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Abstracts of recently accepted papers

Interferometric Observations of Formaldehyde in the Protoplanetary Disk around LkCa15

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Emission from the $2_{12}-1_{11}$ line of H_2CO has been detected and marginally resolved toward LkCa15 by the Nobeyama Millimeter Array. The column density of H_2CO is higher than that observed in DM Tau and than predicted by theoretical models of disk chemistry, and the line intensity profile is less centrally peaked than that for CO. Similar behavior is observed in other organic gaseous molecules in the LkCa15 disk.

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http://arxiv.org/abs/astro-ph/0211440

Detections of Ro-Vibrational H_2 Emission from the Disks of T Tauri Stars

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We report the detection of quiescent H_2 emission in the v=1→0 S(1) line at 2.12183 μm in the circumstellar environment of two classical T Tauri stars, GG Tau A and LkCa 15, in high-resolution (R $\simeq$ 60,000) spectra, bringing to four, including TW Hya and the weak-lined T Tauri star DoAr 21, the number of T Tauri stars showing such emission. The equivalent widths of the H_2 emission line lie in the range 0.05-0.10 Å and, in each case, the central velocity of the emission line is centered at the star's systemic velocity. The line widths range from 9 to 14 km s^{-1}, in agreement with those expected from gas in Keplerian orbits in circumstellar disks surrounding K-type stars at distances $\geq$ 10 AU from the sources. We suggest that UV fluorescence and X-ray heating are likely candidates responsible for producing the observed emission. We present mass estimates from the measured line intensities and show that the estimated masses are consistent with those expected from the possible mechanisms responsible for stimulating the observed emission. The high temperatures and low densities required for significant emission in the v=1→0 S(1) line suggests that we have detected reservoirs of hot H_2 gas located in the low density, upper atmospheres of circumstellar disks of these stars.

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astroph/0301124

Mid-Infrared Imaging of the Protostellar Binary L1448N–IRS3(A,B)

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Mid-infrared ($10-25$ μm) imaging of the protostellar binary system L1448N-IRS3(A,B) is presented. Only one source, IRS3(A), was detected at mid-infrared wavelengths – all of the mid-infrared emission from IRS3(A,B) emanates from IRS3(A). The mid-infrared luminosity of IRS3(A) is $L_{midir} = 1.3(d/300\mathrm{pc})^2 \mathrm{L}_\odot$, which yields a central source mass, depending on the mass infall rate, of $M_* = 0.2 M_\odot (10^{-6} M_\odot yr^{-1}/\dot{M})$. The envelope mass surrounding IRS3(A) is $\sim 0.15 M_\odot$, suggesting that the central source and the envelope are of comparable mass. The locations of IRS3(A) and IRS3(B) on an $M_{env} - L_{bol}$ diagram indicate that IRS3(A) and IRS3(B) appear to be class I and class 0 protostars, respectively.

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http://xxx.lanl.gov/abs/astro-ph/0211082

Detection of Nine M8.0-L0.5 Binaries: The Very Low Mass Binary Population and its Implications for Brown Dwarf and VLM Star Formation

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Use of the highly sensitive Hokupa'a/Gemini curvature wavefront sensor has allowed direct adaptive optics (AO) guiding on very low mass (VLM) stars with SpT=M8.0-L0.5. A survey of 39 such objects detected 9 VLM binaries. Most of these systems are tight (separation <5 AU) and have similar masses (ΔKs<0.8 mag; $0.85< q <1.0$). We find a sensitivity corrected binary fraction in the range 15±7% for M8.0-L0.5 stars with separations >2.6 AU. This is slightly less than the 32±9% measured for more massive M0-M4 dwarfs over the same separation range (Fischer & Marcy 1992). It appears M8.0-L0.5 binaries (as well as L and T dwarf binaries) have a much smaller semi-major axis distribution peak (∼4 AU) than early M binaries. We also find no VLM binary systems (defined here as systems with M_{tot} <0.185 solar masses) with separations >15 AU.

We briefly explore possible reasons why VLM binaries are slightly less common, nearly equal mass, and much more tightly bound compared to more massive binaries. We find that a kick during the ejection of a forming VLM binary from a close triple or quadruple encounter (imparting a differential kick of ∼3 km/s between the members of the binary) could reproduce the observed cut-off in the semi-major axis distribution at ∼20 AU. However, the estimated binarity (∼<5%; Bate et al. 2002) produced by such "ejection scenarios" is below the 9-15% observed. Similarly, the dynamical decay models of Sterzik & Durisen (1998); Durisen, Sterzik, & Pickett (2001) also cannot produce a VLM binary fraction above ∼5%. Our estimate of a fragmentation-produced VLM binary semi-major axis distribution contains a significant fraction of "wide" VLM binaries with a>20 AU in contrast to observation. Hence more detailed theoretical work will be needed to explain this very interesting VLM binary population.

