and the orbital parameters of the system.

A Stokes V Zeeman signature is clearly visible in most of the least-squares deconvolution profiles and varies on a time-scale on the order of 1 d. We have fitted the 30 profiles simultaneously, using a χ^2 minimization method, with a centred and a decentred-dipole model. The best-fitting model is obtained with a reduced $\chi^2 = 1.0$ and provides a rotation period of 4.3281 ± 0.0010 d, an inclination angle of $60^\circ \pm 11^\circ$ and a magnetic obliquity angle $\beta = 125^\circ \pm 8^\circ$. The polar strength of the magnetic dipole field is 1000 ± 150 G, which is decentred by $0.05 \pm 0.04\ R_\star$ from the centre of the star. The derived magnetic field model is qualitatively identical to those commonly observed in the Ap/Bp stars.

Our determination of the inclination of the rotation axis leads to a radius of the primary which is smaller than that derived from the HR diagram position. This can be explained by a larger intrinsic luminosity of the secondary relative to the primary, due to a larger circumstellar extinction of the secondary relative to the primary.

Published by Monthly Notices of the Royal Astronomical Society (Vol. 385, p. 391)

Spitzer, Near-Infrared, and Submillimeter Imaging of the Relatively Sparse Young Cluster, Lynds 988e

Thomas S. Allen[1], Judith L. Pipher[1,2], Robert A. Gutermuth[3,2], S. Thomas Megeath[4,2], Joseph D. Adams[5], Terry L. Herter[5], Jonathan P. Williams[6], Jennifer A. Goetz-Bixby[1], Lori E. Allen[3] and Philip C. Myers[3]

[1] Department of Physics and Astronomy, University of Rochester, Rochester, NY 14627, USA
[2] Visiting Astronomer, Kitt Peak National Observatory, National Optical Astronomy Observatory
[3] Harvard-Smithsonian Center for Astrophysics, Mail Stop 42, 60 Garden Street, Cambridge, MA 02138, USA
[4] University of Toledo, Department of Physics and Astronomy, Toledo OH 43606, USA

[5] Cornell University, Department of Radiophysics Space Research, Ithaca NY 14853, USA
[6] Institute for Astronomy, University of Hawaii, 2680 Woodlawn Drive, Honolulu, HI 96822, USA

We present Spitzer images of the relatively sparse, low-luminosity young cluster L988e, as well as complementary near-infrared (NIR) and submillimeter images of the region. The cluster is asymmetric, with the western region of the cluster embedded within the molecular cloud, and the slightly less dense eastern region to the east of, and on the edge of, the molecular cloud. With these data, as well as with extant Hα data of stars primarily found in the eastern region of the cluster, and a molecular ^{13}CO gas emission map of the entire region, we investigate the distribution of forming young stars with respect to the cloud material, concentrating particularly on the differences and similarities between the exposed and embedded regions of the cluster. We also compare star formation in this region to that in denser, more luminous and more massive clusters already investigated in our comprehensive multiwavelength study of young clusters within 1 kpc of the Sun.

Published by The Astrophysical Journal (Vol. 675, p. 491)

Thermal Methanol Observations of the Outflow from the G31.41+0.31 Hot Molecular Core

E. Araya[1,2], P. Hofner[1,2], S. Kurtz[3], L. Olmi[4,5] and H. Linz[6]

[1] New Mexico Institute of Mining and Technology, Physics Department, 801 Leroy Place, Socorro, NM 87801, USA
[2] National Radio Astronomy Observatory, P.O. Box 0, Socorro, NM 87801, USA
[3] Centro de Radioastronomía y Astrofísica, Universidad Autónoma de México, Apdo. Postal 3-72, 58089, Morelia, Michoacán, Mexico
[4] Istituto di Radioastronomia, INAF, Sezione di Firenze, Largo Enrico Fermi 5, I-50125 Florence, Italy
[5] University of Puerto Rico at Rio Piedras, Physics Department, P.O. Box 23343, San Juan, PR 00931
[6] Max-Planck-Institut für Astronomie, Königstuhl 17, D-69117 Heidelberg, Germany

The G31.41+0.31 region hosts one of the most prominent hot molecular cores known. Coincident with the hot molecular core is an outflow whose orientation has been controversial. We report VLA-C observations of thermal methanol ($7_0 - 6_1 A^+$, 44 GHz) toward the position of the G31.41+0.31 hot molecular core. Our goals are to clarify the orientation of the outflow and to study the properties of a molecular outflow from a very young region of massive star formation. We confirm that the outflow is indeed associated with the hot molecular core. Our observations strongly suggest that the outflow is oriented in the northeast-southwest direction. The outflow is massive ($\gtrsim 15 M_\odot$), with a dynamical time of the order of $\sim 4 \times 10^3$ yr, and has a wide-angle bipolar morphology.

Published by The Astrophysical Journal (Vol. 675, p. 420)

The Ionizing Stars of the Galactic Ultra–Compact HII Region G45.45+0.06

Robert D. Blum[1] and Peter J. McGregor[2]

[1] NOAO Gemini Science Center, 950 N Cherry Ave, Tucson, 85719, USA
[2] Austrailian National University, Cotter Road, Weston Creek, ACT 2611, Australia

E-mail contact: rblum *at* noao.edu

Using the NIFS near–infrared integral–field spectrograph behind the facility adaptive optics module, ALTAIR, on Gemini North, we have identified several massive O–type stars that are responsible for the ionization of the Galactic Ultra–Compact HII region G45.45+0.06. The sources "m" and "n" from the imaging study of Feldt et al. (1998) are classified as hot, massive O–type stars based on their $K-$band spectra. Other bright point sources show red and/or nebular spectra and one appears to have cool star features that we suggest are due to a young, low–mass pre–main sequence component. Still two other embedded sources ("k" and "o" from Feldt et al.) exhibit CO bandhead emission that may arise in circumstellar disks which are possibly still accreting. Finally, nebular lines previously identified only in higher excitation planetary nebulae and associated with Kr III and Se IV ions are detected in G45.45+0.6.

Accepted by The Astronomical Journal

http://xxx.lanl.gov/abs/0802.2895

LkHα 330: Evidence for Dust Clearing through Resolved Submillimeter Imaging

J.M. Brown[1], G.A. Blake[2], C. Qi[3], C.P. Dullemond[4] and D.J. Wilner[3]

[1] Division of Physics, Mathematics, and Astronomy, MC 105-24, California Institute of Technology, Pasadena, CA 91125,USA

[2] Division of Geological and Planetary Sciences, California Institute of Technology, Pasadena, CA 91125, USA

[3] Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, Mail Stop 42, Cambridge, MA 02138, USA

[4] Max-Planck-Institut für Astronomie, Koenigstuhl 17, 69117 Heidelberg, Germany

E-mail contact: jmb *at* astro.caltech.edu

Mid-infrared spectrophotometric observations have revealed a small subclass of circumstellar disks with spectral energy distributions (SEDs) suggestive of large inner gaps with low dust content. However, such data provide only an indirect and model-dependent method of finding central holes. We present here the direct characterization of a 40 AU radius inner gap in the disk around LkHα 330 through 340 GHz (880 μm) dust continuum imaging with the Submillimeter Array (SMA). This large gap is fully resolved by the SMA observations and mostly empty of dust with less than 1.3×10^{-6} $M_\odot$ of solid particles inside of 40 AU. Gas (as traced by accretion markers and CO M-band emission) is still present in the inner disk and the outer edge of the gap rises steeplyfeatures in better agreement with the underlying cause being gravitational perturbation than a more gradual process such as grain growth. Importantly, the good agreement of the spatially resolved data and spectrophotometry-based model lends confidence to current interpretations of SEDs with significant dust emission deficits as arising from disks with inner gaps or holes. Further SED-based searches can therefore be expected to yield numerous additional candidates that can be examined at high spatial resolution.

Published by The Astrophysical Journal Letters (Vol. 675, p. L109)

Molecular jets driven by high-mass protostars: a detailed study of the IRAS 20126+4104 jet

A. Caratti o Garatti[1], D. Froebrich[2], J. Eislöffel[1], T. Giannini[3] and B. Nisini[3]

[1] Thüringer Landessternwarte Tautenburg, Sternwarte 5, D-07778 Tautenburg, Germany

[2] Centre for Astrophysics and Planetary Science, University of Kent, Canterbury, CT2 7NH, United Kingdom

[3] INAF - Osservatorio Astronomico di Roma, via Frascati 33, I-00040 Monte Porzio, Italy

E-mail contact: caratti *at* tls-tautenburg.de

Context. Protostellar jets from intermediate- and high-mass protostars provide an excellent opportunity to understand the mechanisms responsible for intermediate- and high-mass star formation. A crucial question is if they are scaled-up versions of their low-mass counterparts. Such high-mass jets are relatively rare and, usually, they are distant and highly embedded in their parental clouds. The IRAS 20126+4104 molecular jet, driven by a $10^4\,L_\odot$ protostar, represents a suitable target to investigate.
Aims. We present here an extensive analysis of this protostellar jet, deriving the kinematical, dynamical, and physical conditions of the H_2 gas along the flow.
Methods. The jet has been investigated by means of near-IR H_2 and [FeII] narrow-band imaging, high resolution spectroscopy of the 1-0 S(1) line (2.12 μm), NIR (0.9-2.5 μm) low resolution spectroscopy, along with ISO-SWS and LWS spectra (from 2.4 to 200 μm).
Results. The flow shows a complex morphology. In addition to the large-scale jet precession presented in previous studies, we detect a small-scale wiggling close to the source, that may indicate the presence of a multiple system. The peak radial velocities of the H_2 knots range from -42 to -14 km s^{-1} in the blue lobe, and from -8 to 47 km s^{-1} in the red lobe. The low resolution spectra are rich in H_2 emission, and relatively faint [FeII] (NIR), [OI] and [CII] (FIR) emission is observed in the region close to the source. A warm H_2 gas component has an average excitation temperature that ranges between 2000 K and 2500 K. Additionally, the ISO-SWS spectrum reveals the presence of a cold component (520 K), that strongly contributes to the radiative cooling of the flow and plays a major role in the dynamics of the flow. The estimated L_{H_2} of the jet is $8.2\pm0.7\,L_\odot$, suggesting that IRAS 20126+4104 has an accretion rate significantly increased compared to low-mass YSOs. This is also supported by the derived mass flux rate from the H_2 lines ($\dot{M}_{out}(H_2)\sim7.5\times10^{-4}\,M_\odot\,yr^{-1}$). The comparison between the H_2 and the outflow parameters strongly indicates that the jet is driving, at least partially, the outflow. As already found for low-mass protostellar jets, the

measured H_2 outflow luminosity is tightly related to the source bolometric luminosity.
Conclusions. As for few other intermediate- and high-mass protostellar jets in the literature, we conclude that IRAS 20126+4104 jet is a scaled-up version of low-mass protostellar counterparts.

Accepted by Astronomy & Astrophysics
astro-ph/0803.2012

The role of carbon grains in the deuteration of H_2

S. Cazaux[1], P. Caselli[2], V. Cobut[3] and J. Le Bourlot[4]

[1] Kapteyn Astronomical Institute, PO box 800, 9700AV Groningen, The Netherlands
[2] School of Physics and Astronomy, University of Leeds, LS2 9JT, Leeds, UK
[3] LERMA, UMR 8112 du CNRS, 5 Mail Gay-Lussac, Observatoire de Paris et Universite de Cergy Pontoise, F-95031 Cergy-Pontoise Cedex, France
[4] LUTH, UMR 8102 CNRS, Universite Paris 7 and Observatoire de Paris, Place J. Janssen, 92195 Meudon, France

E-mail contact: cazaux *at* astro.rug.nl

Aims: The production of molecular hydrogen and its deuterated forms onto carbonaceous dust grains is investigated in detail. The goal of this study is to estimate the importance of the chemistry occuring on grain surfaces for the deuteration of H2. Furthermore, we aim to find a robust and general surface chemical model which can be used in different astrophysical environments. Methods: Surface processes are described for the cases of graphitic and amorphous–carbon grains, where laboratory work is available. Langmuir–Hinshelwood as well as Eley–Rideal surface chemistries are included in the model and their relative contributions are highlighted. Analytic expressions are derived for H2, HD, and D2 formation efficiencies for both type of grains. Rate equations are tested against stochastic methods. Results: As expected, rate equations and stochastic methods diverge for grain sizes lower than a critical value acrit. For grain sizes below this critical value, D2 formation decreases to favour HD formation. The formation efficiencies of H2 and D2 can be calculated by adding a correction factor to the rate equations methods. We found that because of the presence of chemisorbed sites, which can store atoms to form molecules up to high grain temperatures, the formation efficiency of HD and D2 is very high compared to models where only physisorption sites are taken into account. When considering a realistic distribution of dust grains, we found that the formation rate of H2 and HD is enhanced by an order of magnitude if small grains are taken into account. The processes described in this paper, that allow a strong enhancement of the deuterated forms of molecular hydrogen, could explain the high degree of deuterium fractionation observed in protostellar environments.

Accepted by Astronomy & Astrophysics

Spitzer observations of the Massive star forming complex S254-S258: structure and evolution

L. Chavarría[1,2], L. Allen[2], J. Hora[2], C. Brunt[3] and G. Fazio[2]

[1] Departamento de Astronomia, Universidad de Chile, Camino del Observatorio 1515, Las Condes, Santiago, Chile
[2] Harvard-smithsonian Center for Astrophysics, 60 Garden St., Cambridge, MA02138, USA
[3] The School of Physics, University of Exeter, The Queens Drive, Exeter, Devon, UK EX4 4QL

E-mail contact: lchavarr *at* cfa.harvard.edu

We present Spitzer-IRAC, NOAO 2.1meter-Flamingos, Keck-NIRC, and FCRAO-SEQUOIA observations of the massive star forming complex S254-S258, covering an area of 25×20 arc-minutes. Using a combination of the IRAC and NIR data, we identify and classify the young stellar objects (YSO) in the complex. We detect 510 sources with near or mid IR-excess, and we classify 87 Class I, and 165 Class II sources. The YSO are found in clusters surrounded by isolated YSO in a low-density distributed population. The ratio of clustered to total YSO is 0.8. We identify six new clusters in the complex. One of them, G192.63-00, is located around the ionizing star of the HII region S255. We hypothesize that the ionizing star of S255 was formed in this cluster. We also detect a southern component of the cluster in HII region S256. The cluster G192.54-0.15, located inside HII region S254 has a V_{LSR} of 17 km s^{-1} with respect to the main cloud, and we conclude that it is located in the background of the complex. The structure of the molecular cloud is examined using ^{12}CO and ^{13}CO, as well as a near-IR extinction map. The main body of

the molecular cloud has V_{LSR} between 5 and 9 km s^{-1}. The arc-shaped structure of the molecular cloud, following the border of the HII regions, and the high column density in the border of the HII regions support the idea that the material has been swept up by the expansion of the HII regions.

Accepted by Astrophysical Journal

http://www.cfa.harvard.edu/~lchavarr/Preprints/ms.pdf

Vertical Shearing Instabilities in Radially Shearing Disks: The Dustiest Layers of the Protoplanetary Nebula

E. Chiang[1]

[1] Center for Integrative Planetary Sciences, Astronomy Department, University of California at Berkeley, Berkeley, CA 94720, USA

E-mail contact: echiang *at* astro.berkeley.edu

Gravitational instability of a vertically thin, dusty sheet near the midplane of a protoplanetary disk has long been proposed as a way of forming planetesimals. Before Roche densities can be achieved, however, the dust-rich layer, sandwiched from above and below by more slowly rotating dust-poor gas, threatens to overturn and mix by the Kelvin-Helmholtz instability (KHI). Whether such a threat is real has never been demonstrated: the Richardson criterion for the KHI is derived for two-dimensional Cartesian shear flow and does not account for rotational forces. Here we present three-dimensional numerical simulations of gas-dust mixtures in a shearing box, accounting for the full suite of disk-related forces: the Coriolis and centrifugal forces, and radial tidal gravity. Dust particles are assumed small enough to be perfectly entrained in gas; the two fluids share the same velocity field but obey separate continuity equations. We find that the Richardson number Ri does not alone determine stability. The critical value of Ri below which the dust layer overturns and mixes depends on the height-integrated metallicity Σ_d/Σ_g (surface density ratio of dust to gas). Nevertheless, for Σ_d/Σ_g between 1 and 5 times solar, the critical Ri maintains a nearly constant value of 0.1. Keplerian radial shear stabilizes those modes that would otherwise disrupt the layer at large Ri. If the height-integrated metallicity is at least 5 times greater than the solar value of 0.01, then midplane dust densities can approach Roche densities. Such a metal-rich environment might be expected to produce gas giant planets having similarly supersolar metallicities.

Published by The Astrophysical Journal (Vol. 675, p. 1549)

Constraining the Earliest Circumstellar Disks and their Envelopes

Hsin-Fang Chiang[1]**, Leslie W. Looney**[1]**, Konstantinos Tassis**[2]**, Lee G. Mundy**[3] **and Telemachos Ch. Mouschovias**[4]

[1] Department of Astronomy, University of Illinois at Urbana-Champaign, USA

[2] Department of Astronomy and Astrophysics and the Kavli Institute for Cosmological Physics,University of Chicago, USA

[3] Department of Astronomy, University of Maryland, College Park, USA

[4] Departments of Physics and Astronomy, University of Illinois at Urbana-Champaign, USA

E-mail contact: hchiang2 *at* uiuc.edu

Using interferometric data from BIMA observations, combined with detailed modeling in Fourier space of the physical structures predicted by models, we constrain the circumstellar envelope parameters for four Class 0 young stellar objects, as well as their embedded circumstellar disks. The envelopes of these objects are still undergoing collapse, and theoretical collapse models can be compared to the observations. Since it has been suggested in a previous study that both the Larson-Penston and Shu similarity solutions underestimate the age of the system, we adopt Tassis & Mouschovias' model of the collapse process, which includes all relevant magnetic fields effects. The results of the model fitting show a good consistency between theory and data; furthermore, no age problem exists since the Tassis & Mouschovias' model is age independent for the first 255 kyr. Although the majority of the continuum dust emission arises from the circumstellar envelopes, these objects have well known outflows, which suggest the presence of circumstellar disks. At the highest resolution, most of the large-scale envelope emission is resolved out by interferometry, but the small-scale residual emission remains, making it difficult to observe only the compact disk

component. By modeling the emission of the envelope and subtracting it from the total emission, we constrain the disk masses in our four systems to be comparable to or smaller than the typical disk masses for T Tauri systems.