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To download this paper link to http://xxx.lanl.gov/abs/astro-ph/0301095

A layered edge-on circumstellar disk around HK Tau B

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We present the first high angular resolution 1.4 mm and 2.7 mm continuum maps of the T Tauri binary system HK Tau obtained with the Plateau de Bure Interferometer. The contributions of both components are well disentangled at 1.4 mm and the star previously known to host an edge-on circumstellar disk, HK Tau B, is elongated along the disk's major axis. The optically bright primary dominates the thermal emission from the system at both wavelengths, confirming that it also has its own circumstellar disk. Its non-detection in scattered light images indicates that the two disks in this binary system are not parallel. Our data further indicate that the circumprimary disk is probably significantly smaller than the circumsecondary disk.
We model the millimeter thermal emission from the circumstellar disk surrounding HK Tau B. We show that the disk mass derived from scattered light images cannot reproduce the 1.4 mm emission using opacities of the same population of submicron dust grains. However, grain growth alone cannot match all the observed properties of this disk. We propose that this disk contains three separate layers: two thin outer surfaces which contain dust grains that are very similar to those of the ISM, and a disk interior which is relatively massive and/or has experienced limited grain growth with the largest grains significantly smaller than 1 mm. Such a structure could naturally result from dust settling in a protoplanetary disk.

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Near-infrared Spectra of Chamaeleon I Stars

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We present low resolution (R $\sim$ 500) near-infrared spectra of 46 candidate young stellar objects in the Chamaeleon I star-forming region recently detected in several deep photometric surveys of the cloud. Most of these stars have $K <$ 12. In addition, we present spectra of 63 previously known southern hemisphere young stars mainly belonging to the Chamaeleon I and Lupus dark clouds. We describe near-infrared spectroscopic characteristics of these stars and use the water vapor indexes to derive spectral types for the new objects. Photometric data from the literature are used to estimate the bolometric luminosities of all sources. We apply D'Antona & Mazzitelli (1998) pre-main sequence evolutionary tracks and isocrones to derive masses and ages. We detect two objects with mass below the H burning limit among the 46 new candidates. One of these object (PMK99 IR Cha INa1) is the likely driving source of a bipolar outflow in the northern region of the cloud.

Combining our targets with previously known members of the cloud we analyze the mass and age distributions for 145 stars in the Chamaeleon I dark cloud. The mass histogram rises from about 2.5 $M_\odot$ up to 0.4 $M_\odot$ and then falls off. The median mass is 0.30 $M_\odot$. The current population with masses > 0.4 $M_\odot$ is essentially complete. The scarcity of very low mass members is interpreted as population bias towards the least massive and fainter objects. If we assume the *true* Chamaeleon I IMF is flat (in logarithmic mass bins) in the interval 0.4 – 0.04$M_\odot$ as found by Comerón et al. (2000, A&A 359:269) in the central 300 arcmin^2 region, then we estimate that $\sim$ 100 stars remain to be found in that mass range. The distribution of ages indicates an active star-formation episode within the last $\sim 5 \times 10^5$ yr and a decreasing rate at older ages (few $\times 10^7$ yr).

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Dust properties of the dark cloud IC 5146 - Submillimeter and NIR imaging

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We present the results of a submillimeter dust continuum study of a molecular ridge in IC 5146 carried out at 850 μm and 450 μm with SCUBA on the James Clerk Maxell Telescope (JCMT). The mapped region is $\sim 14' \times 2.5'$ in size ($\sim 2\,\mathrm{pc} \times 0.3\,\mathrm{pc}$) and consists of at least four dense cores which are likely to be prestellar in nature. To study the dust properties of the ridge and its embedded cores, we combined the dust emission data with dust extinction data obtained by Lada et al. (1999) from the NIR colors of background giant stars. The ridge shows dust extinctions above ~ 10 mag, rising up to 35 mag in the cores.