Accepted by ApJ

http://arxiv.org/abs/0803.1272

Chandra spectroscopy of the hot star beta Crucis and the discovery of a pre-main-sequence companion

David H. Cohen[1], Michael A. Kuhn[1,2], Marc Gagné[3], Eric L. N. Jensen[1], Nathan A. Miller[4]

[1] Swarthmore College
[2] currently at Penn State
[3] West Chester University
[4] University of Wisconsin, Eau Claire

E-mail contact: cohen *at* astro.swarthmore.edu

In order to test the O star wind-shock scenario for X-ray production in less luminous stars with weaker winds, we made a pointed 74 ks observation of the nearby early B giant, beta Cru (B0.5 III), with the Chandra High Energy Transmission Grating Spectrometer. We find that the X-ray spectrum is quite soft, with a dominant thermal component near 3 million K, and that the emission lines are resolved but quite narrow, with half-widths of 150 km/s. The forbidden-to-intercombination line ratios of Ne IX and Mg XI indicate that the hot plasma is distributed in the wind, rather than confined near the photosphere. It is difficult to understand the X-ray data in the context of the standard wind-shock paradigm for OB stars, primarily because of the narrow lines, but also because of the high X-ray production efficiency. A scenario in which the bulk of the outer wind is shock heated is broadly consistent with the data, but not very well motivated theoretically. It is possible that magnetic channeling could explain the X-ray properties, although no field has been detected on beta Cru. We detected periodic variability in the hard (hnu ¿ 1 keV) X-rays, modulated on the known optical period of 4.58 hours, which is the period of the primary beta Cep pulsation mode for this star. We also have detected, for the first time, an apparent companion to beta Cru at a projected separation of 4 arcsec. This companion was likely never seen in optical images because of the presumed very high contrast between it and beta Cru in the optical. However, the brightness contrast in the X-ray is only 3:1, which is consistent with the companion being an X-ray active low-mass pre-main-sequence star. The companion's X-ray spectrum is relatively hard and variable, as would be expected from a post T Tauri star. The age of the beta Cru system (between 8 and 10 Myr) is consistent with this interpretation which, if correct, would add beta Cru to the roster of Lindroos binaries – B stars with low-mass pre-main-sequence companions.

Accepted by MNRAS

URL for preprints: http://astro.swarthmore.edu/∼cohen/papers/bcru_mnras2008.pdf

The Evolution of the Multiplicity of Embedded Protostars I: Sample Properties and Binary Detections

Michael Connelley[1], Bo Reipurth[2] and Alan Tokunaga[3]

[1] NASA Ames Research Center, MS 245-6, Moffett Field, CA 94035, USA
[2] University of Hawai'i Institute for Astronomy, 640 N. Aohoku Pl., Hilo HI 96720, USA
[3] University of Hawai'i Institute for Astronomy, 2680 Woodlawn Dr., Honolulu, HI 96822, USA

E-mail contact: Michael.S.Connelley *at* nasa.gov

We present the observational results of a near-infrared survey of a large sample of Class I protostars to determine the Class I binary separation distribution from $\sim$ 100 AU to $\sim$ 5000 AU. We selected targets from a new sample of 267 nearby candidate Class I objects. This sample is well understood, consists of mostly Class I young stellar objects (YSOs) within 1 kpc, has targets selected from the whole sky, and is not biased by previous studies of star formation. We observed 189 Class I YSOs north of $\delta = -40°$ at H, K and L′-bands, with a median angular resolution of 0.33″ at L′. We determined our detection limit for close binary companions by observing artificial binaries. We chose a contrast limit and an outer detection limit to minimize contamination and to ensure a candidate companion is gravitationally bound. Our survey used observations at L′ rather than K-band for the detection of binary companions since there is less scattered light and better seeing at L′. This paper presents the position of our targets, the near-IR photometry of sources detected in our fields at L′, as well as the observed properties of the 89 companions (73 of which are new). Although we chose contrast and separation limits to minimize contamination, we expect that there are 6 stars identified as binary companions that are contamination. L′ finder charts for each field are shown to facilitate future research on these objects.

Accepted by The Astronomical Journal

astro-ph 0803.1656

The Evolution of the Multiplicity of Embedded Protostars II: Binary Separation Distribution & Analysis

Michael Connelley[1], Bo Reipurth[2] and Alan Tokunaga[3]

[1] NASA Ames Research Center, MS 245-6, Moffett Field, CA 94035, USA
[2] University of Hawai'i Institute for Astronomy, 640 N. Aohoku Pl., Hilo HI 96720, USA
[3] University of Hawai'i Institute for Astronomy, 2680 Woodlawn Dr., Honolulu, HI 96822, USA

E-mail contact: Michael.S.Connelley *at* nasa.gov

We present the Class I protostellar binary separation distribution based on the data tabulated in the companion paper. We verify the excess of Class I binary stars over solar-type main-sequence stars, especially at separations beyond 500 AU. Although our sources are in nearby star forming regions distributed across the entire sky (including Orion), none of our objects are in a high stellar density environment. A log-normal function, used by previous authors to fit the main-sequence and T Tauri binary separation distributions, poorly fits our data and we determine that a log-uniform function is a much better fit. The binary separation distribution changes significantly during the Class I phase, and the binary frequency at separations greater than 1000 AU declines steadily with respect to spectral index. Despite these changes, the binary frequency remains constant until the end of the Class I phase, when it drops sharply. We propose a scenario to account for the changes in the Class I binary separation distribution. This scenario postulates that companions with a separation greater than $\sim$ 1000 AU were ejected during the Class 0 phase, but remain gravitationally bound due to the mass of the envelope. As the envelope dissipates, these companions become unbound and the binary frequency at wide separations declines. Circumstellar and circumbinary disks are expected to play an important role in the orbital evolution at closer separations. This scenario predicts that a large number of Class 0 objects should be non-hierarchical multiple systems, and that many Class I YSOs with a widely separated companion should also have a very close companion. We also find that Class I protostars are not dynamically pristine, and have experienced dynamical evolution before they are visible as Class I objects. For the first time, evidence is presented showing that the Class I binary frequency and the binary separation distribution strongly depend on the star forming environment. The reason for this dependence remains unclear.

Accepted by The Astronomical Journal

astro-ph 0803.1172

A shallow though extensive H_2 2.12 micron imaging survey of Taurus-Auriga-Perseus: I. NGC1333, L1455, L1448 and B1

C.J. Davis[1], P. Scholz[1,2], P. Lucas[3], M.D. Smith[4] and A. Adamson[1]

[1] Joint Astronomy Centre, 660 North A'ohoku Place, Hilo, Hawaii 96720, USA
[2] Dept. Physics and Astronomy, University of Victoria, Victoria BC, Canada
[3] Centre for Astrophysics Research, University of Hertfordshire, Hatfield AL10 9AB, UK
[4] School of Physical Sciences, University of Kent, Canterbury CT2 7NR, England

E-mail contact: c.davis *at* jach.hawaii.edu

We discuss wide-field near-IR imaging of the NGC1333, L1448, L1455 and B1 star forming regions in Perseus. The observations have been extracted from a much larger narrow-band imaging survey of the Taurus-Auriga-Perseus complex. These H_2 observations are complemented by broad-band K imaging, mid-IR imaging and photometry from the Spitzer Space Telescope, and published submillimetre CO J=3-2 maps of high-velocity molecular outflows. We

detect and label 85 H_2 features and associate these with 26 molecular outflows. Three are parsec-scale flows, with a mean flow lobe length exceeding 11.5 arcmin. 37 (44%) of the detected H_2 features are associated with a known Herbig-Haro object, while 72 (46%) of catalogued HH objects are detected in H_2 emission. Embedded Spitzer sources are identified for all but two of the 26 molecular outflows. These candidate outflow sources all have high near-to-mid-IR spectral indices (mean value of $\alpha \sim 1.4$) as well as red IRAC 3.6 μm - 4.5 μm and IRAC/MIPS 4.5 μm - 24.0 μm colours: 80% have [3.6] - [4.5] > 1.0 and [4.5] - [24] > 1.5. These criteria – high α and red [4.5] - [24] and [3.6] - [4.5] colours – are powerful discriminants when searching for molecular outflow sources. However, we find no correlation between α and flow length or opening angle, and the outflows appear randomly orientated in each region. The more massive clouds are associated with a greater number of outflows, which suggests that the star format

Accepted by MNRAS

http://www.jach.hawaii.edu/∼cdavis/

Small-Scale Behavior of the Physical Conditions and the Abundance Discrepancy in the Orion Nebula

Adal Mesa-Delgado[1], César Esteban[1] and Jorge García-Rojas[1,2]

[1] Instituto de Astrofísica de Canarias, E-38200 La Laguna, Tenerife, Spain

[2] Instituto de Astronomía, UNAM, Apdo. Postal 70-264, 04510 México D.F., Mexico

E-mail contact: amd *at* ll.iac.es

We present the results of long-slit spectroscopy, in several positions, of the Orion Nebula. Our goal is to study the spatial distributions of a large number of nebular quantities, including line fluxes, physical conditions, and ionic abundances, at a spatial resolution of about 1″. In particular, we have compared the O^{++} abundance determined from collisionally excited and recombination lines in 671 individual one-dimensional spectra covering different morphological zones of the nebula. We find that protoplanetary disks (proplyds) show prominent spikes of $T_e([N^{ii}])$, which is probably produced by collisional deexcitation due to the high electron densities found in these objects. Herbig-Haro objects show also relatively high values of $T_e([N^{ii}])$, but these are probably produced by local heating due to shocks. We also find that the spatial distribution of the pure recombination O II and [O III] lines is fairly similar. The abundance discrepancy factor (ADF) of O^{++} remains rather constant along the slit positions, except in some particular small areas of the nebula, such as at the locations of the most conspicuous Herbig-Haro objects. There is also an apparent slight increase of the ADF in the inner 40″ around θ^1 Ori C. We find a negative radial gradient of $T_e([O^{iii}])$ and $T_e([N^{ii}])$ in the nebula, based on the projected distance from θ^1 Ori C. In addition, the ADF of O^{++} seems to increase very slightly with the electron temperature. Finally, we estimate the value of the mean-square electron temperature fluctuation, the so-called t^2 parameter. Our results indicate that the hypothetical thermal inhomogeneities, if they exist, should be smaller than our spatial resolution element.

Published by The Astrophysical Journal (Vol. 675, p. 389)

First VLBI observations of methanol maser polarisation, in G339.88-1.26

R. Dodson[1]

[1] Observatorio Astronómico Nacional, Apartado 112, Alcala de Henares 28803, Spain

E-mail contact: r.dodson *at* oan.es

Aims. We investigate class II methanol masers and the environment in which they form with the Long Baseline Array (LBA).

Methods. Using full polarisation VLBI, we were able to measure the magnetic field directions so as to distinguish between the two main models of the environment in which methanol masers form: disks or shocks.

Results. We present polarised images of the methanol maser source G339.88-1.26, made with the LBA at 6.7-GHz. With these first polarisation maps made with the LBA, which successfully reproduce observations with the ATCA confirming the new AIPS code, a new technique for Southern VLBI is opened. The magnetic field directions found are inconstant with methanol masers arising in disks for the majority of the emission.

Published by Astronomy & Astrophysics (Vol. 480, p. 767)

A model of cloud fragmentation

George B. Field, Eric G. Blackman and Eric R. Keto

E-mail contact: gfield *at* cfa.harvard.edu

We present a model in which the supersonic motions observed in molecular clouds are driven by gravitational energy released as large structures fragment into smaller ones. The fragmentation process begins in large molecular clouds, and continues down to fragments of a critical mass defined as the mass at which gravitational confinement may be replaced by pressure confinement. The power laws that describe the scaling of density, mass, and number spectra of the fragments are given in terms of the observed velocity dispersion of the fragments. The results agree with observations over the range from several to about a third of a million solar masses.

Published by Monthly Notices of the Royal Astronomical Society (Vol. 385, p. 181)

Complex Chemistry in Star-Forming Regions: An Expanded Gas-Grain Warm-up Chemical Model

Robin T. Garrod[1], Susanna L. Widicus Weaver[2] and Eric Herbst[3]

[1] Max-Planck-Institut für Radioastronomie, Auf dem Hügel 69, Bonn, 53121, Germany
[2] Departments of Chemistry and Astronomy, University of Illinois at Urbana-Champaign, Urbana, IL 61801, USA
[3] Departments of Physics, Chemistry and Astronomy, The Ohio State University, Columbus, OH 43210, USA

E-mail contact: rgarrod *at* mpifr-bonn.mpg.de

Gas-phase processes were long thought to be the key formation mechanisms for complex organic molecules in star-forming regions. However, recent experimental and theoretical evidence has cast doubt on the efficiency of such processes. Grain-surface chemistry is frequently invoked as a solution, but until now there have been no quantitative models taking into account both the high degree of chemical complexity and the evolving physical conditions of star-forming regions. Here, we introduce a new gas-grain chemical network, wherein a wide array of complex species may be formed by reactions involving radicals. The radicals we consider (H, OH, CO, HCO, CH_3, CH_3O, CH_2OH, NH and NH_2) are produced primarily by cosmic ray-induced photodissociation of the granular ices formed during the colder, earlier stages of evolution. The gradual warm-up of the hot core is crucial to the formation of complex molecules, allowing the more strongly-bound radicals to become mobile on grain surfaces. This type of chemistry is capable of reproducing the high degree of complexity seen in Sgr B2(N), and can explain the observed abundances and temperatures of a variety of previously detected complex organic molecules, including structural isomers. Many other complex species are predicted by this model, and several of these species may be detectable in hot cores. Differences in the chemistry of high- and low-mass star-formation are also addressed; greater chemical complexity is expected where evolution timescales are longer.

Accepted by The Astrophysical Journal

http://arxiv.org/abs/0803.1214

Large-scale photometric activity of UX Ori type stars

V. P. Grinin[1,2], O. Yu. Barsunova[1], S. Yu. Shugarov[3,4], P. Kroll[5] and S. G. Sergeev[2]

[1] Main Astronomical Observatory, Russian Academy of Sciences (Pulkovo), St. Petersburg, Russia
[2] Crimean Astrophysical Observatory, Nauchnyi, Crimea, Ukraine
[3] P. K. Shternberg State Astronomical Institute, Moscow State University, Moscow, Russia
[4] Astronomical Institute of the Slovak Academy of Sciences, Tatranska Lomnica, Slovakia
[5] Sonnenberg Astronomical Observatory, Sonnenberg, Germany

E-mail contact: grinin *at* gao.spb.ru

Radical readjustments in the photometric activity of young stars owing to sudden changes in the circumstellar extinction are discussed using the light curves of two UX Ori type stars, CQ Tau and V1184 Tau, as examples. Changes of this sort can be caused by large deviations from axial symmetry in the distribution of circumstellar dust, as well as by large variations in the mass accretion rate in circumstellar disks. A large amount of dust may also appear in the vicinity of a young star owing to collisions of planetesimals.

Published by Astrophysics (Vol. 51, p. 1)

SiO line emission from C-type shock waves: interstellar jets and outflows

A. Gusdorf[1,2], S. Cabrit[3], D. R. Flower[1] and G. Pineau des Forts[2,3,4]

[1] Physics Department, The University, Durham DH1 3LE, UK
[2] Institut d'Astrophysique Spatiale (IAS), Btiment 121, F-91405 Orsay, France
[3] LERMA (UMR 8112 du CNRS), Observatoire de Paris, 61 Avenue de l'Observatoire, F-75014 Paris, France
[4] Universite Paris-Sud 11 and CNRS (UMR8617)

E-mail contact: antoine.gusdorf *at* durham.ac.uk

We study the production of SiO in the gas phase of molecular outflows, through the sputtering of Si–bearing material in refractory grain cores, which are taken to be olivine; we calculate also the rotational line spectrum of the SiO. The sputtering is driven by neutral particle impact on charged grains, in steady–state C-type shock waves, at the speed of ambipolar diffusion. The emission of the SiO molecule is calculated by means of an LVG code. A grid of models, with shock speeds in the range $20 < v_{\rm s} < 50$ km s^{-1} and preshock gas densities $10^4 < n_{\rm H} < 10^6$ cm^{-3}, has been generated. We compare our results with those of an earlier study (Schilke et al. 1997). Improvements in the treatment of the coupling between the charged grains and the neutral fluid lead to narrower shock waves and lower fractions of Si ($\lesssim$10%) being released into the gas phase. Erosion of grain cores is significant ($\gtrsim$1%) only for C-type shock speeds $v_{\rm s} > 25$ km s^{-1}, given the adopted properties of olivine. More realistic assumptions concerning the initial fractional abundance of O_2 lead to SiO formation being delayed, so that it occurs in the cool, dense postshock flow. Good agreement is obtained with recent observations of SiO line intensities in the L1157 and L1448 molecular outflows. The inferred temperature, opacity, and SiO column density in the emission region differ significantly from those estimated by means of LVG 'slab' models. The fractional abundance of SiO is deduced and found to be in the range $4\times10^{-8} \lesssim n({\rm SiO})/n_{\rm H} \lesssim 3\times10^{-7}$. Observed line profiles are wider than predicted and imply multiple, unresolved shock regions within the beam.

Accepted by Astronomy & Astrophysics

Investigation of the conspicuous infrared star cluster and star-forming region "RCW 38 IR Cluster"

A.L. Gyulbudaghian[1] and J. May[2]

[1] V.A.Ambartsumian Byurakan Astrophysical Observatory, Armenia
[2] Departamento de Astronomia, Universidad de Chile, Casilla 36-D, Santiago, Chile

E-mail contact: agyulb *at* bao.sci.am

The infrared star cluster RCW 38 IR Cluster, which is also a massive star-forming region, is investigated. The results of observations with the SEST (Cerro La Silla, Chile) telescope on the 2.6-mm ^{12}CO spectral line and with SIMBA on the 1.2-mm continuum are given. The ^{12}CO observations revealed the existence of several molecular clouds, two of which (clouds 1 and 2) are connected with the object RCW 38 IR Cluster. Cloud 1 is a massive cloud, which has a depression in which the investigated object is embedded. It is not excluded that the depression was formed by the wind and/or emission from the young bright stars belonging to the star cluster. Rotation of cloud 2, around the axis having SE-NW direction, with an angular velocity $\omega = 4.6 \times 10^{-14}$s^{-1} is also found. A red-shifted outflow with velocity $\sim +5.6$ km/s, in the SE direction and perpendicular to the elongation of cloud 2 has also been found. The investigated cluster is associated with an IR point source IRAS 08573-4718, which has IR colors typical for a non-evolved embedded (in the cloud) stellar object. The cluster is also connected with a water maser. The SIMBA image shows the existence of a central bright condensation, coinciding with the cluster itself, and two extensions. One of these extensions (the one with SW-NE direction) coincides, both in place and shape, with cloud 2, so that the possibility that this extension might also be rotating like cloud 2 is not excluded. In the vicinity of these extensions there are condensations resembling HH objects

Published by Astrophysics (Vol. 51, p. 29)

The Initial Mass Function of the Massive Star-forming Region NGC 3603 from Near-Infrared Adaptive Optics Observations

Y. Harayama[1], F. Eisenhauer[1], and F. Martins[1]

[1] Max-Planck-Institut für extraterrestrische Physik, Postfach 1312, 85741 Garching, Germany

E-mail contact: yohei *at* mpe.mpg.de

We study the initial mass function (IMF) of one of the most massive Galactic star-forming regions NGC 3603 to answer a fundamental question in current astrophysics: is the IMF universal, or does it vary? Using our very deep, high angular resolution JHKSL' images obtained with NAOS-CONICA at the VLT at ESO, we have successfully revealed the stellar population down to the subsolar mass range in the core of the starburst cluster. The derived IMF of NGC 3603 is reasonably fitted by a single power law with index $\Gamma \sim -0.74$ within a mass range of 0.420 $M_\odot$, substantially flatter than the Salpeter-like IMF. A strong radial steepening of the IMF is observed mainly in the inner $r \lesssim 30''$ field, indicating mass segregation in the cluster center. We estimate the total mass of NGC 3603 to be about $1.0 - 1.6 \times 10^4$ $M_\odot$. The derived core density is $\geq 6 \times 10^4$ $M_\odot$ pc^3, an order of magnitude larger than, e.g., the Orion Nebula Cluster. The estimate of the half-mass relaxation time for solar-mass stars is about 10-40 Myr, suggesting that the intermediate- and low-mass stars have not yet been affected significantly by the dynamical relaxation in the cluster. The relaxation time for the high-mass stars can be comparable to the age of the cluster. We estimate that the stars residing outside the observed field cannot steepen the IMF significantly, indicating our IMF adequately describes the whole cluster. Analyzing thoroughly the systematic uncertainties in our IMF determination, we conclude that the power-law index of the IMF of NGC 3603 is $\Gamma = -0.74^{+0.62}_{-0.47}$. Our result thus supports the hypothesis of a potential top-heavy IMF in massive star-forming clusters and starbursts.

Published by The Astrophysical Journal (Vol. 675, p. 1319)

Modeling the Lukewarm Corino Phase - is L1527 unique?

George E. Hassel[1], Eric Herbst[2] and Robin T. Garrod[3]

[1] Department of Physics, The Ohio State University, Columbus, OH 43210, USA
[2] Departments of Physics, Astronomy and Chemistry, The Ohio State University, Columbus, OH 43210, USA
[3] Max-Planck-Institut für Radioastronomie, Auf dem Hügel 69, 53121 Bonn, Germany

E-mail contact: ghassel *at* mps.ohio-state.edu

Sakai et al. have observed long-chain unsaturated hydrocarbons and cyanopolyynes in the low-mass star-forming region L1527, and have attributed this result to a gas-phase ion-molecule chemistry, termed “Warm Carbon Chain Chemistry”, which occurs during and after the evaporation of methane from warming grains. The source L1527 is an envelope surrounding a Class 0/I protostar with regions that possess a slightly elevated temperature of $\approx$ 30 K. The molecules detected by Sakai et al. are typically associated only with dark molecular clouds, and not with the more evolved hot corino phase. In order to determine if L1527 is chemically distinct from a dark cloud, we compute models including various degrees of heating. The results indicate that the composition of L1527 is somewhat more likely to be due to “Warm Carbon Chain Chemistry” than to be a remnant of a colder phase. If so, the molecular products provide a signature of a previously uncharacterized early phase of low mass star formation, which can be characterized as a “lukewarm” corino. We also include predictions for other molecular species that might be observed toward candidate lukewarm corino sources. Although our calculations show that unsaturated hydrocarbons and cyanopolyynes can be produced in the gas phase as the grains warm up to 30 K, they also show that such species do not disappear rapidly from the gas as the temperature reaches 200 K, implying that such species might be detected in hot corinos and hot cores.

Accepted by Astrophys. J.

arXiv e-print available - arXiv:0803.1805

Star formation in Perseus. IV. Mass dependent evolution of dense cores.

Jennifer Hatchell[1] and Gary Fuller[2]

[1] School of Physics, University of Exeter, Stocker Road, Exeter EX4 4QL, U.K.

[2] Jodrell Bank Centre for Astrophysics, Alan Turing Building, University of Manchester, Manchester M13 9PL, U.K.

E-mail contact: hatchell *at* astro.ex.ac.uk

Context: In our SCUBA survey of Perseus, we find that the fraction of protostellar cores increases towards higher masses and the most massive cores are all protostellar.
Aims: In this paper we consider the possible explanations of this apparent mass dependence in the evolutionary status of these cores. We investigate the implications for protostellar evolution and the mapping of the embedded core mass function (CMF) onto the stellar IMF.
Method: We consider the following potential origins of the observed behaviour: dust temperature; selection effects in the submillimetre and in the mid-infrared observations used for pre/protostellar classification; confusion and multiplicity; transient cores; and varying evolutionary timescales. We develop Core Mass Evolution Diagrams (CMEDs) to investigate how the mass evolution of individual cores maps onto the observed CMF.
Results: We find that two physical mechanisms – short timescales for the evolution of massive cores, and continuing accumulation of mass onto protostellar cores – best explain the relative excess of protostars in high mass cores and the rarity of massive starless cores. In addition, we show that confusion both increases the likelihood that a protostar is identified within a core, and increases mass assigned to a core. Selection effects and/or transient cores also contribute to an excess of starless cores at low masses.
Conclusions: The observed pre/protostellar mass distributions are consistent with faster evolution and a shorter lifetime for higher-mass prestellar cores. We rule out longer timescales for higher-mass prestellar cores. The differences in the prestellar and protostellar mass distributions imply that the prestellar CMF (and possibly the combined pre+protostellar CMF) should be steeper than the IMF. A steeper prestellar CMF can be reconciled with the observed similarity of the CMF and the IMF in some regions if a second opposing effect is present, such as the fragmentation of massive cores into multiple systems.

Accepted by A&A

arXiv:0803.1064

Reflected Light from Sand Grains in the Terrestrial Zone of a Protoplanetary Disk

William Herbst[1], Catrina M. Hamilton[2], Katherine LeDuc[1], Joshua N. Winn[3], Christopher M. Johns-Krull[4], Reinhard Mundt[5] and Mansur Ibrahimov[6]

[1] Astronomy Dept., Wesleyan University, Middletown, CT 06459, USA
[2] Physics and Astronomy Department, Dickinson College, Carlisle, PA 17013, USA
[3] Dept. of Physics, MIT, 77 Massachusetts Ave., Cambridge, MA 02139, USA
[4] Dept. of Physics and Astronomy, Rice University, Houston, TX 77005, USA
[5] Max-Planck-Institute for Astronomy, Konigstuhl 17, D-69117, Heidelberg, Germany
[6] Ulugh Beg Astronomical Institute of the Uzbek Academy of Sciences, Astronomicheskaya 33, 700052 Tashkent, Uzbekistan

E-mail contact: wherbst *at* wesleyan.edu

We show that grains have grown to mm size (sand sized) or larger in the terrestrial zone (within ∼3 AU) of the protoplanetary disk surrounding the 3 Myr old binary star KH 15D. We also argue that the reflected light in the system reaches us by back scattering off the far side of the same ring whose near side causes the obscuration.

Accepted by Nature, March 13, 2008

http://xxx.lanl.gov/abs/0803.1782

Subarcsecond Submillimeter Imaging of the Ultracompact HII Region G5.89-0.39

Todd R. Hunter[1], Crystal L. Brogan[1], Remy Indebetouw[1,2] and Claudia J. Cyganowski[3]

[1] NRAO, 520 Edgemont Rd, Charlottesville, VA 22901, USA
[2] University of Virginia, Astronomy Dept., P.O. Box 3818, Charlottesville, VA, 22903-0818, USA
[3] University of Wisconsin, Madison, WI 53706, USA

E-mail contact: thunter *at* nrao.edu

We present the first subarcsecond submillimeter images of the enigmatic ultracompact HII region (UCHII) G5.89-0.39. Observed with the SMA, the 875 μm continuum emission exhibits a shell-like morphology similar to longer wavelengths. By using images with comparable angular resolution at five frequencies obtained from the VLA archive and CARMA, we have removed the free-free component from the 875 μm image. We find five sources of dust emission: two compact warm objects (SMA1 and SMA2) along the periphery of the shell, and three additional regions further out. There is no dust emission inside the shell, supporting the picture of a dust-free cavity surrounded by high density gas. At subarcsecond resolution, most of the molecular gas tracers encircle the UCHII region and appear to constrain its expansion. We also find G5.89-0.39 to be almost completely lacking in organic molecular line emission. The dust cores SMA1 and SMA2 exhibit compact spatial peaks in optically-thin gas tracers (e.g. $^{34}SO_2$), while SMA1 also coincides with 11.9μm emission. In CO(3-2), we find a high-velocity north/south bipolar outflow centered on SMA1, aligned with infrared H_2 knots, and responsible for much of the maser activity. We conclude that SMA1 is an embedded intermediate mass protostar with an estimated luminosity of 3000 $L_\odot$ and a circumstellar mass of ≈ 1 $M_\odot$. Finally, we have discovered an NH_3 (3,3) maser located 12$''$ northwest of the UCHII region, coincident with a 44 GHz CH_3OH maser, and possibly associated with the Brγ outflow source identified by Puga et al. (2006).

Accepted by The Astrophysical Journal

http://arxiv.org/abs/0803.0587

Turbulent transport and its effect on the dead zone in protoplanetary discs

Martin Ilgner[1] and Richard P.Nelson[1]

[1] Astronomy Unit, Queen Mary, University of London, Mile End Rd, London E1 4NS, UK

E-mail contact: m.ilgner *at* qmul.ac.uk

Context:
Protostellar accretion discs have cool, dense midplanes where externally originating ionisation sources such as X–rays or cosmic rays are unable to penetrate. This suggests that for a wide range of radii, MHD turbulence can only be sustained in the surface layers where the ionisation fraction is sufficiently high. A dead zone is expected to exist near the midplane, such that active accretion only occurs near the upper and lower disc surfaces. Recent work, however, suggests that under suitable conditions the dead zone may be enlivened by turbulent transport of ions from the surface layers into the dense interior.

Aims:
In this paper we present a suite of simulations that examine where, and under which conditions, a dead zone can be enlivened by turbulent mixing.

Methods:
We use three–dimensional, multifluid shearing box MHD simulations, which include vertical stratification, ionisation chemistry, ohmic resistivity, and ionisation due to X–rays from the central protostar. We compare the results of the MHD simulations with a simple reaction–diffusion model.

Results:
The simulations show that in the absence of gas-phase heavy metals, such as magnesium, turbulent mixing has essentially no effect on the dead zone. The addition of a relatively low abundance of magnesium, however, increases the recombination time and allows turbulent mixing of ions to enliven the dead zone completely beyond a distance of 5 AU from the central star, for our particular disc model.

Conclusions:
During the late stages of protoplanetary disc evolution, when small grains have been depleted and the disc surface density has decreased below its high initial value, the structure of the dead zone may be significantly altered by the action of turbulent transport. This may have important consequences for ongoing planet formation in these discs.

Accepted by Astronomy and Astrophysics

http://arxiv.org/abs/0802.4409

Sequential and spontaneous star formation around the mid-infrared halo H II region KR 140

C.R. Kerton[1], K. Arvidsson[1], Lewis B.G. Knee[2] and C. Brunt[3]

[1] Department of Physics and Astronomy, Iowa State University, Ames, IA 50011, USA
[2] Atacama Large Millimeter Array, Avenida El Golf 40, Piso 18, Las Condes, Santiago, Chile
[3] School of Physics, University of Exeter, Stocker Road, Exeter EX4 4QL, UK

E-mail contact: kerton *at* iastate.edu

We use Two-Micron All-Sky Survey and Midcourse Space Experiment infrared observations, along with new molecular line (CO) observations, to examine the distribution of young stellar objects (YSOs) in the molecular cloud surrounding the halo H II region KR 140 in order to determine if the ongoing star formation activity in this region is dominated by sequential star formation within the photodissociation region (PDR) surrounding the H II region. We find that KR 140 has an extensive population of YSOs that have 'spontaneously' formed due to processes not related to the expansion of the H II region. Much of the YSO population in the molecular cloud is concentrated along a dense filamentary molecular structure, traced by $C^{18}O$, that has not been erased by the formation of the exciting O star. Some of the previously observed submillimetre clumps surrounding the H II region are shown to be sites of recent intermediate- and low-mass star formation while other massive starless clumps clearly associated with the PDR may be the next sites of sequential star formation.

Published by Monthly Notices of the Royal Astronomical Society (Vol. 385, p. 995)

Orbits and Masses in the T Tauri System

Rainer Köhler[1,2], Thorsten Ratzka[3], T. M. Herbst[2] and Markus Kasper[4]

[1] ZAH, Landessternwarte, Heidelberg, Germany
[2] Max-Planck-Institut für Astronomie, Heidelberg, Germany
[3] Astrophysikalisches Institut Potsdam, Germany
[4] European Southern Observatory, Garching, Germany

E-mail contact: r.koehler *at* lsw.uni-heidelberg.de

We investigate the binary star T Tauri South, presenting the orbital parameters of the two components and their individual masses. We combined astrometric positions from the literature with previously unpublished VLT observations. Model fits yield the orbital elements of T Tau Sa and Sb. We use T Tau N as an astrometric reference to derive an estimate for the mass ratio of Sa and Sb. Although most of the orbital parameters are not well constrained, it is unlikely that T Tau Sb is on a highly elliptical orbit or escaping from the system. The total mass of T Tau S is rather well constrained to $3.0^{+0.15}_{-0.24}\,\mathrm{M}_{\odot}$. The mass ratio Sb:Sa is about 0.4, corresponding to individual masses of $M_{\mathrm{Sa}} = 2.1 \pm 0.2\,M_{\odot}$ and $M_{\mathrm{Sb}} = 0.8 \pm 0.1\,M_{\odot}$. This confirms that the infrared companion in the T Tauri system is a pair of young stars obscured by circumstellar material.

Accepted by Astronomy and Astrophysics

http://www.lsw.uni-heidelberg.de/users/rkoehler/Papers/index.html, http://arxiv.org/abs/0802.3178

The Physics of Protoplanetesimal Dust Agglomerates. II. Low-Velocity Collision Properties

Doreen Langkowski[1], Jens Teiser[2] and Jürgen Blum[1]

[1] Institut für Geophysik und extraterrestrische Physik, Technische Universität zu Braunschweig, Mendelssohnstraße 3, D-38106 Braunschweig, Germany
[2] Institut für Planetologie, Westfälische Wilhelmsuniversität Münster, Wilhelm-Klemm-Straße 10, D-48149 Münster, Germany

For the investigation of collisions among protoplanetesimal dust aggregates, we performed microgravity experiments in which the impacts of high-porosity millimeter-sized dust aggregates into 2.5 cm high-porosity dust aggregates can be studied. The dust aggregates consisted either of monodisperse spherical, quasi-monodisperse irregular, or polydisperse irregular micrometer-sized dust grains and were produced by random ballistic deposition with porosities between 85% and 93%. Impact velocities ranged from ~ 0.1 to 3 m s^1, and impact angles were almost randomly distributed. In

addition to the smooth surfaces of the target aggregates formed in our experiments, we "molded" target aggregates such that the radii of the local surface curvatures corresponded to the projectile radii, decreasing the targets' porosities to 80% - 85%. The experiments showed that impacts into the highest porosity targets almost always led to sticking, whereas for the less porous dust aggregates, consisting of monodisperse spherical dust grains, the collisions with intermediate velocities and high impact angles resulted in the bouncing of the projectile with a mass transfer from the target to the projectile aggregate. Sticking probabilities for the impacts into the "molded" target aggregates were considerably decreased. For the impacts into smooth targets, we measured the depth of intrusion and the crater volume, and were able to derive some interesting dynamical properties which can help to derive a collision model for protoplanetesimal dust aggregates. Future models of the aggregate growth in protoplanetary disks should take into account noncentral impacts, impact compression, the influence of the local radius of curvature on the collisional outcome, and the possible mass transfer between the target and projectile agglomerates in nonsticking collisions.

Published by The Astrophysical Journal (Vol. 675, p. 764)

On the Formation of Perseus OB1 at High Galactic Latitudes

Hsu-Tai Lee[1] and Jeremy Lim[1]

[1] Institute of Astronomy and Astrophysics, Academia Sinica, P.O. Box 23-141, Taipei 106, Taiwan, R.O.C.

E-mail contact: htlee *at* asiaa.sinica.edu.tw

The Per OB1 association, which contains the remarkable double cluster h and χ Per, is unusual in not having a giant molecular cloud in its vicinity. We show from *Hipparcos* data that the luminous members of this association exhibits a bulk motion away from the galactic plane, such that their average velocity increases with height above the galactic plane. We find HAeBe and T Tauri stars towards probable remnant molecular clouds associated with Per OB1. These star-forming regions lie well beyond the location of the luminous member stars at heights of 280–400 pc above the galactic plane, far higher than that previously found for embedded clusters. We argue that the observed motion of the luminous member stars is most naturally explained if many formed from molecular gas pushed and accelerated outwards by an expanding superbubble driven presumably by stellar winds and perhaps also supernova explosions. A large shell of atomic hydrogen gas and dust that lies just beyond the remnant molecular clouds, believed to be driven by just such a superbubble, may comprise the swept-up remains of the parental giant molecular cloud from which this association formed. In support of this picture, we find a weak trend for the younger O star members to lie at higher galactic latitudes than the older supergiant members. The star-forming regions located at even larger heights above the galactic plane presumably correspond to more recent episodes of star formation at or near the periphery of this superbubble.