A map of dust temperatures, constructed from the continuum flux ratios, shows significant temperature gradients: we find temperatures of up to ~ 20 K in the outskirts and between the cores, and down to $\sim$10 K in the cores themselves. The cores themselves are almost isothermal, although their average temperatures vary between 10 K and 18 K. We used the extinction data to derive in addition a map of the dust emissivity parametrized by $\kappa' = \kappa_{850}/\kappa_{\mathrm{V}}$. The average value of κ' agrees well with the canonical value of Mathis (1990). We find that κ' increases by a factor of ~ 3.8 from $\sim 1.3\,10^{-5}$ to $\sim 5\,10^{-5}$ when the dust temperature decreases from ~ 20 K to ~ 12 K. A Monte Carlo simulation shows that this change is significant with regard to the estimated calibration uncertainties. This is consistent with models of dust evolution in prestellar cores by Ossenkopf & Henning (1994) which predict that grain coagulation and the formation of ices on grain surfaces in the cold, dense cloud interiors lead to a significant increase of the 850 μm dust opacity. This interpretation is furthermore supported by the previous detection of gas-phase depletion of CO in one of the IC 5146 cores by Kramer et al. (1999). Observations of dust fluxes at short wavelengths are however needed to verify this result.

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`http://www.ph1.uni-koeln.de/~kramer/publications.html`

HI Narrow Self–Absorption in Dark Clouds

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We have used the Arecibo telescope to carry out an survey of 31 dark clouds in the Taurus/Perseus region for narrow absorption features in HI (λ 21cm) and OH (1667 and 1665 MHz) emission. We detected HI narrow self–absorption (HINSA) in 77% of the clouds that we observed. HINSA and OH emission, observed simultaneously are remarkably well correlated. Spectrally, they have the same nonthermal line width and the same line centroid velocity. Spatially, they both peak at the optically–selected central position of each cloud, and both fall off toward the cloud edges. Sources with clear HINSA feature have also been observed in transitions of CO, ^{13}CO, C^{18}O, and CI. HINSA exhibits better correlation with molecular tracers than with CI.

The line width of the absorption feature, together with analyses of the relevant radiative transfer provide upper limits to the kinetic temperature of the gas producing the HINSA. Some sources must have a temperature close to or lower than 10 K. The correlation of column densities and line widths of HINSA with those characteristics of molecular tracers suggest that a significant fraction of the atomic hydrogen is located in the cold, well–shielded portions of molecular clouds, and is mixed with the molecular gas. This is in contrast with with general HI self absorption (HISA), many of which have no CO counterpart.

The average number density ratio [HI]/[H_2] is 1.5×10^{-3}. The inferred HI density appears consistent with but is slightly higher than the value expected in steady state equilibrium between formation of HI via cosmic ray destruction

of H_2 and destruction via formation of H_2 on grain surfaces. The distribution and abundance of atomic hydrogen in molecular clouds is a critical test of dark cloud chemistry and structure, including the issues of grain surface reaction rates, PDRs, circulation, and turbulent diffusion.

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http://www.astro.cornell.edu/ di/preprints/hinsa.ps.gz

Massive Quiescent Cores in Orion. I. Temperature Structure

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We have mapped four massive cores in Orion using the NH_3 (J,K) = (1,1) and (J,K) = (2,2) inversion transitions, as part of our effort to study the pre–protostellar phase of massive star formation. These cores were selected to be quiescent, i.e. they contain no apparent IR sources and are not associated with any molecular outflows. These cores are one order of magnitude more massive than dark cloud cores and have about twice the line width. This paper focuses on their temperature structure. We find a statistically significant correlation between the gas kinetic temperature and the gas column density. The general trend is for the gas to be colder where the column density is higher, which we interpret to mean that the interiors of these cores are colder than the regions surrounding them. This is in contrast with dark cloud cores, which exhibit relatively flat temperature profiles. The temperature gradient within the massive quiescent Orion cores is consistent with an external radiation source heating the dust, and dust–gas collisions providing relatively close coupling between dust and gas temperatures. From linewidth and temperature, we also obtained the spatial distribution of the turbulence. An anticorrelation is found between the intensity of emission and the degree of turbulence. Thus, we suggest that the initial stage of massive pre–protostellar cloud cores is relatively quiescent condensations which are cooler than their surroundings.