Accepted by ApJ

http://www.asiaa.sinica.edu.tw/~htlee/

Oxygen isotope anomalies of the Sun and the original environment of the Solar system

Jeong-Eun Lee[1], Edwin A. Bergin[2] and James R. Lyons[3]

[1] Department of Astronomy and Space Science, Sejong University, Seoul 143-747, Korea
[2] Department of Astronomy, The University of Michigan, 500 Church Street, Ann Arbor, Michigan 48109-10424, USA
[3] Institute of Geophysics and Planetary Physics, Department of Earth and Space Sciences, University of California, Los Angeles, California 90095, USA

E-mail contact: jelee *at* sejong.ac.kr

We present results from a model of oxygen isotopic anomaly production through selective photodissociation of CO within the collapsing proto-Solar cloud. Our model produces a proto-Sun with a wide range of Δ^{17}O values depending on the intensity of the ultraviolet radiation field. Dramatically different results from two recent Solar wind oxygen isotope measurements indicate that a variety of compositions remain possible for the solar oxygen isotope composition. However, constrained by other measurements from comets and meteorites, our models imply the birth of the Sun in a stellar cluster with an enhanced radiation field and are therefore consistent with a supernova source for ^{60}Fe in meteorites.

Accepted by Meteoritics & Planetary Science (http://arxiv.org/abs/0803.0692)

Measurement of the epicycle frequency in the galactic disk, and initial velocities of open clusters

J.R.D. Lépine[1], Wilton S. Dias[2], and Yu. Mishurov[3]

[1]Instituto de Astronomia, Geofísica e Ciências Atmosféricas, Universidade de São Paulo, Cidade Universitária, São Paulo, SP, Brazil
[2]UNIFEI, Instituto de Ciências Exatas, Universidade Federal de Itajubá, Itajubá, MG, Brazil
[3]South Federal University (Rostov State University), Rostov-on-Don, Russia

E-mail contact: jacques@astro.iag.usp.edu

A new method to measure the epicycle frequency κ in the galactic disk is presented. We make use of the large database on open clusters completed by our group to derive the observed velocity vector (amplitude and direction) of the clusters in the galactic plane. In the epicycle approximation, this velocity is equal to the circular velocity given by the rotation curve, plus a residual or perturbation velocity, of which the direction rotates as a function of time with the frequency κ. Due to the non-random direction of the perturbation velocity at the birth time of the clusters, a plot of the present day direction angle of this velocity as a function of the age of the clusters reveals systematic trends from which the epicycle frequency can be obtained. Our analysis considers that the Galactic potential is mainly axis-symmetric, or in other words, that the effect of the spiral arms on the galactic orbits is small; in this sense our results do not depend on any specific model of the spiral structure. The values of κ that we obtain provide constraints on the rotation velocity of the disk; in particular, V_0 is found to be 230 ± 15 kms^{-1} even if the short scale ($R_0 = 7.5$ kpc) of the galaxy is adopted. The measured κ at the solar radius is $43{\pm}5$ kms^{-1}kpc^{-1}. The distribution of initial velocities of open clusters is discussed.

Accepted by MNRAS

Hipparcos distance estimates of the Ophiuchus and the Lupus cloud complexes

M. Lombardi[1,2], C. J. Lada[3], and J. Alves[4]

[1] Space Telescope European Coordination Facility/ESO, Karl-Schwarzschild-Straße 2, 85748 Garching, Germany
[2] University of Milan, Department of Physics, via Celoria 16, 20133 Milan, Italy
[3] Harvard-Smithsonian Center for Astrophysics, Mail Stop 42, 60 Garden Street, Cambridge, MA 02138, USA
[4] Calar Alto Observatory - Centro Astronómico Hispano Alemán, C/Jesús Durbán Remón 2-2, 04004 Almeria, Spain

E-mail contact: mlombard *at* eso.org

We combine extinction maps from the Two Micron All Sky Survey (2MASS) with Hipparcos and Tycho parallaxes to obtain reliable and high-precision estimates of the distance to the Ophiuchus and Lupus dark complexes. Our analysis, based on a rigorous maximum-likelihood approach, shows that the ρ-Ophiuchi cloud is located at (119 ± 6) pc and the Lupus complex is located at (155 ± 8) pc; in addition, we are able to put constraints on the thickness of the clouds and on their orientation on the sky (both these effects are not included in the error estimate quoted above). For Ophiuchus, we find some evidence that the streamers are closer to us than the core. The method applied in this paper is currently limited to nearby molecular clouds, but it will find many natural applications in the GAIA-era, when it will be possible to pin down the distance and three-dimensional structure of virtually every molecular cloud in the Galaxy.

Published by Astronomy & Astrophysics (Vol. 480, p. 785)

The Disk Population of the Chamaeleon I Star-forming Region

K. L. Luhman[1], L. E. Allen[2], P. R. Allen[1], R. A. Gutermuth[2], L. Hartmann[3], E. E. Mamajek[2], S. T. Megeath[4], P. C. Myers[2] and G. G. Fazio[2]

[1] Department of Astronomy and Astrophysics, The Pennsylvania State University, University Park, PA 16802, USA
[2] Harvard-Smithsonian Center for Astrophysics, Cambridge, MA 02138, USA
[3] Department of Astronomy, University of Michigan, Ann Arbor, MI 48109, USA
[4] Department of Physics and Astronomy, The University of Toledo, Toledo, OH 43606, USA

E-mail contact: kluhman *at* astro.psu.edu

We present a census of circumstellar disks in the Chamaeleon I star-forming region. Using the Infrared Array Camera and the Multiband Imaging Photometer on board the Spitzer Space Telescope, we have obtained images of Chamaeleon I at 3.6, 4.5, 5.8, 8.0, and 24 μm. To search for new disk-bearing members of the cluster, we have performed spectroscopy on objects that have red colors in these data. Through this work, we have discovered four new members of Chamaeleon I with spectral types of M4, M6, M7.5, and L0. The first three objects are highly embedded ($A_J \sim 5$) and reside near known protostars, indicating that they may be among the youngest low-mass sources in the cluster ($\tau < 1$ Myr). The L0 source is the coolest known member of Chamaeleon I. Its luminosity implies a mass of 0.0040.01 $M_\odot$, making it the least massive brown dwarf for which a circumstellar disk has been reliably detected. To characterize the disk population in Chamaeleon I, we have classified the infrared spectral energy distributions of the 203 known members that are encompassed by the Spitzer images. Through these classifications, we find that the disk fraction in Chamaeleon I is roughly constant at 50% from 0.01 to 0.3 $M_\odot$. These data are similar to the disk fraction of IC 348, which is a denser cluster at the same age as Chamaeleon I. However, the disk fraction at is significantly higher in Chamaeleon I than in IC 348 (65% vs. 20%), indicating longer disk lifetimes in Chamaeleon I for this mass range. Thus, low-density star-forming regions like Chamaeleon I may offer more time for planet formation around solar-type stars than denser clusters.

Published by The Astrophysical Journal (Vol. 675, p. 1375)

Global magnetohydrodynamical models of turbulence in protoplanetary disks: I. A cylindrical potential on a Cartesian grid and transport of solids

W. Lyra[1], A. Johansen[2], H. Klahr[2], and N. Piskunov[1]

[1] Department of Astronomy and Space Physics, Uppsala Astronomical Observatory, Box 515, 751 20 Uppsala, Sweden
[2] Max-Planck-Institut für Astronomie, Königstuhl 17, 69117 Heidelberg, Germany

E-mail contact: wlyra *at* astro.uu.se

Aims. We present global 3D MHD simulations of disks of gas and solids, aiming at developing models that can be used to study various scenarios of planet formation and planet-disk interaction in turbulent accretion disks. A second goal is to demonstrate that Cartesian codes are comparable to cylindrical and spherical ones in handling the magnetohydrodynamics of the disk simulations while offering advantages, such as the absence of a grid singularity, for certain applications, e.g., circumbinary disks and disk-jet simulations.

Methods. We employ the PENCIL CODE, a 3D high-order finite-difference MHD code using Cartesian coordinates. We solve the equations of ideal MHD with a local isothermal equation of state. Planets and stars are treated as particles evolved with an N-body scheme. Solid boulders are treated as individual superparticles that couple to the gas through a drag force that is linear in the local relative velocity between gas and particle.

Results. We find that Cartesian grids are well-suited for accretion disk problems. The disk-in-a-box models based on Cartesian grids presented here develop and sustain MHD turbulence, in good agreement with published results achieved with cylindrical codes. Models without an inner boundary do not show the spurious build-up of magnetic pressure and Reynolds stress seen in the models with boundaries, but the global stresses and alpha viscosities are similar in the two cases. We investigate the dependence of the magnetorotational instability on disk scale height, finding evidence that the turbulence generated by the magnetorotational instability grows with thermal pressure. The turbulent stresses depend on the thermal pressure obeying a power law of 0.24 ± 0.03, compatible with the value of 0.25 found in shearing box calculations. The ratio of Maxwell to Reynolds stresses decreases with increasing temperature, dropping from 5 to 1 when the sound speed was raised by a factor 4, maintaing the same field strength. We also study the dynamics of solid boulders in the hydromagnetic turbulence, by making use of 10^6 Lagrangian particles embedded in the Eulerian grid. The effective diffusion provided by the turbulence prevents settling of the solids in a infinitesimally thin layer, forming instead a layer of solids of finite vertical thickness. The measured scale height of this diffusion-supported layer of solids implies turbulent vertical diffusion coefficients with globally averaged Schmidt numbers of 1.0 ± 0.2 for a model with $\alpha \approx 10^{-3}$ and 0.78 ± 0.06 for a model with $\alpha \approx 10^{-1}$. That is, the vertical turbulent diffusion acting on the solids phase is comparable to the turbulent viscosity acting on the gas phase. The average bulk density of solids in the turbulent flow is quite low ($\rho_{\rm p} = 6.0 \times 10^{-11}$ kg m^{-3}), but in the high pressure regions, significant overdensities are observed, where the solid-to-gas ratio reached values as great as 85, corresponding to 4 orders of magnitude higher than the initial interstellar value of 0.01.

Published by Astronomy & Astrophysics (Vol. 479, p. 883)

Interacting coronae of two T Tauri stars: first observational evidence for solar-like helmet streamers

M. Massi[1], E. Ros[1], K. M. Menten[1], M. Kaufman Bernadó[1], G. Torricelli-Ciamponi[2], J. Neidhöfer[1], A. Boden[3], D. Boboltz[4], A. Sargent[5], and G. Torres[6]

[1] Max-Planck-Institut für Radioastronomie, Auf dem Hügel 69, 53121 Bonn, Germany

[2] INAF - Osservatorio Astrofisico di Arcetri, Largo E. Fermi 5, 50125 Firenze, Italy

[3] Michelson Science Center, California Institute of Technology, 770 South Wilson Ave., Pasadena CA 91125, USA

[4] US Naval Observatory, 3450 Massachusetts Ave, Washington DC 20392, USA

[5] Division of Physics, Math, and Astronomy, California Institute of Technology, MS 105-24, Pasadena, CA 91125, USA

[6] Harvard-Smithsonian Center for Astrophysics, 60 Garden St., Cambridge, MA 02138, USA

E-mail contact: mmassi *at* mpifr-bonn.mpg.de

Context. The young binary system V773 Tau A exhibits a persistent radio flaring activity that gradually increases from a level of a few mJy at apoastron to more than 100 mJy at periastron. Interbinary collisions between very large (>15 R*) magnetic structures anchored on the two rotating stars of the system have been proposed to be the origin of these periodic radio flares. Magnetic structures extended over tens of stellar radii, that can also account for the observed fast decay of the radio flares, seem to correspond to the typical solar semi-open quite extended magnetic configurations called helmet streamers.

Aims. We aim to find direct observational evidence for the postulated, solar-like, coronal topologies.

Methods. We performed seven-consecutive-day VLBI observations at 8.4 GHz using an array consisting of the VLBA and the 100-m Effelsberg telescope. V773 Tau A was phase-referenced to QSO B0400+258.

Results. Two distinctive structures appear in the radio images here presented. They happen to be associated with the primary and secondary stars of the V773 Tau A system. In one image (Fig. 2B) the two features are extended up to 18 R* each and are nearly parallel revealing the presence of two interacting helmet streamers. One image (Fig. 2E) taken a few hours after a flare monitored by the 100-m Effelsberg telescope shows one elongated fading structure substantially rotated with respect to those seen in the B run. The same decay scenario is seen in Fig. 2G for the helmet streamer associated with the other star.

Conclusions. This is the very first direct evidence revealing that even if the flare origin is magnetic reconnection due to interbinary collision, both stars independently emit in the radio range with structures of their own. These structures are helmet streamers, observed for the first time in stars other than the Sun. The complete extent of each helmet streamer above the stellar surface is about 24 R* which implies that they can practically interact throughout the whole orbit, even rather close to apoastron where the stellar separation is 52 R*. However, the radio flares become stronger when the stars approach. Around periastron the stellar separation is only 30 R*, nearly covered by a single streamer: the two streamers overlap producing the observed giant flares.

Published by Astronomy & Astrophysics (Vol. 480, p. 489)

Fitting the young main-sequence; distances, ages and age spreads.

Nathan. J. Mayne[1] and Tim Naylor[1]

[1] School of Physics, University of Exeter, Stocker Road, Exeter, EX4 4QL.

E-mail contact: nathan *at* astro.ex.ac.uk

We use several main-sequence models to derive distances (and extinctions), with statistically meaningful uncertainties for 11 star-forming-regions and young clusters. The model dependency is shown to be small, allowing us to adopt the distances derived using one model. Using these distances we have revised the age order for some of the clusters of Mayne et al (2007). The new nominal ages are: ≈ 2 Myrs for NGC6530 and the ONC, ≈ 3 Myrs for λ Orionis, NGC2264 and σ Orionis, $\approx 4-5$ Myrs for NGC2362, ≈ 13 Myrs for h and χ Per, ≈ 20 Myrs for NGC1960 and ≈ 40 Myrs for NGC2547. In cases of significantly variable extinction we have derived individual extinctions using a revised Q-method (Johnson and Morgan, 1953). These new data show that the largest remaining uncertainty in deriving an age ordering (and necessarily ages) is metallicity. We also discuss the use of a feature we term the R-C gap overlap to provide a diagnostic of **isochronal** age spreads or varying accretion histories within a given star-formation-region.

Finally, recent derivations of the distance to the ONC lie in two groups. Our new more precise distance of 391^{+12}_{-9} pc allows us to decisively reject the further distance, we adopt 400 pc as a convenient value.

Accepted by Monthly Notices of the Royal Astronomical Society

http://www.astro.ex.ac.uk/people/nathan/publications.html

The Spitzer c2d Survey of Large, Nearby, Interstellar Clouds. XI. Lupus Observed With IRAC and MIPS

Bruno Merín[1,2], Jes Jørgensen[3], Loredana Spezzi[4], Juan M. Alcalá[4], Neal J. Evans II[5], Paul M. Harvey[5], Nicholas Chapman[6], Tracy Huard[7], Ewine F. van Dishoeck[2,8], Fernando Comerón[8]

[1] Research and Scientific Support Department, European Space Agency (ESTEC), PO Box 299, 2200 AG Noordwijk, The Netherlands
[2] Leiden Observatory, Leiden University, PO Box 9513, 2300 RA Leiden, The Netherlands
[3] Argelander-Institut für Astronomie, University of Bonn, Auf dem Hügel 71, 53121 Bonn, Germany
[4] INAF - Osservatorio Astronomico di Capodimonte, via Moiariello 16, I-80131, Naples, Italy
[5] Department of Astronomy, University of Texas at 1 University Station C1400 Austin, TX 78712-0259, USA
[6] Astronomy Department, University of Maryland, College Park, MD 20742, USA
[7] Smithsonian Astrophysical Observatory, 60 Garden Street, MS42, Cambridge, MA 02138, USA
[8] Max Planck Institut für Extraterrestrische Physik, Giessenbachstrasse 1, 85748 Garching, Germany
[9] European Southern Observatory, Karl-Schwarzschild-Strasse 2, 85748 Garching bei München, Germany

E-mail contact: bmerin *at* rssd.esa.int

We present c2d Spitzer/IRAC observations of the Lupus I, III and IV dark clouds and discuss them in combination with optical and near-infrared and c2d MIPS data. With the Spitzer data, the new sample contains 159 stars, 4 times larger than the previous one. It is dominated by low- and very-low mass stars and it is complete down to M ≈ 0.1M$_\odot$. We find 30-40% binaries with separations between 100 to 2000 AU with no apparent effect in the disk properties of the members. A large majority of the objects are Class II or Class III objects, with only 20 (12%) of Class I or Flat spectrum sources. The disk sample is complete down to "debris"-like systems in stars as small as M $\approx$ 0.2 M$_\odot$ and includes sub-stellar objects with larger IR excesses. The disk fraction in Lupus is $70-80$%, consistent with an age of $1-2$ Myr. However, the young population contains 20% optically thick accretion disks and 40% relatively less flared disks. A growing variety of inner disk structures is found for larger inner disk clearings for equal disk masses. Lupus III is the most centrally populated and rich, followed by Lupus I with a filamentary structure and by Lupus IV, where a very high density core with little star-formation activity has been found. We estimate star formation rates in Lupus of $2-10$ M$_\odot$ Myr^{-1} and star formation efficiencies of a few percent, apparently correlated with the associated cloud masses.

Accepted by Astrophysical Journal Supplements.

Preprint: http://arxiv.org/abs/0803.1504
Full-res. figures: http://peggysue.as.utexas.edu/SIRTF/PAPERS/pap102.pub.pdf

Clustering of Emission-line Stars in the W5E HII region

Makoto Nakano[1], Koji Sugitani[2], Takahiro Niwa[3], Yoichi Itoh[3] and Makoto Watanabe[4]

[1] Faculty of Education and Welfare Science, Oita University, Oita 870-1192, Japan
[2] Graduate School of Natural Sciences, Nagoya City University, Mizuho-ku, Nagoya 467-8501, Japan
[3] Graduate School of Science and Technology, Kobe University, Kobe 657-8501, Japan
[4] Subaru Telescope, National Astronomical Observatory of Japan, 650 North A'ohoku Place, Hilo, HI 96720, USA

E-mail contact: mnakano *at* cc.oita-u.ac.jp

We have made a new survey of emission-line stars in the W5E HII region to investigate the population of PMS stars near the OB stars by using the Wide Field Grism Spectrograph 2 (WFGS2). A total of 139 Hα emission stars were detected and their g'i'-photometry was performed. The spatial distribution of them shows three aggregates, i.e., two aggregates near the bright-rimmed clouds at the edge of W5E HII region (BRC 13 and BRC 14) and one near the exciting O7V star. The age and mass of each Hα star were estimated from the extinction corrected color-magnitude

diagram and theoretical evolutionary tracks. We found, for the first time in this region, that the young stars near the exciting star are systematically older (4 Myr) than those near the edge of the HII region (1 Myr). This result supports that the formation of stars proceed sequentially from the center of HII region to the eastern bright rim. We further suggest a possibility that the birth of low mass stars near the exciting star of HII region precede the production of massive OB stars in the pre-existing molecular cloud.

Accepted by PASJ

arXiv:0802.2624

A Spitzer survey of young stellar objects in the Rosette Molecular Cloud

C.J. Poulton[1], T.P. Robitaille[1], J.S. Greaves[1], I.A. Bonnell[1], J.P. Williams[2] and M.H. Heyr[3]

[1] SUPA, School of Physics & Astronomy, University of St. Andrews, North Haugh, St. Andrews, Fife KY16 9SS, UK
[2] Institute for Astronomy, University of Hawaii, 2680 Woodlawn Drive, Honolulu, HI 96822, USA
[3] Department of Astronomy, University of Massachusetts, Amherst, MA 01003, USA

E-mail contact: cp85 *at* st-and.ac.uk

We present results from a survey of the Rosette Molecular Cloud (RMC) using both the Infrared Array Camera (IRAC) and Multiband Imaging Photometer for Spitzer (MIPS) onboard the Spitzer Space Telescope. We have mapped a region of active star formation covering an area approximately 1° by 1.5° including several previously known clusters. Spectral energy distributions (SEDs) fitted to our data combined with that from Two Micron All Sky Survey (2MASS) are used to identify young stellar objects (YSOs) with infrared (IR) excesses. We find that roughly 50 per cent of the sources are forming in clustered environments and identify seven clusters of IR excess sources including four that were previously unknown. We investigate evidence for triggering of star formation due to the ionization front, identified in Brackett-α emission, associated with the young open cluster NGC 2244. Although the position of several of the clusters of IR excess sources are coincident with the ionization front, the bulk of the youngest YSOs are located far from the ionization front, in clusters located along the mid-plane of the cloud. We conclude that although triggering from the H II nebula is a possible origin for some of the recent star formation, the majority of the active star formation is occurring in already dense regions of the cloud not compressed by the expansion of the H II region.

Published by Monthly Notices of the Royal Astronomical Society (Vol. 384, p. 1249)

Resolving the chemistry in the disk of TW Hydrae I. Deuterated species

Chunhua Qi[1], David J. Wilner[1], Yuri Aikawa[2], Geoffrey A. Blake[3] and Michiel R. Hogerheijde[4]

[1] Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, Cambridge, MA 02138, USA
[2] Department of Earth and Planetary Sciences, Kobe University, Kobe 657-8501, Japan
[3] Divisions of Geological & Planetary Sciences and Chemistry & Chemical Engineering, California Institute of Technology, MS 150–21, Pasadena, CA 91125, USA
[4] Leiden Observatory, Leiden University, PO Box 9513, 2300 RA, Leiden, The Netherlands

E-mail contact: cqi *at* cfa.harvard.edu

We present Submillimeter Array (SMA) observations of several deuterated species in the disk around the classical T Tauri star TW Hydrae at arcsecond scales, including detections of the DCN J=3–2 and DCO^+ J=3–2 lines, and upper limits to the HDO $3_{1,2}$–$2_{2,1}$, ortho-H_2D^+ $1_{1,0}$–$1_{1,1}$ and para-D_2H^+ $1_{1,0}$–$1_{0,1}$ transitions. We also present observations of the HCN J=3–2, HCO^+ J=3–2 and $H^{13}CO^+$ J=4–3 lines for comparison with their deuterated isotopologues. We constrain the radial and vertical distributions of various species in the disk by fitting the data using a model where the molecular emission from an irradiated accretion disk is sampled with a 2D Monte Carlo radiative transfer code. We find that the distribution of DCO^+ differs markedly from that of HCO^+. The D/H ratios inferred change by at least one order of magnitude (0.01 to 0.1) for radii <30 AU to $\geq$70 AU and there is a rapid falloff of the abundance of DCO^+ at radii larger than 90 AU. Using a simple analytical chemical model, we constrain the degree of ionization, x(e-)=n(e-)/n(H_2), to be $\sim 10^{-7}$ in the disk layer(s) where these molecules are present. Provided the distribution of DCN follows that of HCN, the ratio of DCN to HCN is determined to be $1.7\pm0.5 \times 10^{-2}$; however, this ratio is very sensitive to the poorly constrained vertical distribution of HCN. The resolved radial distribution of DCO^+ indicates that *in situ* deuterium fractionation remains active within the TW Hydrae disk and must be considered in

the molecular evolution of circumstellar accretion disks.

Accepted by The Astrophysical Journal

http://arXiv.org/abs/0803.2753

Spitzer/MIPS Observations of Stars in the Beta Pictoris Moving Group

L. M. Rebull[1], K. R. Stapelfeldt[2], M. W. Werner[2], V. G. Mannings[1], C. Chen[3], J. R. Stauffer[1], P. S. Smith[4], I. Song[1], D. Hines[5] and F. J. Low[4]

[1] Spitzer Science Center
[2] JPL
[3] NOAO
[4] University of Arizona
[5] SSI

E-mail contact: rebull *at* ipac.caltech.edu

We present Multiband Imaging Photometer for Spitzer (MIPS) observations at 24 and 70 μm for 30 stars, and at 160 μm for a subset of 12 stars, in the nearby ($\sim$30 pc), young ($\sim$12 Myr) Beta Pictoris Moving Group (BPMG). In several cases, the new MIPS measurements resolve source confusion and background contamination issues in the IRAS data for this sample. We find that 7 members have 24 μm excesses, implying a debris disk fraction of 23%, and that at least 11 have 70 μm excesses (disk fraction of $\geq$37%). Five disks are detected at 160 μm (out of a biased sample of 12 stars observed), with a range of 160/70 flux ratios. The disk fraction at 24 and 70 μm, and the size of the excesses measured at each wavelength, are both consistent with an "inside-out" infrared excess decrease with time, wherein the shorter-wavelength excesses disappear before longer-wavelength excesses, and consistent with the overall decrease of infrared excess frequency with stellar age, as seen in Spitzer studies of other young stellar groups. Assuming that the infrared excesses are entirely due to circumstellar disks, we characterize the disk properties using simple models and fractional infrared luminosities. Optically thick disks, seen in the younger TW Hya and η Cha associations, are entirely absent in the BPMG. Additional flux density measurements at 24 and 70 μm are reported for nine Tucanae-Horologium Association member stars. Since this is <20% of the association membership, limited analysis on the complete disk fraction of this association is possible.

Accepted by ApJ

http://web.ipac.caltech.edu/staff/rebull/research.html

Deconstructing the High-Mass Star-Forming Region IRAS 23033+5951

Michael A. Reid[1] and Brenda C. Matthews[2]

[1] Harvard-Smithsonian Center for Astrophysics, Submillimeter Array Project, 645 North Aohoku Place., Hilo, HI 96720, USA
[2] Herzberg Institute of Astrophysics, National Research Council of Canada, Victoria, BC V9E 2E7, Canada

We report interferometric observations of the high-mass star-forming object IRAS 23033+5951. Our observations reveal two massive molecular cloud cores, designated IRAS 23033+5951-MMS1 and IRAS 23033+5951-MMS2. MMS1 has already formed a massive protostar and MMS2 appears to be on the verge of doing so. The latter core may be an example of a massive analog to a Class 0 star-forming object. The more evolved core shows some evidence of N_2H^+ destruction near the protostar, consistent with similar findings in low-mass star-forming objects. In addition to the already-known prominent HCO^+ outflow, our SiO 2-1 and CH_3OH 2-1 maps show evidence for two more candidate outflows, both presumably less powerful than the main one. Both cores are embedded in an elongated feature whose major axis is oriented almost exactly perpendicular to the axis of the most prominent outflow in the region. Although it has many of the characteristics of a disk, the 87,000 AU (0.42 pc) diameter of this structure suggests that it is more likely to be the flattened, rotating remnant of the natal molecular cloud fragment from which the star-forming cores condensed. We conclude that IRAS 23033+5951 is an excellent example of massive star formation proceeding in relative isolation, perhaps by the method of monolithic collapse and disk accretion.

Published by The Astrophysical Journal (Vol. 675, p. 1343)

Detection of Interstellar Cyanoformaldehyde (CNCHO)

Anthony J. Remijan[1], **J. M. Hollis**[2], **F. J. Lovas**[3], **Wilmer D. Stork**[4,5], **P. R. Jewell**[1] **and D. S. Meier**[6,7]

[1] National Radio Astronomy Observatory, 520 Edgemont Road, Charlottesville, VA 22903-2475, USA
[2] NASA Goddard Space Flight Center, Computational and Information Sciences and Technology Office, Code 606, Greenbelt, MD 20771, USA
[3] Optical Technology Division, National Institute of Standards and Technology, Gaithersburg, MD 20899, USA
[4] Plastipak Packaging, Inc., 3310 West Springfield Avenue, Champaign, IL 61821, USA
[5] Parkland College, Department of Natural Sciences, 2400 West Bradley Avenue, Champaign, IL 61821, USA
[6] David S. Meier is a Jansky Fellow of the National Radio Astronomy Observatory, USA
[7] National Radio Astronomy Observatory, Array Operations Center, P.O. Box O, 1003 Lopezville Road, Socorro, NM 87801, USA

Cyanoformaldehyde (CNCHO) has been detected toward the star-forming region Sagittarius B2(N) with the 100 m Green Bank Telescope (GBT) by means of four P-branch rotational transitions in emission, the 7(0, 7)-6(1, 6) at 8.6 GHz, the 8(0, 8)-7(1, 7) at 19.4 GHz, the 9(0, 9)-8(1, 8) at 30.3 GHz, and the 10(0, 10)-9(1, 9) at 41.3 GHz, and one P-branch transition in absorption, the 5(1, 5)-6(0, 6) at 2.1 GHz. The five b-type transitions have favorable transition line strengths ($S_{ij}\mu^2 > 10D^2$) and occur in spectral regions that have little possibility of confusion with other molecular species. The transition line strengths and energy levels involved in the four cyanoformaldehyde transitions in emission are similar; however, transitions with larger beam sizes give systematically higher column densities, suggesting that CNCHO is spatially extended and not concentrated toward the Sgr B2(N-LMH) position. Moreover, with a GBT beamwidth of $\sim 350''$, the 5(1, 5)-6(0, 6) transition of CNCHO was detected in absorption, confirming the widespread spatial extent of this molecule. We suggest that cyanoformaldehyde is likely formed in a neutral-radical reaction of two other interstellar molecules known for widespread spatial distributions: formaldehyde (H_2CO) and the cyanide (CN) radical.

Published by The Astrophysical Journal Letters (Vol. 675, p. L85)

Evolution of First Cores and Formation of Stellar Cores in Rotating Molecular Cloud Cores

Kazuya Saigo[1], **Kohji Tomisak**[1,2] **and Tomoaki Matsumoto**[1,3]

[1] National Astronomical Observatory of Japan, Mitaka, Tokyo 181-8588, Japan
[2] School of Physical Sciences, Graduate University for Advanced Studies (SOKENDAI)
[3] Faculty of Humanity and Environment, Hosei University, Fujimi, Chiyoda-ku, Tokyo 102-8160, Japan

E-mail contact: saigo *at* th.nao.ac.jp

We followed the collapse of cloud cores with various rotation speed and density frustrations using three-dimensional hydrodynamical simulations by assuming a barotropic equation of state and examined the comprehensive evolution paths from the rotation molecule cloud core to stellar core. We found that the evolutionary paths depend only on the angular velocity of initial cloud core . These evolutionary paths agree well with predictions of Saigo and Tomisaka's quasi-equilibrium axisymmetric models and SPH calculations of Bate. Evolutionary paths are qualitatively classified into three types. (1) A slowly rotating cloud with $\Omega_{c0} < 0.01/t_{ff} = 0.05(\rho_{c0}/10^{-19}\text{g cm}^{-3})^{1/2}$ rad Myr^{-1} shows spherical-type evolution, where is the initial central density. Such a cloud forms a first core which is mainly supported by the thermal pressure. The first core has a small mass of $M_{core} \sim 0.01 M_{\odot}$ and a short lifetime of a few $\times 100$ yr. After exceeding the H_2 dissociation density $\rho \simeq 5.6 \times 10^{-8}$ g cm^{-3}, it begins the second collapse, and the whole of the first core accretes onto the stellar core/disk within a few free-fall timescales. (2) A rotating cloud with $0.01/t_{ff} < \Omega_{c0} \lesssim 0.05/t_{ff}$ shows disk-type evolution. In this case, the first core becomes a centrifugally supported massive disk with and the lifetime is a few thousand years. The first core is unstable against nonaxisymmetric dynamic instability and forms spiral arms. The gravitational torque through spiral structure extracts angular momentum from the central region to the outer region of the first core. And only a central part with $r \sim 1$AU begins the second collapse after exceeding dissociation density. However, the outer remnant disk keeps its centrifugal balance after stellar core formation. It seems that this remnant of the first core should control the mass and angular momentum accretion onto the newborn stellar system. (3) A rotating cloud with $0.05/t_{ff} \lesssim \Omega_{c0}$ tends to fragment into binary or multiple during the first core phase.

Published by The Astrophysical Journal (Vol. 674, p. 997)

H_2O and OH Gas in the Terrestrial Planetforming Zones of Protoplanetary Disks

Colette Salyk[1], Klaus M. Pontoppidan[1], Geoffrey A. Blake[1], Fred Lahuis[2,3], Ewine F. van Dishoeck[3] and Neal J. Evans II[4]

[1] California Institute of Technology, Division of Geological and Planetary Sciences, MS 150-21, Pasadena, CA 91125, USA

[2] SRON National Institute for Space Research, P.O. Box 800, 9700 AV Groningen, Netherlands

[3] Leiden Observatory, Leiden University, P.O. Box 9513, 2300 RA Leiden, Netherlands

[4] Astronomy Department, University of Texas, Austin, TX 78712, USA

We present detections of numerous 10-20 μm H_2O emission lines from two protoplanetary disks around the T Tauri stars AS 205A and DR Tau, obtained using the InfraRed Spectrograph on the Spitzer Space Telescope. Follow-up 35 μm Keck NIRSPEC data confirm the presence of abundant water and spectrally resolve the lines. We also detect the P4.5 (2.934 μm) and P9.5 (3.179 μm) doublets of OH and $^{12}CO/^{13}CO$ $v = 1 \rightarrow 0$ emission in both sources. Line shapes and LTE models suggest that the emission from all three molecules originates between 0.5 and 5 AU, and so will provide a new window for understanding the chemical environment during terrestrial planet formation. LTE models also imply significant columns of H_2O and OH in the inner disk atmospheres, suggesting physical transport of volatile ices either vertically or radially, while the significant radial extent of the emission stresses the importance of a more complete understanding of nonthermal excitation processes.

Published by The Astrophysical Journal Letters (Vol. 676, p. L49)

Odin observations of the Galactic centre in the 118-GHz band. Upper limit to the O_2 abundance

Aa. Sandqvist[1], B. Larsson[1], Å. Hjalmarson[2], P. Bergman[2], P. Bernath[3], U. Frisk[4], M. Olberg[1], L. Pagani[5], and L.M. Ziurys[6]

[1] Stockholm Observatory, AlbaNova University Center, SE-106 91 Stockholm, Sweden

[2] Onsala Space Observatory, SE-439 92 Onsala, Sweden

[3] Department of Chemistry, University of York, Heslington, York, YO10 5DD, UK

[4] Swedish Space Corporation, P. O. Box 4207, SE-171 04 Solna, Sweden

[5] LERMA & UMR8112 du CNRS, Observatoire de Paris, 61, FR-75014 Paris, France

[6] Arizona Radio Observatory, Steward Observatory, University of Arizona, Tucson, AZ 85721, USA

E-mail contact: aage *at* astro.su.se

The Odin satellite has been used to search for the 118.75-GHz line of molecular oxygen (O_2) in the Galactic centre. Odin observations were performed towards the Sgr A* circumnuclear disk (CND), and the Sgr A +20 $\mathrm{km\,s^{-1}}$ and +50 $\mathrm{km\,s^{-1}}$ molecular clouds using the position-switching mode. Supplementary ground-based observations were carried out in the 2-mm band using the ARO Kitt Peak 12-m telescope to examine suspected SiC features. A strong emission line was found at 118.27 GHz, attributable to the $J = 13 - 12$ HC_3N line. Upper limits are presented for the 118.75-GHz O_2 $(1_1 - 1_0)$ ground transition line and for the 118.11-GHz $^3\Pi_2, J = 3 - 2$ ground state SiC line at the Galactic centre. Upper limits are also presented for the 487-GHz O_2 line in the Sgr A +50 $\mathrm{km\,s^{-1}}$ cloud and for the 157-GHz, $J = 4 - 3$, SiC line in the Sgr A +20 and +50 $\mathrm{km\,s^{-1}}$ clouds, as well as the CND. The CH_3OH line complex at 157.2 - 157.3 GHz has been detected in the +20 and +50 $\mathrm{km\,s^{-1}}$ clouds but not towards Sgr A*/CND. A 3σ upper limit for the fractional abundance ratio of $[O_2]/[H_2]$ is found to be $X(O_2) \leq 1.2 \times 10^{-7}$ towards the Sgr A molecular belt region.