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http://www.astro.cornell.edu/$\tilde{\text{d}}$i/preprints/orion.ps.gz

The Enigmatic HH 255

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To gain insight into the nature of the peculiar Herbig-Haro object HH 255 (also called Burnham's nebula), we use previously published observations to derive information about the emission line fluxes as a function of position within HH 255 and compare them with the well-studied, and relatively well-behaved bow shock HH 1. There are some qualitative similarities in the Hα and [O III] 5007 lines in both objects. However, in contrast to the expectation of the standard bow shock model, the fluxes of the [O I] 6300, [S II] 6731, and [N II] 6583 lines are essentially constant along the axis of the flow, while the electron density decreases, over a large distance within HH 255.

We also explore the possibility that HH 255 represents the emission behind a standing or quasi-stationary shock. The shock faces upwind, and we suggest, using theoretical arguments, that it may be associated with the collimation of the southern outflow from T Tauri. Using a simplified magnetohydrodynamic simulation to illustrate the basic concept, we demonstrate that the existence of such a shock at the north edge of HH 255 could indeed explain its unusual kinematic and ionization properties. Whether or not such a shock can explain the detailed emission line stratification remains an open question.

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Brown dwarfs in the Pleiades cluster : clues to the substellar mass function

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We present the results of a 6.4 square degrees imaging survey of the Pleiades cluster in the I and Z-bands. The survey extends up to 3 degrees from the cluster center and is 90% complete down to $I \simeq 22$. It covers a mass range from $0.03M_\odot$ to $0.48M_\odot$ and yields 40 brown dwarf candidates (BDCs) of which 29 are new. The spatial distribution of BDCs is fitted by a King profile in order to estimate the cluster substellar core radius. The Pleiades mass function is then derived across the stellar-substellar boundary and we find that, between $0.03M_\odot$ and $0.48M_\odot$, it is well represented by a single power-law, $dN/dM \propto M^{-\alpha}$, with an index $\alpha = 0.60 \pm 0.11$. Over a larger mass domain, however, from $0.03M_\odot$ to $10M_\odot$, the mass function is better fitted by a log-normal function. We estimate that brown dwarfs represent about 25% of the cluster population which nevertheless makes up less than 1.5% of the cluster mass. The early dynamical evolution of the cluster appears to have had little effect on its present mass distribution at an age of 120 Myr. Comparison between the Pleiades mass function and the Galactic field mass function suggests that apparent differences may be mostly due to unresolved binary systems.

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Dense Shell around a Young Intermediate-Mass Star NGC 2264 IRS1

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The results of $H^{13}CO^+$ J=1-0 line and 93-GHz continuum observations of NGC 2264 IRS1, the luminous infrared source known as Allen's source, are reported. IRS1 is a young intermediate-mass star with a surrounding YSO cluster around, and is associated with a molecular outflow. High angular resolution interferometric observations were performed using the Nobeyama Millimeter Array, and mapping observations were conducted using a 45-m telescope. The continuum map reveals four sources, three of which correspond to the submillimeter sources detected by Ward-Thompson et al. (2000). Four compact clumps are also detected in the $H^{13}CO^+$ map, two of which are associated with these millimeter/submillimeter continuum sources without bipolar outflow. These $H^{13}CO^+$ clumps as a whole form an incomplete dense shell of 0.12 pc in diameter around IRS1, and the outer part of the shell is clearly traced on the single-dish map. The shell or cavity structure suggests that the outflow from IRS1 has evacuated part of the surrounding envelope in ~ 0.1 Myr. The kinematic properties can be interpreted as two clumps of entrained or compressed material derived from the steady outflow. It is concluded that the activity of IRS1 may have triggered the formation of cluster members in the dense surrounding shell.

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http://www.nro.nao.ac.jp/library/report/list.html (NRO Report No. 576)

Infrared observations of NGC 3603 II. A 11.9 μm and 18 μm survey

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We present results of the first sub-arcsec resolution mid infrared survey of the southern hemisphere giant H II region NGC 3603. We have observed selected fields in the vicinity of the OB cluster at wavelengths of 11.9 μm and 18 μm using TIMMI 2 mounted on the ESO 3.6 m telescope. These fields comprise areas with dense molecular cores, embedded near infrared sources as well as several OH, H_2O and CH_3OH maser sources, which give indications of ongoing star formation processes. We report the detection of 36 mid infrared point sources and additionally provide flux measurements for 42 knots of diffuse emission.

In the area surveyed the protostar IRS 9A is found to be the most luminous source at both 11.9 μm and 18 μm. Located in its immediate vicinity two more sources (IRS 9B and IRS 9C) also exhibit significant 11.9 μm and 18 μm emission, thus providing further indications for IRS 9 being an association of protostars in its own right. Several other 11.9 μm point sources are related to near infrared sources with strong K-band excess emission and / or to maser sources, which classifies them as young sources, too. In contrast, the second strongest 11.9 μm source, IRS 4, appears to be in a more evolved stage.