Accepted by A&A

Also available as arXiv:0803.1726 at astro-ph

Variability of Disk Emission in Pre-Main Sequence and Related Stars. I. HD 31648 and HD 163296 - Isolated Herbig Ae Stars Driving Herbig-Haro Flows

Michael L. Sitko[1,2], William J. Carpenter[1], Robin L. Kimes[1], J. Leon Wilde[1], David K. Lynch[3], Ray W. Russell[3], Richard J. Rudy[3], Stephen S. Mazuk[3], Catherine C. Venturini[3], Richard C. Puetter[4], Carol A. Grady[5,6], Elisha F. Polomski[7], John P. Wisnewski[6], Suellen M. Brafford[8], H.B. Hammel[2] and

R. Brad Perry[9]

[1] Department of Physics, University of Cincinnati, Cincinnati, OH 45221-0011, USA
[2] Space Science Institute, 4750 Walnut St., Suite 205, Boulder, CO 80301, USA
[3] The Aerospace Corporation, Los Angeles, CA 90009, USA
[4] Center for Astrophysics and Space Science, University of California at San Diego, San Diego, CA 92093, USA
[5] Eureka Scientific, Inc., Oakland, CA 94602, USA
[6] Exoplanets and Stellar Astrophysics Laboratory, Goddard Space Flight Center, Greenbelt, MD 20771, USA
[7] Department of Astronomy, University of Minnesota, Minneapolis, MN 55455, USA
[8] 1328 Gumbert Dr., Amelia, OH 45102, USA
[9] NASA Langley Research center, Hampton, VA 23681, USA

E-mail contact: sitko *at* spacescience.org

Infrared photometry and spectroscopy covering a time span of a quarter century are presented for HD 31648 (MWC 480) and HD 163296 (MWC 275). Both are isolated Herbig Ae stars that exhibit signs of active accretion, including driving bipolar flows with embedded Herbig-Haro (HH) objects. HD 163296 was found to be relatively quiescent photometrically in its inner disk region, with the exception of a major increase in emitted flux in a broad wavelength region centered near 3 μm in 2002. In contrast, HD 31648 has exhibited sporadic changes in the entire 3-13 μm region throughout this span of time. In both stars the changes in the 1-5 μm flux indicate structural changes in the region of the disk near the dust sublimation zone, possibly causing its distance from the star to vary with time. Repeated thermal cycling through this region will result in the preferential survival of large grains, and an increase in the degree of crystallinity. The variability observed in these objects has important consequences for the interpretation of other types of observations. For example, source variability will compromise models based on interferometry measurements unless the interferometry observations are accompanied by nearly-simultaneous photometric data.

Accepted by The Astrophysical Journal

http://arxiv.org/abs/0712.4014

On the Evolution of the Dense Core Mass Function

Jonathan J. Swift[1] **and Jonathan P. Williams**[1]

[1] Institute for Astronomy, 2680 Woodlawn Dr., Honolulu, HI 96822-1897

E-mail contact: js *at* ifa.hawaii.edu

The mass distributions of dense cores in star-forming regions are measured to have a shape similar to the initial mass function of stars. This has been generally interpreted to mean that the constituent cores will form individual stars or stellar systems at a nearly constant star formation efficiency. This article presents a series of numerical experiments evolving distributions of dense cores into stars to quantify the effects of stellar multiplicity, global core fragmentation, and a varying star formation efficiency. We find that the different evolutionary schemes have an overall small effect on the shape of the resultant distributions of stars. Our results imply that at the current level of observational accuracy the comparison between mass functions of dense cores and stars alone is insufficient to discern different evolutionary models. Observations over a wide range of mass scales including the high or low-mass tails of these distributions have the largest potential to distinguish between different core evolution scenarios.

Accepted by The Astrophysical Journal

http://xxx.lanl.gov/abs/0802.2099

Survey of intermediate/high-mass star-forming regions at centimeter and millimeter wavelengths

Álvaro Sánchez-Monge[1]**, Aina Palau**[1,2]**, Robert Estalella**[1]**, Maria T. Beltrán**[1] **and Josep M. Girart**[3]

[1] Departament d'Astronomia i Meteorologia, Universitat de Barcelona, Martí i Franquès 1, E-08028 Barcelona, Spain

[2] Laboratorio de Astrofísica Espacial y Física Fundamental, INTA, Apartado 78, E-28691 Villanueva de la Cañada, Madrid, Spain

[3] Institut de Ciències de l'Espai (CSIC-IEEC), Campus UAB – Facultat de Ciències, Torre C5 – parell 2, E-08193 Bellaterra, Catalunya, Spain

E-mail contact: asanchez *at* am.ub.es

We present the results of millimeter and centimeter continuum observations, made with the IRAM 30 m telescopend the VLA, toward a sample of 11 luminous IRAS sources classified as high-mass protostellar object candidates. We find 1.2 mm emission for all (but one) regions likely tracing the dust core in which the massive young stellar object is forming, for which we estimate masses ranging from 10 to 140 $M_\odot$. For all the sources, but one, we detect centimeter emission associated with the IRAS source, being compact or ultracompact HII region candidates, with early B-type stars as ionizing stars. The 7 mm emission is partially resolved for the four sources observed at this wavelength, with contribution of dust emission at 7 mm ranging from negligible to 44%. By combining our data with infrared surveys we fitted the spectral energy distribution of the sources. Finally, we find a correlation between the degree of disruption of the natal cloud, estimated from the fraction of dust emission associated with the centimeter source relative to the total amount of dust in its surroundings, and the size of the centimeter source. From this correlation, we establish an evolutionary sequence which is consistent with the evolutionary stage expected from maser/outflow/dense gas emission and with the infrared excess.

Accepted by A&A

http://arxiv.org/abs/0802.3132
http://www.am.ub.es/∼robert/preprints/survey_cm_mm.pdf
http://www.am.ub.es/∼asanchez/preprints/survey_cm_mm.pdf

Strong Near-Infrared Emission Interior to the Dust-Sublimation Radius of Young Stellar Objects MWC275 and AB Aurigae.

A. Tannirkulam[1], J. D. Monnier[1], R. Millan-Gabet[2], T. J. Harries[3], E. Pedretti[4], T. A. ten Brummelaar[5], H. McAlister[5], N. Turner[5], J. Sturmann[5] and L. Sturmann[5]

[1] University of Michigan
[2] Michelson Science Center
[3] University of Exeter, School of Physics
[4] University of St. Andrews
[5] CHARA, Georgia State University

E-mail contact: atannirk *at* umich.edu

Using the longest optical-interferometeric baselines currently available, we have detected strong near-infrared (NIR) emission from inside the dust-destruction radius of Herbig Ae stars MWC275 and AB Aur. Our sub-milli-arcsecond resolution observations unambiguously place the emission between the dust-destruction radius and the magnetospheric co-rotation radius. We argue that this new component corresponds to hot gas inside the dust-sublimation radius, confirming recent claims based on spectrally-resolved interferometry and dust evaporation front modeling.

Accepted by ApJL

http://xxx.lanl.gov/abs/0803.1484

From Mean Motion Resonances to Scattered Planets: Producing the Solar System, Eccentric Exoplanets, and Late Heavy Bombardments

Edward W. Thommes[1], Geoffrey Bryden[2], Yanqin Wu[3] and Frederic A. Rasio[1]

[1] Department of Physics and Astronomy, Northwestern University, Evanston, IL 60208, USA
[2] Jet Propulsion Laboratory, Pasadena, CA 91109, USA
[3] Department of Astronomy and Astrophysics, University of Toronto, ON M5S 3H4, Canada

We show that interaction with a gas disk may produce young planetary systems with closely spaced orbits, stabilized by mean motion resonances between neighbors. On longer timescales, after the gas is gone, interaction with a remnant planetesimal disk tends to pull these configurations apart, eventually inducing dynamical instability. We find that this

can lead to a variety of outcomes; some cases resemble the solar system, while others end up with high-eccentricity orbits reminiscent of the observed exoplanets. A similar mechanism has been previously suggested as the cause of the lunar late heavy bombardment. Thus, it may be that a large-scale dynamical instability, with more or less cataclysmic results, is an evolutionary step common to many planetary systems, including our own.

Published by The Astrophysical Journal (Vol. 675, p. 1538)

Constraining the Envelope Structure of L1527 IRS: Infrared Scattered Light Modeling

John J. Tobin[1], Lee Hartmann[1], Nuria Calvet[1] and Paola D'Alessio[2]

[1] Department of Astronomy, University of Michigan, Ann Arbor, MI 48109, USA

[2] Centro de Radioastronomia y Astrofisica, UNAM, Apartado Postal 3-72 (Xangari), 58089 Morelia, Michoacian, Mexico

E-mail contact: jjtobin *at* umich.edu

We model Spitzer Space Telescope observations of the Taurus Class 0 protostar L1527 IRS (IRAS 04368+2557) to provide constraints on its protostellar envelope structure. The nearly edge-on inclination of L1527 IRS, coupled with the highly spatially-resolved near to mid-infrared images of this object and the detailed IRS spectrum, enable us to constrain the outflow cavity geometry quite well, reducing uncertainties in the other derived parameters. The mid-infrared scattered light image shows a bright central source within a dark lane; the aspect ratio of this dark lane is such that it appears highly unlikely to be a disk shadow. In modeling this dark lane, we conclude that L1527 IRS is probably not described by a standard TSC envelope with simple bipolar cavities. We find it necessary to model the dark lane and central source as a modified inner envelope structure. This structure may be due either to a complex wind-envelope interaction or induced by the central binary. To fit the overall SED, we require the central source to have a large near to mid-infrared excess, suggesting substantial disk accretion. Our model reproduces the overall morphology and surface brightness distribution of L1527 IRS fairly well, given the limitations of using axisymmetric models to fit the non-axisymmetric real object, and the derived envelope infall rates are in reasonable agreement with some other investigations. IRAC observations of L1527 IRS taken 12 months apart show variability in total flux and variability in the opposing bipolar cavities, suggesting asymmetric variations in accretion. We also provide model images at high resolution for comparison to future observations with current ground-based instrumentation and future space-based telescopes.

Accepted by The Astrophysical Journal

http://arxiv.org/abs/0802.2677

http://astro.lsa.umich.edu/∼jjtobin/L1527.pdf

High-Resolution H_2O Maser Observations toward IRAS Sources in Bright-Rimmed Clouds

R. Valdettaro[1], V. Migenes[2], M. A. Trinidad[2], J. Brand[3] and F. Palla[1]

[1] INAFOsservatorio Astrofisico di Arcetri, Largo Enrico Fermi 5, 50125 Florence, Italy

[2] Departamento de Astronomía, Universidad de Guanajuato, P.O. Box 144, Guanajuato, GTO 36000, Mexico

[3] INAFIstituto di Radioastronomia, Via Gobetti 101, 40129 Bologna, Italy

Bright-rimmed clouds (BRCs) are clouds that have been compressed by an external ionization shock front. We present the first high-resolution VLA observations of 20 of these BRCs in the northern hemisphere. We detected water maser emission from three objects: IRAS 21346+5714 (BRC 36), IRAS 21388+5622 (BRC 37), and IRAS 21445+5712 (BRC 39). The low detection rate supports the evidence that BRCs produce mostly low-luminosity objects, for which maser emission is weak and episodic, and suggests that the embedded sources are in a more advanced evolutionary phase than Class 0 objects.

Published by The Astrophysical Journal (Vol. 675, p. 1352)

Photodissociation of small carbonaceous molecules of astrophysical interest

Marc C. van Hemert[1] and Ewine F. van Dishoeck[2]

[1] Leiden Institute of Chemistry, P.O. Box 9502, 2300 RA Leiden, The Netherlands
[2] Leiden Observatory, Leiden University, P.O. Box 9513, 2300 RA Leiden, The Netherlands

E-mail contact: ewine *at* strw.leidenuniv.nl

Astronomical observations have shown that small carbonaceous molecules can persist in interstellar clouds exposed to intense ultraviolet radiation. Current astrochemical models lack quantitative information on photodissociation rates in order to interpret these data. We here present ab initio multi-reference configuration-interaction calculations of the vertical excitation energies, transition dipole moments and oscillator strengths for a number of astrophysically relevant molecules: C_3, C_4, C_2H, $l-$ and $c-C_3H$, $l-$ and $c-C_3H_2$, HC_3H, $l-C_4H$ and $l-C_5H$. Highly excited states up to the 9'th root of each symmetry are computed, and several new states with large oscillator strengths are found below the ionization potentials. These data are used to calculate upper limits on photodissociation rates in the unattenuated interstellar radiation field by assuming that all absorptions above the dissociation limit lead to dissociation.

Rates and cross sections are posted at http://www.strw.leidenuniv.nl/∼ewine/photo

Accepted by Chemical Physics 343, 292 (2008)

http://www.strw.leidenuniv.nl/∼ewine/e-prints/chemphys.pdf

Is the silicate emission feature only influenced by grain size?

N. V. Voshchinnikov[1,2] and Th. Henning[3]

[1]Sobolev Astronomical Institute, St. Petersburg University, Universitetskii prosp. 28, St. Petersburg, 198504 Russia
[2]Isaac Newton Institute of Chile, St. Petersburg Branch
[3]Max-Planck-Institut für Astronomie, Königstuhl 17, D-69117 Heidelberg, Germany

E-mail contact: nvv@astro.spbu.ru

The flattening of the 10 μm silicate emission feature observed in the spectra of T Tauri and Herbig Ae/Be stars is usually interpreted as an indicator of grain growth. We show in this paper that a similar behaviour of the feature shape occurs when the porosity of composite grains varies. The fluffy aggregates, having inclusions of different sizes, were modeled by multi-layered spheres consisting of amorphous carbon, amorphous silicate and vacuum. It is also found that the inclusion of crystalline silicates in composite porous particles can lead to a shift of the known resonances and production of new ones.

Accepted by Astronomy & Astrophysics Letters

([arXiv:0803.3227])

Numerical Simulations of the Gravitational Instability in the Dust Layer of a Protoplanetary Disk Using a Thin Disk Model

Shigeru Wakita[1] and Minoru Sekiya[2]

[1] Department of Earth and Planetary Sciences, Graduate School of Sciences, Kyushu University, Hakozaki, Higashi-ku, Fukuoka 812-8581, Japan
[2] Department of Earth and Planetary Sciences, Faculty of Sciences, Kyushu University, Hakozaki, Higashi-ku, Fukuoka 812-8581, Japan

E-mail contact: shigeru *at* geo.kyushu-u.ac.jp

The growth of the gravitational instability in the dust layer of a protoplanetary disk is investigated. In order to see the effects of only the gravitational instability, we assume a laminar disk which has no radial pressure gradient as an unperturbed state so that the shear and the streaming instabilities do not grow. We neglect the relative velocity between the dust and gas parallel to the disk plane assuming that the dust and gas couple firmly by the mutual friction. However, we take account of the dust settling by using an analytic solution of dust density growth. We construct a two-dimensional thin disk model in which the radial and azimuthal directions in the midplane are taken as independent variables. In order to keep a certain amount of a disturbance, which is considered to exist not only at

the beginning but all through the time evolution, we give perturbations repeatedly per Keplerian shear time in a local frame of reference. We find that the gravitational instability grows for the dust particle when the dimensionless gas friction time (the product of the gas friction time and the Keplerian angular velocity) is equal to 0.01. On the other hand, the gravitational instability does not grow sufficiently before the dust layer becomes infinitesimally thin if the dimensionless gas friction time is equal to 0.1. These results are consistent with the axisymmetric study by Yamoto and Sekiya. However, the gravitational instability grows nonaxisymmetrically, and trailing surface density patterns arise.

Published by The Astrophysical Journal (Vol. 675, p. 1559)

A Chandra Study of the Rosette Star-forming Complex. I. The Stellar Population and Structure of the Young Open Cluster NGC 2244

Junfeng Wang[1], Leisa K. Townsley[1], Eric D. Feigelson[1], Patrick S. Broos[1], Konstantin V. Getman[1], Carlos G. Román-Zúñiga[2,3] and Elizabeth Lada[3]

[1] Department of Astronomy and Astrophysics, Pennsylvania State University, University Park, PA 16802, USA
[2] Harvard-Smithsonian Center for Astrophysics, Cambridge, MA 02138, USA
[3] Department of Astronomy, University of Florida, Gainesville, FL 32611, USA

E-mail contact: jwang *at* astro.psu.edu

We present the first high spatial resolution X-ray study of NGC 2244, the 2 Myr old stellar cluster in the Rosette Nebula, using Chandra. Over 900 X-ray sources are detected; 77% have optical or FLAMINGOS NIR stellar counterparts and are mostly previously uncataloged young cluster members. The X-rayselected population is estimated to be nearly complete between 0.5 and 3 $M_\odot$. A number of further results emerge from our analysis: (1) The X-ray LF and the associated K-band LF indicate a normal Salpeter IMF for NGC 2244. This is inconsistent with the top-heavy IMF reported from earlier optical studies that lacked a good census of < 4 $M_\odot$ stars. By comparing the NGC 2244 and Orion Nebula Cluster XLFs, we estimate a total population of 2000 stars in NGC 2244. (2) The spatial distribution of X-ray stars is strongly concentrated around the central O5 star, HD 46150. The other early O star, HD 46223, has few companions. The cluster's stellar radial density profile shows two distinctive structures: a power-law cusp around HD 46150 that extends to 0.7 pc, surrounded by an isothermal sphere extending out to 4 pc with core radius 1.2 pc. This double structure, combined with the absence of mass segregation, indicates that this 2 Myr old cluster is not in dynamical equilibrium. (3) The fraction of X-rayselected cluster members with K-band excesses caused by inner protoplanetary disks is 6%, slightly lower than the 10% disk fraction estimated from the FLAMINGOS study based on the NIR-selected sample. (4) X-ray luminosities for 24 stars earlier than B4 confirm the long-standing relation. The Rosette OB X-ray spectra are soft and consistent with the standard model of small-scale shocks in the inner wind of a single massive star.