Towards the center of the OB cluster we observe mid infrared emission arising from the three Wolf-Rayet stars WR 43abc, providing evidence for dust production and / or the presence of plasma in their circumstellar envelopes. Spread all over the cluster, we detect a number of sources with mid infrared fluxes close to the sensitivity limit ($\sim$ 0.01 Jy) of our 11.9 μm data, which apparently have very red K$-$N colours. We suggest that these sources are circumstellar disks which are externally heated by the nearby massive stars.

Towards the south and west of the OB cluster, large amounts of diffuse emission are found closely correlated with ionized material. We identify at least 7 shocks and ionization fronts, reflecting the enormous impact of the fast stellar winds and ionizing photons, originating from the massive cluster stars, on the adjacent gas and dust. This is impressively emphasized by the shocked and ionized material associated with the heads of the two prominent pillars. Both pillars are easily seen in our 11.9 μm and 18 μm data: the western one rather prominent in emission, the eastern one more pronounced in absorption against a strong diffuse mid infrared background.

Among those sources, for which our data do not reveal any point-like mid infrared counterpart, are IRS 1 as well as the three "proplyds". However, at least for "proplyd" 3 we detect extended, rim-like 11.9 μm emission. Therefore, we consider it likely that NGC 3603's "proplyds" simply represent scaled-down versions of the neighbouring pillars, i.e. remnant density enhancements of the pristine molecular cloud which to date were able to resist the ionizing and photoevaporating radiation from the nearby OB stars.

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Near–infrared and ISOCAM observations of the Chamaeleon II dark cloud

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An infrared study including ISOCAM images at 6.75 and 14.3 μm of a large portion (28'×26') of the Chamaeleon II dark cloud and sub-arcsec resolution JHK_s images of the central (4.9'×4.9') area is presented. Combining the ISOCAM observations with J and Ks photometry obtained with DENIS, we have found 12 young stars, of which 8 are previously identified sources. Of the new candidate YSOs, ISO-ChaII13 shows a clear mid–IR excess with an infrared luminosity of $\sim 0.02 L_\odot$ and a stellar luminosity $\geq 0.01\ L_\odot$. This last value of luminosity corresponds to that expected for a sub–stellar object with an age between 1–10Myr. The analysis of the $J-H/H-K$ diagram of the sources detected in the central part of the dark cloud has allowed us to identify 10 very faint sources not found by ISOCAM with possible near-IR excesses that may be embedded young brown dwarfs. Finally, the center of the dark cloud is characterized by the presence of the Class I YSO IRAS 12553-7651(ISO-ChaII28) with L_{bol}=1.49 $L_\odot$, and associated with a faint nebulosity observed at 2.2 μm.

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Oscillations in the PMS δ Scuti star V346 Ori

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We report the discovery of periodicities in the light curve of the Pre-Main Sequence (PMS) Herbig Ae star V346 Ori. We interpret variations in the light curve of the star as the superposition of at least two periodic signals that result from δ Scuti-type stellar oscillations. The computation of linear non-adiabatic radial pulsation models for PMS stars reproduces these periods for a 1.55 $M_\odot$ star with $T_{eff} = 7410$ K and $\log L/L_\odot = 0.74$ pulsating in the fundamental and in the second overtone. If our assumption of radial oscillations is indeed correct, the star's location on the HR diagram places it at a distance significantly smaller than that of the Orion star forming region, hence raising questions regarding the evolutionary status of V346 Ori. Observations with better time sampling and spanning a longer period of time are needed if the latter question is to be addressed fully.

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http://www.astro.up.pt/users/dfmf/MS3087.ps.gz

Looking into the Horsehead

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We present the first interferometric CO(1-0) map of the Horsehead Nebula, made with the BIMA array. The map has an angular resolution of about 10″, corresponding to about 0.02 pc. The CO form of the Horsehead closely matches its appearance in visible dust, with the CO emission dominated by a bright, thin ridge along its western side. The molecular cloud exhibits a pronounced velocity gradient of 5 $\mathrm{km\,s^{-1}\ pc^{-1}}$ from the northeast to the southwest with the southwestern portion being redshifted. The mass of the cloud is 27 $M_\odot$. We find an unusual U-shaped feature aligned with the "horse's nose" for which we discuss several interpretations. The northern portion of the U may trace a small outflow driven by the embedded young star B33-1. We discuss the formation, evolution, and ultimate fate of this well-known nebula.

Accepted by Astron. J.

The measurement of a longitudinal component of FU Ori's magnetic field.

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We observed FU Ori with the 6 m telescope of the Special Astrophysical Observatory on January 24, 2002 to measure a longitudinal component $B_\parallel$ of its magnetic field by means of the Main Stellar Spectrograph equipped with the polarimetric analyzer. The following upper limits (at 3σ level) were found:

a) $B_\parallel < 350 - 400$ G in the Fe I, Ni I and Ca I absorption lines formation region (disk+wind);

b) $B_{\|} < 200$ G in the region, where absorption component of H_α line's (P Cyg) profile is originated.

We concluded that the total strength of large scale magnetic field, that presumbly collimates disk wind, does not exceed 300 G.

We also found that $B_{\|} < 100$ G in the region, where emission component of H_α line is originated. One can not exclude that total field strength B here is much larger than 100 G, but magnetic field lines was almost perpendicular to the line of sight at the moment of observation.

Accepted by Astron. Letters

3D Continuum Radiative Transfer in Complex Dust Configurations around Stellar Objects and Active Galactic Nuclei - I. Computational Methods and Capabilities

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We present the new grid-based code SteinRay which has been developed to solve the full 3D continuum radiative transfer problem generally arising in the analysis of star-forming regions, matter around evolved stars, starburst galaxies, or tori around active galactic nuclei. The program calculates the intensity emerging from these complicated structures using a combination of step-size controlled ray-tracing and adaptive multi-wavelength photon transport grids. Along with a 2nd order finite differencing approach, the grids are optimized to reduce the discretization error and provide global error control. The full wavelength-dependent problem is solved without any flux approximation, and for arbitrary scattering properties of the dust. The program is designed to provide spatially resolved images, visibilities, and spectra of complex dust distributions even without any symmetry for wavelengths ranging from the UV to FIR and allows for multiple internal and external sources. In this paper, the algorithm is described and the capabilities of the code are illustrated by the treatment of 1D and 3D test cases. Analyzing the properties of typical cosmic dust, we discuss the wavelength range for which the time-consuming solution on adaptive grids can be omitted. The temperature is calculated self-consistently using standard accelerated Λ-iteration.

Astronomy & Astrophysics

http://www.astro.uni-jena.de/Users/stein/Science/publn.htm

Detection of Gaps in Circumstellar Disks

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We analyze the spectral appearance of gaps occurring in circumstellar disks possibly indicating the presence of a protoplanetary or planetary object. Based on the standard parameterized disk model, we explore the 10-parameter space of possible disk configurations and properties to identify the parameter ranges where the ratio of the continuum flux from disks without and with a gap is maximum. The exploration is performed with a Monte Carlo search, the maxima are found using a simulated annealing algorithm. The strongest influence on the spectra occurs for wavelengths ranging from 10 to 300 μm, with a maximum flux ratio of 1.5 for a single planet gap and 2.5 for a double planet gap, respectively. Analyzing the resulting spectra, we conclude that investigating SEDs without spectral dust features, gaps typically caused by planets can not be detected as a prominent feature.

Astrophysical Journal Letters

http://www.astro.uni-jena.de/Users/stein/Science/publn.htm

Deconstructing HD 28867

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The 3" pair of B9 stars, HD 28867, is one of the brightest X-ray sources in the Taurus-Auriga star forming region. In this multi-wavelength study, we attempt to deduce the source of the X-ray emission. We show that the East component is the X-ray source. The East component has a near-IR excess and displays narrow absorption lines in the optical, both of which are consistent with a cool stellar companion. This companion is one of the brightest low mass pre-main sequence stars in Tau-Aur; at 2 μm it and the B9 star are equally bright. We see evidence for radial velocity variability in the cool component of >34 km s^{-1}. It is not visible in K band speckle imaging, which constrains the companion to lie within 14 AU of the B star.

We also report on a possible fourth member of the group, an M1 star 18" south of HD 28867.

Accepted by Astron. J.