Published by The Astrophysical Journal (Vol. 675, p. 464)

The IPHAS catalogue of Hα emission-line sources in the northern Galactic plane

A.R. Witham[1], C. Knigge[1], J.E. Drew[2], R. Greimel[3,4], D. Steeghs[5,6], B.T. Gänsicke[5], P.J. Groot[7] and A. Mampaso[8]

[1] School of Physics & Astronomy, University of Southampton, Highfield SO17 1BJ, UK
[2] Imperial College London, Blackett Laboratory, Exhibition Road, London SW7 2AZ, UK
[3] Isaac Newton Group of Telescopes, Apartado de correos 321, E-38700 Santa Cruz de la Palma, Spain
[4] Institute of Physics, University of Graz, Universitätsplatz 5, 8010 Graz, Austria
[5] Department of Physics, University of Warwick, Coventry CV4 7AL, UK
[6] HarvardSmithsonian Center for Astrophysics, 60 Garden Street, Cambridge, MA 02138, USA
[7] Department of Astrophysics/IMAPP, Radboud University Nijmegen, PO Box 9010, 6500 GL, Nijmegen, the Netherlands
[8] Instituto de Astrofísica de Canarias, 38200 La Laguna, Tenerife, Spain

E-mail contact: christian *at* astro.soton.ac.uk

We present a catalogue of point-source Hα emission-line objects selected from the INT/WFC Photometric Hα Survey

(IPHAS) of the northern Galactic plane. The catalogue covers the magnitude range $13 \leq r' \leq 19.5$ and includes Northern hemisphere sources in the Galactic latitude range $-5° < b < 5°$. It is derived from ~ 1500 deg^2 worth of imaging data, which represents 80 per cent of the final IPHAS survey area. The electronic version of the catalogue will be updated once the full survey data become available. In total, the present catalogue contains 4853 point sources that exhibit strong photometric evidence for Hα emission. We have so far analysed spectra for $\sim$ 300 of these sources, confirming more than 95 per cent of them as genuine emission-line stars. A wide range of stellar populations are represented in the catalogue, including early-type emission-line stars, active late-type stars, interacting binaries, young stellar objects and compact nebulae.

The spatial distribution of catalogue objects shows overdensities near sites of recent or current star formation, as well as possible evidence for the warp of the Galactic plane. Photometrically, the incidence of Hα emission is bimodally distributed in (r′ - i′). The blue peak is made up mostly of early-type emission-line stars, whereas the red peak may signal an increasing contribution from other objects, such as young/active low-mass stars. We have cross-matched our Hα-excess catalogue against the emission-line star catalogue of Kohoutek & Wehmeyer, as well as against sources in SIMBAD. We find that fewer than 10 per cent of our sources can be matched to known objects of any type. Thus IPHAS is uncovering an order of magnitude more faint ($r' > 13$) emission-line objects than were previously known in the Milky Way.

Published by Monthly Notices of the Royal Astronomical Society (Vol. 384, p. 1277)

Star Formation in the Extreme Outer Galaxy: Digel Cloud 2 Clusters

Chikako Yasui[1], Naoto Kobayashi[1,2], Alan T. Tokunaga[3], Hiroshi Terada[2] and Masao Saito[4]

[1] Institute of Astronomy, School of Science, University of Tokyo, 2-21-1 Osawa, Mitaka, Tokyo, 181-0015, Japan
[2] Subaru Telescope, National Astronomical Observatory of Japan, 650 North A'ohoku Place, Hilo, HI 96720, USA
[3] Institute for Astronomy, University of Hawaii, 2680 Woodlawn Drive, Honolulu, HI 96822, USA
[4] ALMA Project, National Astronomical Observatory of Japan, 2-21-1 Osawa, Mitaka, Tokyo 181-8588, Japan

E-mail contact: ck_yasui *at* ioa.s.u-tokyo.ac.jp

We obtained deep near-infrared (NIR) images of two embedded clusters at the northern and southern CO peaks of Cloud 2, which is one of the most distant star-forming regions in the extreme outer Galaxy, at the Galactic radius (R_g) of $\sim$ 19 kpc. We detected cluster members with a mass detection limit of $< 0.1 M_\odot$, which is well into the substellar regime (K $\sim$ 21 mag, 5 σ). These high-quality data enable a comparison of EOG values to those in the solar neighborhood on the same basis for the first time. We first constructed the NIR color-color diagram in the Mauna Kea Observatory (MKO) filter system and also for the low-metallicity environment, since the metallicity in the EOG is much lower than it is in the solar neighborhood. The estimated stellar density suggests that "isolated-type" star formation is ongoing in Cloud 2-N, while "cluster-type" star formation is ongoing in Cloud 2-S. Despite this different star formation mode, other characteristics of the two clusters are almost identical: (1) the K-band luminosity functions (KLFs) of the two clusters are quite similar, as are the estimated IMFs and ages ($\sim$0.51 Myr) from the KLF fitting; (2) the estimated star formation efficiencies (SFEs) for both clusters are typical compared to those of embedded clusters in the solar neighborhood. The similarity of two independent clusters with a large separation ($\sim$ 25 pc) strongly suggests that their star formation activities were triggered by the same mechanism, probably a supernova remnant (GSH 138-01-94), as suggested in our earlier works.

Published by The Astrophysical Journal (Vol. 675, p. 443)

The Vela Molecular Ridge Young Population: from pre-stellar condensations to young clusters

Massimo De Luca

University of Rome "Tor Vergata" - INAF Osservatorio Astronomico di Roma

2401 N Milo B. Sampson Lane, Bloomington - IN 47408, USA

Electronic mail: delucama *at* indiana.edu

Ph.D dissertation directed by: Teresa Giannini, Dario Lorenzetti

Ph.D degree awarded: February 2008

The aim of this thesis is the characterization of the proto-stellar population of a star forming region (about one square degree) of the Vela Giant Molecular Cloud Complex, paying particular attention on the correlation between young objects and physical and morphological characteristics of the cloud interstellar medium. As a by-product, observational targets for new generation instrumentation have been also identified.

Giant Molecular Clouds contain over 80 % of the molecular hydrogen content of the Galaxy and are now considered responsible for most of the star birth. They thus represent the most promising sites for the research activity on star formation.

By analysing the large-scale cloud structure we describe the gas-dust condensations inside which collapse into new stars begins. It follows a detailed inspection of both the infrared emission arising from such condensations and of the mass-loss phenomena (jets and outflows) associated with the youngest objects. This allows us to draw interesting conclusions regarding the star-forming modalities, both within each condensation and, more in general, within the cloud, enabling a comparison with other Galactic clouds.

The large analysed database covers the range from Near-Infrared to millimeter wavelengths and has been obtained by means of both ground based and space-born facilities (we present also the first results of the on-going study of maps acquired by the Spitzer Space Telescope).

The contribution given by this study to the present-day research activity on star formation mostly concerns the debates regarding: *(i)* the spatial relation between sites of star birth and interstellar material distribution, *(ii)* the link between the mass distribution of the cloud condensations and the Initial Mass Function, *(iii)* the statistics of different evolutionary stages of young objects within dust and molecular cores, *(iv)* the identification of interesting sources for a future investigation by means of more powerful instrumentation (e.g. ALMA and Herschel).

http://www.mporzio.astro.it/∼bruni/

Star formation triggered by supernovae shocks

Marcia Leao

Instituto de Astronomia, Geofisica e Ciencias Atmosfericas, University of Sao Paulo, Brazil

Rua do Matao, 1226, Cidade Universitaria, Sao Paulo/SP, Brazil - 05508-090

Electronic mail: mrmleao *at* astro.iag.usp.br

Ph.D dissertation directed by: Elisabete M. de Gouveia Dal Pino

Ph.D degree awarded: December 2007

In this work, we have investigated the role of astrophysical shocks in the diffuse gas as a mechanism for triggering star formation, giving emphasis to the impact of a supernova remnant (SNR) into a neutral cloud in order to examine the conditions at which these interactions can lead to the formation of dense structures which are able to become gravitationally unstable either in the presence or in the absence of magnetic fields. We have derived analytically a set of conditions that are favorable for driving gravitational instability in the cloud and thus star formation. One of these conditions determines the Jeans mass limit for the shocked cloud material due to the SNR impact. A second constraint establishes that the shock front that propagates inside cloud must have energy enough to sweep it entirely before stalling inside it due to radiative losses. In this way, the shock will be able to inject a maximum possible energy into the cloud material and compress it efficiently. A third condition establishes that the same shock front should not be too strong, otherwise it could destroy the cloud completely making the gas to disperse in the interstellar medium before becoming gravitationally unstable. Using these three conditions, we have built diagrams of the SNR radius, R_{SNR}, versus the initial cloud density, n_c, that reveal a zone where star formation is allowed. These diagrams have been also tested with fully 3-D hydrodynamical radiatively cooling numerical simulations previously performed by Melioli, de Gouveia Dal Pino, de la Reza, & Raga (MNRAS, **373**, 811, 2006) and we have found that the numerical results are consistent with those established by the SNR-cloud density diagrams. While the inclusion of a homogeneous magnetic field approximately perpendicular to the impact velocity of the SNR with an intensity $\sim 1\ \mu$G within the cloud results only a small shrinking of the star formation zone in the diagrams a larger magnetic field ($\sim 10\ \mu$G) causes a significant shrinking, as expected. Applications of our results to several star formation regions in our own galaxy have revealed that the star formation in those sites could have been triggered by shock waves from SN explosions (e.g., the large CO shell in Cassiopeia, and the Edge Cloud 2 in Scorpius) for specific ranges of values of the initial neutral cloud density. Finally, we have evaluated the star formation efficiency from our diagrams and found that they are much smaller than the observed values in our own Galaxy (SFE < 0.3). This analytical result is compatible with previous numerical work in the literature (e.g., Joung & Mac Low, 2006, ApJ., **653**, 1266). It also suggests that the mechanism presently investigated, though very powerful to drive structure formation, supersonic turbulence and eventually, local star formation, does not seem to be sufficient to drive global star formation in normal star forming galaxies, nor even when the magnetic field in the neutral clouds is neglected.

PhD and Postdoctoral positions on star formation and astrochemistry at MPIfR, Bonn, Germany

Two PhD positions and one postdoctoral positions are available at the Max-Planck-Institut für Radioastronomie in Bonn (Germany), in the framework of the Emmy Noether group led by Dr. Bérengère Parise, focussing on deuterium astrochemistry and the emergence of molecular complexity in the formation of solar-like systems, funded by the German research agency (Deutsche Forschung Gemeinschaft). All positions are available as early as May 2008, and appointments should start no later than September 2008.

The successful candidates will work in the millimeter and submillimiter group of MPIfR, they will have access to the cutting-edge 12m APEX submm telescope (www.apex-telescope.org), and to other facilities such as the IRAM single dish and interferometer telescopes, the SMA interferometer, and the ALMA interferometer (early science 2010). They will also benefit from the close collaboration with the laboratory group of the Cologne University.

The first PhD topic is focussed on the understanding of the emergence of molecular complexity in star-forming regions by observation and modeling of deuterium fractionation of prebiotic molecules. The second PhD topic will focus on the understanding of the interaction between gas and grains, by observing deuterated water (observations possible from the ground) in objects spanning different evolutionary stages. The postdoctoral fellow will carry on interferometric studies on the spatial distribution of complex molecules, as well as carry her/his own research in collaboration with the other group members.

The PhD positions are 3-years contracts, with full social benefits (E13(2/3) of the TvöD German system). The students will be encouraged to participate in the IMPRS (International Max Planck Research School). The postdoctoral fellow is appointed for 2 years, with possible renewal, on a E13 TvöD contract with full social benefits. For more details, see: http://www.mpifr-bonn.mpg.de/staff/bparise/Emmynoether.html

Interested candidates should send a CV, a list of publications and a statement of research interests (for the postdoctoral position) to bparise@mpifr-bonn.mpg.de or to the postal address below. Candidates should also arrange to have 2 letters of reference directly sent to the same email address. Applications and letters of reference received before April 15th will be given full consideration.

Reference address:

Dr. Bérengère Parise, MPIfR, Auf dem Hügel 69, 53121 Bonn, Germany

Postdoctoral Research Position in Infrared Astronomy and Star Formation

E-mail contact: megeath@physics.utoledo.edu

The physics and astronomy department of the University of Toledo has an opening for a postdoctoral research associate in infrared astronomy and star formation. The successful applicant will work with Prof. Tom Megeath on The Herchel Orion Protostar survey (HOPS), a recently selected Herschel key project which will use the PACS instrument to take far-IR images and spectra of protostars in the Orion molecular clouds. The expected tasks span the entire trajectory of the key project: participation in the development of a data pipeline, implementing the reduction and analysis of the data, using radiative transfer codes to model the data, and publishing papers in collaboration with an international team of investigators. The applicant will also have access to existing Spitzer imaging surveys of star forming regions in the nearest 2 kpc and will be encouraged to develop their own projects with that data. The appointment is for one year initially, but is expected to extend to 3 years. The UToledo astronomy program has nine faculty members and active programs in star formation, IR spectroscopy, circumstellar disks, interstellar dust, and galactic and extragalactic clusters. Requirements are a Ph.D. in astronomy, experience with reducing and analyzing infrared data, and research experience in star formation. Please send applications to megeath@physics.utoledo.edu by April 1 with the names and email addresses of three references. Further information can be found at http://www.physics.utoledo.edu/∼megeath/index.html.

Institute of Astronomy, University of Cambridge, Postdoctoral Research Appointment in Debris Disks and Extrasolar Planets

The Institute of Astronomy has a vacancy for a postdoctoral researcher to collaborate with Mark Wyatt on research of debris disks and extrasolar planets, but would also be encouraged to pursue their own research. Applications are welcomed from researchers with interests in either theory or observations.

There is a concentration of extrasolar planet and disk researchers in the Institute of Astronomy, the Department of Applied Mathematics and Theoretical Physics and the Cavendish Astrophysics Group in Cambridge. The Isaac Newton Institute will be hosting a four month research programme from August to December 2009 on the dynamics of disks and planets, so Cambridge will be a particular focus for research during this appointment.

The 3 year position is available from 1 October 2008. The salary scale will be 25,888 to 33,780 (GBP) pa, depending on experience, plus superannuation benefits. Applicants should have a Ph.D. in Astronomy or related field. Electronic applications including a CV, publication list, research statement and coversheet PD18 should be sent for the attention of Dr Mark Wyatt, pdrec@ast.cam.ac.uk. Any attachments must be in PDF format. Other formats will not be accepted. Alternatively postal applications should be sent to Mark Wyatt, Postdoc. Recruitment, Institute of Astronomy, Madingley Road, Cambridge, CB3 0HA, UK. The deadline for applications is 2nd May 2008

Applicants should also ask three referees to send letters of recommendation to this postal address or to pdrec@ast.cam.ac.uk by the same date. Enquiries may be sent to pdrec@ast.cam.ac.uk

Further information about the Institute of Astronomy can be found at http://www.ast.cam.ac.uk and form PD18 from http://www.admin.cam.ac.uk/offices/personnel/forms/pd18

Postdoctoral Position in Observational Star Formation

Astrophysics Group, University of Exeter, UK

The Astrophysics Group of the University of Exeter invites applications for a fixed-term, 2-year postdoctoral appointment working on observational star formation with Prof Mark McCaughrean. The position is funded by CONSTELLATION, a European Commission Marie Curie Research Training Network focusing on the origin of stellar masses. The institutions involved in CONSTELLATION are the University of Exeter (coordinator); Astronomical Institute Prague; Astrophysical Institute Potsdam; CEA Saclay; Cardiff University; ENS Lyon; University of Lisbon; IAC Tenerife; INAF Palermo; INAF Arcetri; LAOG Grenoble; University of Cambridge; and University of St Andrews.

The successful applicant for the position will have an appropriate first degree and a PhD (or equivalent), and should also have strong experience with high spatial resolution and/or wide-field astronomical imaging and multi-object spectroscopy at optical, infrared, and/or X-ray wavelengths. Within CONSTELLATION, they will work on observational studies of densely-clustered star-forming regions, looking at the birth and influence of massive stars and/or the physics of the low-mass end of the IMF. This work will involve collaborative projects within the network and significant inter-team travel; CONSTELLATION young researchers also take part in a range of schools and workshops across the network as part of their training. Observational facilities available to CONSTELLATION include the ESO VLT, Gemini, GTC, VISTA, UKIRT, CFHT, JCMT, Herschel, HST, and XMM.

Applicants must meet EC Marie Curie RTN rules concerning academic and nationality eligibility, including a transnational mobility requirement. Successful applicants will be paid at Marie Curie rates, a generous package which includes a mobility allowance and a significant contribution to research-related expenses.

Applications should be made via the network website, where full details of the network structure, its science goals, and eligibility requirements can also be found:
`http://www.constellation-rtn.eu`
`http://www.constellation-rtn.eu/Positions`

Further information on the Exeter Astrophysics Group can be found at: `http://www.astro.ex.ac.uk`

Informal enquiries can be made to Prof Mark McCaughrean via email to mjm *at* astro.ex.ac.uk.

The closing date for receipt of applications is May 1 2008. The starting date is no later than November 30 2008.

Equal Opportunities Employer

New Light on Young Stars: *Spitzer's* View of Circumstellar Disks

The *Spitzer* Science Center invites you to its 5th annual conference "New Light on Young Stars," an international astrophysics meeting in Pasadena, CA on October 26 - 30, 2008. The unprecedented infrared sensitivity of the *Spitzer* Space Telescope has enabled major advances in the study of protostellar, protoplanetary, and debris disks. Now, as *Spitzer* nears the transition from cryogenic to warm mission, it is an opportune time to assess and synthesize recent progress in our understanding of circumstellar disks and focus on the outstanding science questions for future work. At the meeting, results from *Spitzer's* surveys of circumstellar matter in the Milky Way will be considered in the context of work at other wavelengths and underlying theory in the following topic areas:

- Surveys of star-formation regions
- Effects of environment and central object on young disk properties
- Structure of protostellar/protoplanetary disks and envelopes
- Spectroscopic diagnostics of circumstellar gas and dust
- Transition disks, disk evolution, and planet formation
- Frequency, structure, and theory of debris disks

The meeting should be a milestone for our community in assessing how *Spitzer* has impacted these areas of astronomy. It will contain both invited and contributed talks, as well as poster sessions. In addition, time will be allocated for discussion of controversial topics, such as how to define transition disks and the nature of diskless young stars.