Full text is available at http://www.astro.sunysb.edu/fwalter/PUBS/HD28867.ps

Resolution of Distance Ambiguities of Inner Galaxy Massive Star Formation Regions II

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54 ultracompact (UC) HII regions in the GLIMPSE survey region ($|b|$ <1^o and 30^o < l < 70^o) were observed in H_2CO and H110α using the 305m Arecibo telescope. By analyzing H_2CO absorption against the UC HII region continuum emission, we resolve the distance ambiguity toward 44 sources. This determination is critical to measure global physical properties of UC HII regions (e.g. luminosity, size, mass) and properties of the Galaxy (e.g. spiral structure, abundance gradients). We find that the distribution of UC HII regions in this survey is consistent with a "local spur", the Perseus, Sagittarius and Scutum arms as delineated by Taylor & Cordes (1993) and references therein. However, departures from model velocities produce distance uncertainties only slightly smaller than the proposed arm separations.

Accepted by Astrophys. J. Supp.

ftp.astro.wisc.edu/outgoing/watson/papers/arecibo.pdf

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Dissertation Abstracts

Velocity Structure of Protostellar Envelopes : Gravitational Collapse and Rotation

Arnaud Belloche

Thesis work conducted at: Service d'Astrophysique, CEA/Saclay, France

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Ph.D dissertation directed by: Philippe André

Ph.D degree awarded: November 2002

Stars form from the gravitational collapse of prestellar condensations in molecular clouds. The major aim of this thesis is to compare the predictions of collapse models with observations of both very young (class 0) protostars and starless condensations in millimeter molecular lines. We wish to understand what determines the masses of forming stars and whether the initial conditions have an effect on the dynamical evolution of a condensation. Using a Monte-Carlo radiative transfer code, we analyze rotation and infall spectroscopic signatures to study the velocity structure of a sample of protostellar condensations.

We show that the envelope of the class 0 protostar IRAM 04191 in the Taurus molecular cloud is undergoing both extended, subsonic infall and fast, differential rotation. We propose that the inner part of the envelope is a magnetically supercritical core in the process of decoupling from the ambient cloud still supported by the magnetic field. We suggest that the kinematical properties observed for IRAM 04191 are representative of the physical conditions characterizing isolated protostars shortly after point mass formation.

On the other hand, a similar study for the prestellar condensations of the Rho Ophiuchi protocluster yields mass accretion rates that are an order of magnitude higher than in IRAM 04191. This suggests that individual protostellar collapse in clusters is induced by external disturbances. Moreover, we show that the condensations do not have time to orbit significantly through the protocluster gas before evolving into protostars and pre-main-sequence stars. This seems inconsistent with models which resort to dynamical interactions and competitive accretion to build up a mass spectrum comparable to the stellar initial mass function.

We conclude that protostellar collapse is nearly spontaneous in regions of isolated star formation such as the Taurus cloud but probably strongly induced in protoclusters.

New Jobs

Postdoctoral Position: MAX-PLANCK-INSTITUTE FOR RADIOASTRONOMY

MAX-PLANCK-INSTITUTE FOR RADIOASTRONOMY
Auf dem Huegel 69, D-53121 Bonn, Germany
Tel: 49 - 228 525 297, FAX: 49 - 228 525 435
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Email Inquiries: kmenten@mpifr-bonn.mpg.de
URL: http://www.mpifr-bonn.mpg.de/div/mm

Attention: Prof. Dr. Karl M. Menten (MPIfR)

The Millimeter and Submillimeter Astronomy Group (Director: Professor K.M. Menten) at the Max-Planck-Institut fuer Radioastronomie, Bonn, has a postdoctoral position open within the Sonderforschungsbereich "Die Entwicklung der interstellaren Materie: THz-Spektroskopie im Weltall und Labor" (The Evolution of Interstellar Matter: THz Spectroscopy in Space and Laboratory).

A successful candidate will participate in preparing and conducting observational programs at current cm- to submm-wave single dish telescopes and interferometers as well as the "Atacama Pathfinder Experiment" (APEX) 12m Telescope, which is expected to become oparation on the Chajnantor Plateau in the Chilean Andes by mid 2003. The observational programs aim at studying early stages of massive star formation and the interaction of newly born massive stars with their environment. A successful applicant is expected to have a strong background in radioastronomical observations and star formation.

The position is available immediately. The appointment will initially be for two years, with a possible extension to three years. A salary will given according to the German Public Service Tarifs. Women and minorities are especially encouraged to apply. Applicants should send a curriculum vitae, their list of publications and a summary of current and proposed research and arrange for three letters of recommendation to be sent by February 1st, 2003 to K. M. Menten at the above address. Informal inquiries are welcome.