To join our mailing list for conference announcements, please send e-mail to: spitzer08@ipac.caltech.edu

For more information: **http://www.ipac.caltech.edu/spitzer2008/**

JENAM 2008 - Symposium 9, September 10-12, Vienna, Austria

Star Formation from Spitzer (Lyman) to Spitzer (Telescope) and Beyond

Many aspects of stellar structure and evolution are close to being solved problems. This is definitely not true of the processes of star formation even in our own Galaxy today, let alone in other galaxies and in the distant past. In hopes of establishing a sense of perspective in the field, JENAM's Symposium 9 will address:

- How star formation came to be recognized as an important discipline and early advances in the field.
- The current situation as it has been clarified by the Spitzer Space Telescope and other recent results on nearby processes and other modes of star formation.
- How the field can be expected to develop over the next decade or two.

SOC: J. Alves, V. Trimble (co-chairs), C. Cesarsky, T. Henning, M. McCaughrean, J. Silk, K. Stapelfeldt

Web page: **www.spitzer2spitzer.org**

SECOND ANNOUNCEMENT OF IAU SYMPOSIUM 255

Low-Metallicity Star Formation: From the First Stars to Dwarf Galaxies

June 16-20, 2008

Rapallo, Genova - Liguria, Italy

MOTIVATION: Although low-mass metal-poor galaxies in the local universe have often been proposed as the "primordial building blocks" in the hierarchical scenario of structure formation, several lines of evidence suggest that this may not be true. These apparent contradictions can be better debated by bringing together astronomers from heterogeneous fields including stellar populations and population synthesis, stellar evolution and the end-products of star formation, the physics and dynamics of the interstellar medium, and chemical evolution. Combining theory of metal-poor and primordial star formation with low- and high-redshift observations over a wide range of wavelengths from the X-ray to the radio will allow us to assess the viability of using local dwarf galaxies as high-redshift analogues.

PAYMENT OF EARLY REGISTRATION: Payment of the early registration fee of *200 Euros* through bank transfer (see http://www.arcetri.astro.it/iaus255/registration.html). After 15 April 2008, the registration fee will become *250 Euros*, payable either through bank transfer or at the beginning of the symposium (in cash) on 15-16 June. The registration fee includes bus transfer from either the Genova or Pisa airports before and after the conference, the welcome cocktail on Sunday, 15 June, coffee breaks, the Abstracts booklet, and the publication of the conference proceedings. Our funding has allowed us to *WAIVE THE REGISTRATION FEE* for IAU grant recipients and for the Invited Speakers; PLEASE do not pay the registration fee if you belong to either of these categories. Also, if you have already registered for the conference, please do not register again; you must only pay the registration fee. The list of participants already registered is available at http://www.arcetri.astro.it/iaus255/participants.html.

ABSTRACT SUBMISSION: Even if you have already submitted an Abstract through our preliminary registration form, you must re-submit it with our LaTex template available at http://www.arcetri.astro.it/iaus255/abstracts.html. The filled-in template (including title, authors, affiliations, and no more than 1 page of abstract text in the compiled LaTex file) must be sent to the Symposium email address iaus255@arcetri.astro.it by 15 April 2008, specifying a preference for either an oral or a poster contribution. Notification of the oral presentations will be given by 15 May 2008. We can host no more than about 100 posters because of limited exhibition space, and notification of successful posters will also be given by 15 May. As stated above, the deadline for abstract submission is 15 April 2008; because of time and space limitations, only abstracts received by this date will be considered for the selection of the contributed talks and poster contributions.

HOTEL RESERVATIONS: A list of hotels can be found at http://www.arcetri.astro.it/iaus255/accommodations.html You are kindly requested to fill out the Hotel Reservation form available there, and fax it to the hotel of your choice. We have secured conventions with the hotels listed, but you are advised to consult their individual web sites or call them to obtain more detailed price and availability information. The deadline for obtaining the prices listed in our web site is 1 April 2008. Because Rapallo is a summer tourist attraction on the Mediterranean sea, it is highly recommended to reserve your accommodation before or by this date.

Detailed information about the Symposium is available at:

http://www.arcetri.astro.it/iaus255/

E P o S 2 0 0 8

The Early Phase of Star Formation
The Future of the Field

July 28 - August 1, 2008
Max-Planck Society Conference Center Ringberg Castle, Germany

Organized by J. Steinacker & A. Bacmann

Scientific Advisory Committee: L. Allen, A. Bacmann, E. Bergin, I. Bonnell, R. Chini, B. Elmegreen, Th. Henning, D. Johnstone, R. Klein, C. Lada, K. Menten, T. Montmerle, J. Steinacker, E. van Dishoeck, M. Walmsley

Objectives of the conference: Given the importance of stars in astronomy, it seems surprising that there is still no generally accepted paradigm for the initial phase of the star formation process.

There is ample evidence from observations and theory that the star formation might be influenced or even controlled by the interplay of gravitation, magnetic fields, radiation, chemistry, and turbulence. But it remains to be identified which processes dominate the initial phase of the stellar formation.

While in the previous meeting EPoS 2006, general aspects of the field have been reviewed, EPoS 2008 aims to explore the future of the field. Special attention will be paid to the observational and theoretical perspectives promising substantial progress in the field.

The conference focuses on early low- and high-mass star formation. The topics covered are: triggered star formation, clustered star formation, cores, chemistry, collapse, fragmentation, jets, competitive accretion, giant molecular clouds, binarity, magnetic fields, initial mass function, turbulence, and early phases of disks.

Conference location: Castle Ringberg, overlooking the Tegernsee in the foothills of the Bavarian Alps, is a unique place for scientific meetings with its relaxed mountain atmosphere high above the daily business activities. Due to its generous architecture, there is ample space to meet and discuss in small groups, meeting rooms, or in the lecture hall. Owned by the Max-Planck Society, this center of scientific communication features several conference rooms, a dining hall, accommodation for the participants as well as a terrace, swimming pool, and a garden. Wireless LAN is available.

Web-site: Relevant information including deadlines, registration, program etc. can be found at

www.mpia.de/homes/stein/EPoS2008/

Registration: Registration is open now, details are given on the website.

The Scientific Advisory Committee will decide about contributed talks/posters and the participation on the basis of submitted abstracts of registered participants only.

There is no registration fee for EPoS 2008.

Please consider the

Deadline for Registration and Abstract Submission: May 1st, 2008

The number of participants is limited to 60.

Looking forward to welcoming you at Ringberg Castle

Jürgen Steinacker and Aurore Bacmann

C O S M I C D U S T - N E A R & F A R

to be held from September 8th to 12th 2008 at the Convention Center in Heidelberg/Germany.

OBJECTIVES

The goal of the meeting is to present a comprehensive assessment of cosmic dust in all astrophysical environments where dust is important for the physical and chemical processes. The meeting is a sequel in a line of cosmic dust conferences starting in Albany in 1972 and following the last very successful meeting in the Rockies Conference Center organized by A. Witt in 2003. "Cosmic Dust - Near & Far" is scheduled at a time where new exciting cosmic dust data are expected from the Spitzer telescope, meteorite/IDP measurements, and the Stardust mission and will take place shortly before the launch of the Herschel mission. The meeting is expected to cover new findings and future perspectives of cosmic dust in environments ranging from the solar system to galaxies and the early universe. Observational results, theoretical models, and the outcome of laboratory experiments will be addressed and their implication for future space missions will be highlighted.

TOPICS

1. Dust around Evolved Stars and in Supernovae
2. Dust in Protoplanetary and Debris Disks, and Substellar Object Atmospheres
3. Dust in the Solar Systems
4. Dust in the Milky Way and other Galaxies
5. Dust in the Early Universe
6. Dust Physics and Chemistry
7. Laboratory Studies of Dust
8. Dust Evolution and Models

SCIENTIFIC ORGANIZING COMMITTEE

Thomas Henning (Chair), Anja Andersen, Luigi Colangeli, Louis d'Hendecourt, Bruce Draine, Priscilla Frisch, Eberhard Gruen, Tadashi Mukai, Harald Mutschke, Yvonne Pendleton, Juergen Steinacker, Adolf Witt

REVIEW SPEAKERS (status January 31st 2008)

Susanne Hoefner, Takashi Kozasa, Dan Watson, Adam Burrows, Diane Wooden, Daniela Calzetti, Takaya Nozawa, Rob Ivison, Cornelia Jaeger, Michel Min, Christine Joblin, Emmanuel Dartois, Bruce Draine, Carsten Dominik

LOCATION

This conference will be held in the Heidelberg Convention Center (Kongresshaus Stadthalle Heidelberg) located directly in the center of downtown Heidelberg overlooking the river Neckar.

The venue is a beautiful old (1903) building equipped with all modern conference facilities. Due to its central location, hotels, touristic sights, the castle and numerous restaurants are all within walking distance.

Heidelberg hosts one of the oldest Universities of Europe, and it has ever been an academic center over a wide field of research areas. The city has five astrophysical institutes, and a large community is interested in galaxy and star formation research.

WEB-SITE AND REGISTRATION

Additional information on this meeting can be found at

http://www.mpia.de/DNF08/

There will be ample room for contributed talks and posters. The online-registration at the webpage is open now. If you want to be added to the email-list for additional announcements about the conference, just write an email with the subject "enter" to DNF08@mpia.de.

We plan to publish the proceedings as an ASP proceedings volume.

The conference webpage provides an accommodation link to hotels where we have block-reserved rooms of various prices.

We hope to see you in Heidelberg in September.

Representing the SOC and LOC,

Thomas Henning

SECOND ANNOUNCEMENT

Protostellar Jets in Context

7-11 July 2008, island of Rhodes, Greece

Registration is now open !

REMINDER: *** Deadline April 7th, 2008 *** for contributed abstracts and financial support requests.

EARLY REGISTRATION IS HIGHLY RECOMMENDED!

see: http://conferences.phys.uoa.gr/jets2008/

Contact: jets2008@phys.uoa.gr

THE CONFERENCE:
Protostellar Jets in Context is an international astrophysics conference open to all interested scientists, which is organized at the initiative of the JETSET European Research and Training Network (RTN) (www.jetsets.org).

SCIENTIFIC RATIONALE:
The main goal is to review the recent contributions of theoretical and computational modelling, high-resolution observations, and laboratory experiments to our understanding of jets and outflows from young stars. The connection with accretion disks and the similarities with outflow phenomena in other astrophysical contexts will also be explored. The conference aims to bring together scientists working in these various fields to stimulate cross-disciplinary exchange. It will contain both invited and contributed talks, as well as poster sessions.

The proceedings will be published by Springer-Verlag (science editors: Kanaris Tsinganos and Tom Ray).

INVITED SPEAKERS:
F. Bacciotti - Resolved inner jets from T Tauri stars
R. Bachiller - Molecular outflows - observations
J. Bally - Protostellar Jets
S. Cabrit - Class O jets
T. Downes - Molecular outflows - modelling
J. Eisloffel - Jet kinematics
J. Ferreira - Disk-wind models
A. Frank - Jets and turbulence
P. Hartigan (tbc) - Magnetic fields in jets
L. Hartmann - The star-jet-disk system and angular momentum transfer
C. Johns-Krull - Hot inner winds from T Tauri stars
A. Konigl - Theory of Wind-Driving Protostellar Disks
S. Lebedev - Laboratory jets
M. Livio (tbc) - Jets in Astrophysics
S. Massaglia - Similarities/differences of AGN/YSO jets
T. Matsumoto - Similarities of the launching mechanism in protostellar/AGN jets
B. Nisini - Class I jets
G. Pineau des Forets (tbc) - Jet and molecular cloud chemistry
A. Raga - Shock formation in Jets
M. Romanova - Disk-Star interaction and Jets
D. Sheperd - Future Prospects with ALMA
F. Shu (tbc) - X-wind models
J. Sokoloski - Jets from white dwarfs
J. Stone (tbc) - accretion disks and their instabilities
E. Trussoni - The KH-instability and the propagation of stellar jets

TOPICS COVERED:
- The jet/wind-launching region: Theories, observations, and numerical simula-tions that address the origin of atomic and molecular jets and winds in young stars, the physics of the star/disk interaction zone, the connection with accretion disks and the role of jets in removing angular momentum. - The propagation, cooling, stability, and environmental impact of jets on scales from the stellar envelope to the parent cloud. Large-scale numerical simula-tions of collimated outflows including AMR codes and cluster/grid technolo-gies. Observations and models of bipolar outflows, from the

X-ray to the submm regime. The origin of knots in jets. - Laboratory experiments that reproduce, in a scaled manner, key aspects of the dynamics of astrophysical jets relevant to their formation, collimation and interaction with the interstellar medium. Experimental benchmarks for HD and MHD codes and radiative transfer in jets. - Similarities and differences between protostellar jets and their astrophysical siblings, for example coronal jets, outflows in planetary nebulae, pulsar jets, jets from symbiotic stars and compact binaries, as well as the collimated large-scale relativistic outflows associated with AGNs and GRBs. A special session will take place focusing on the "Funding opportunities under the EU FP7 Framework Programme" R. Bilyalov - "People" Programme : The Marie Curie Actions in FP7

The detailed program is available at: http://conferences.phys.uoa.gr/jets2008/programm.html.

IMPORTANT DATES:
* Registration is now open! ** http://conferences.phys.uoa.gr/jets2008/registration.html (the registration fee can be paid at later time)

** Deadline for abstract submission: April 7th , 2008 ** ** Deadline for financial support request: April 7th , 2008 ** Deadline for early payment of the registration fee (200 Euros): May 15th, 2008 Deadline for late payment of the registration fee (250 Euros): July 7th, 2008 Deadline for Hotel reservation: June 1st, 2008

SCIENTIFIC ORGANISING COMMITTEE:
Kanaris Tsinganos (Greece) co-chair, Tom Ray (Ireland) co-chair, John Bally (USA), Sylvie Cabrit (France), Suzan Edwards (USA), Sergey Lebedev (UK), Mario Livio (USA), Mark McCaughrean (UK), Silvano Massaglia (IT), Alex Raga (Mexico), Kazunari Shibata (Japan), Frank Shu (USA), Xander Tielens (NL)

LOCAL ORGANISING COMMITTEE:
K. Tsinganos, N. Vlahakis, M. Stute, T. Matsakos, P. Rammos

VENUE:
The conference will take place from July 7-11, 2008 inclusive in the grounds of the international convention center of the Rodos Palace http://www.rodos-palace.gr/, a 5-star resort hotel set in a singular location in one of the most alluring destinations of the Mediterranean. A special room rate has been negotiated for participants at 130 (single)/160 (double) Euros/night (breakfast and lunch included). Advance booking is available through the conference website. High speed on-line Internet connection will be available to hotel guests.

PRACTICAL INFORMATION: Climate: In Rhodes, the Mediterranean summer heat is offset by a cooling, and sometimes strong, sea breeze, making it enjoyable even in July. Average conditions in July are: water temperature 24C (75F), air temperature min: 22C (72F) max: 34C (93F), 13 hours of sun per day, no rain fall.

Getting to Rhodes: There are international charter flights to and from most European cities, as well as to and from the rest of the world. Moreover, there are daily flights from Athens, Heraklion and Thessaloniki and less frequent connections with the neighboring islands of Kastellorizo, Karpathos and Kassos. As July is in the high season, reserving well in advance (at least 2 months) is highly recommended for cheaper fares and availability. Sea Connections: There are regular ferry lines connecting Rhodes to Athens (Piraeus), Thessaloniki, Heraklion, Cyprus and Turkey. Rhodes is also connected with all neighboring islands through extensive boat and hydrofoil services.

For further inquiries contact via email: **jets2008@phys.uoa.gr**

Moving ... ??

If you move or your e-mail address changes, please send the editor your new address. If the Newsletter bounces back from an address for three consecutive months, the address is deleted from the mailing list.

The Birth and Feedback of Massive Stars Within and Beyond the Galaxy

September 25-27, 2008 in Charlottesville, Virginia, USA

The North American ALMA Science Center (http://www.cv.nrao.edu/naasc) will host its third annual science workshop in Charlottesville from September 25-27, 2008. The subject of this year's workshop is "The Birth and Feedback of Massive Stars, Within and Beyond the Galaxy"– a timely theme, given the ability of ALMA's frequency coverage, sensitivity, and resolution to bridge the gap between Galactic and low-redshift extragalactic studies of star formation and feedback.

Key science questions for the workshop include:

- What molecular cloud properties influence massive star formation?
- What are the best observational discriminators between theories of massive star/cluster formation?
- How do forming massive stars affect their parent molecular clouds (e.g., turbulence, triggering)?
- How does massive star formation differ in the most extreme environments (e.g., Galactic center, super star clusters, starburst galaxies)?
- What physics determines star formation scaling relations in galaxies?

More details about the program and logistics can be found at the workshop website: http://www.cv.nrao.edu/naasc/massive08/. The organizers encourage students, postdocs, and senior scientists working on relevant theoretical and (at all wavelengths) observational projects to preregister and submit abstracts before the deadline of May 1st. A majority of the program will be selected from contributed abstracts, with a particular focus on the "wish list" of topics that have been prioritized by the organizers and listed on the website under "meeting philosophy".

We look forward to seeing you in Charlottesville this Fall!

- Remy Indebetouw & Andrew Baker, on behalf of the SOC.

The Star Formation Newsletter is a vehicle for fast distribution of information of interest for astronomers working on star formation and molecular clouds. You can submit material for the following sections: *Abstracts of recently accepted papers* (only for papers sent to refereed journals), *Abstracts of recently accepted major reviews* (not standard conference contributions), *Dissertation Abstracts* (presenting abstracts of new Ph.D dissertations), *Meetings* (announcing meetings broadly of interest to the star and planet formation and early solar system community), *New Jobs* (advertising jobs specifically aimed towards persons within the areas of the Newsletter), and *Short Announcements* (where you can inform or request information from the community).

Latex macros for submitting abstracts and dissertation abstracts (by e-mail to reipurth@ifa.hawaii.edu) are appended to each issue of the newsletter. You can also submit via the Newsletter web interface at http://www2.ifa.hawaii.edu/star-formation/index.cfm
.

The Star Formation Newsletter is available on the World Wide Web at http://www.ifa.hawaii.edu/users/reipurth/newsletter.htm.