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, not reviews nor conference notes), *Dissertation Abstracts* (presenting abstracts of new Ph.D dissertations), *Meetings* (announcing meetings broadly of interest to the star formation and interstellar medium community), *New Books* (giving details of books relevant for the same community), *New Jobs* (advertising jobs specifically aimed towards persons within our specialty), and *Short Announcements* (where you can inform or request information from the community).

Latex macros for submitting abstracts and dissertation abstracts are appended to each issue of the newsletter.

The Star Formation Newsletter is available on the World Wide Web at http://www.ifa.hawaii.edu/∼reipurth or at http://www.eso.org/gen-fac/pubs/starform/ .

Canada Research Chair in Star Formation

The Department of Physics & Astronomy at The University of Western Ontario is pleased to announce a search for a Tier II (Junior) Canada Research Chair at the Assistant or Associate Professor probationary (tenure-track) level in the area of observational astronomy, with specific focus on star formation. All CRC appointments are subject to approval by the CRC office in Ottawa and, it is anticipated that the starting date of the position will be January 1, 2004 or thereafter.

The University of Western Ontario is committed to build upon its strengths and establish a leading program in star formation. The Canada Research Chair (CRC) program has been established by the Government of Canada to enable Canadian universities to foster world-class research excellence. Details on the CRC program can be found at http://www.chairs.gc.ca.

The successful candidate will have an outstanding record of accomplishments in star formation research, demonstrate the potential for leadership in the use of the current and upcoming generation of world-class observatories, and be expected to develop a vigorous research program involving the training of graduate students. A description of Canada's long term plans for participation in new global facilities is described in the Long Range Plan developed by the Canadian Astronomical Society (see http://www.casca.ca/lrp/). Teaching at both the undergraduate and graduate levels will also be expected. CRC positions are open to candidates of any nationality.

The Department of Physics and Astronomy has major research groups in astronomy, atomic and molecular physics, condensed matter physics, and space and atmospheric physics. For more information, see http://www.physics.uwo.ca and http://www.astro.uwo.ca. Our location allows the opportunity to have close ties to researchers at the University of Toronto, McMaster University, and the University of Waterloo, among other places. We are located in London, Ontario, a scenic city of 350,000 people with numerous cultural and recreational opportunities. London is located within two hours drive of both Toronto and Detroit, and has a cost of living that is among the lowest in North America.

We will begin to consider applications and letters of recommendation on April 30, 2003, and the search will continue until the position is filled. Candidates should submit a curriculum vitae, list of publications, and research plan, and must arrange for at least three letters of reference to be sent to:

Professor Michael G. Cottam, Chair
Department of Physics & Astronomy
The University of Western Ontario
London, Ontario N6A 3K7, Canada.

The University of Western Ontario is committed to employment equity and welcomes applications from all qualified women and men, including visible minorities, aboriginal people and persons with disabilities.

FACULTY POSITION IN ASTROBIOLOGY/ASTRONOMY (STAR FORMATION)

ARIZONA STATE UNIVERSITY

The Department of Physics and Astronomy at Arizona State University seeks to fill a tenure-track faculty position in the astronomical aspects of astrobiology. The appointment will be at the assistant professor level, with a preferred starting date of August 16, 2003. Areas of specialization might include observational or theoretical aspects of *star-formation, circumstellar disks, planet formation, early solar system processes*, or related fields.

The successful candidate will be expected to lead an active research program, as well as develop strong interdisciplinary ties with ASU's Astrobiology initiative. The candidate must have a Ph.D. by the time of the appointment, and relevant research experience. Teaching in the Department's extensive undergraduate and graduate programs is an important component of the evaluation of faculty.

The ASU Department of Physics and Astronomy consists of thirty six full-time faculty with research interests in a wide variety of fields. Relevant fields include observational and theoretical astronomy and biophysics. ASU also has a strong program in planetary and geological sciences, and is part of the NASA Astrobiology Institute. The successful applicant will have access to the observatories in Arizona, including the MMT, LBT (2004), and other facilities operated by Steward Observatory. ASU also has a strong tradition of participation in NASA missions.

The initial closing date is March 3, 2003. If necessary, applications will be reviewed each two weeks thereafter until the position is filled. A complete application consists of a letter of application describing research and teaching experience and interests, a CV, and three letters of reference. Please arrange to have letters sent directly to ASU, and include the names of references in the application. Materials must be sent to Jeff Hester, c/o Ms. Joelina Peck, Search Coordinator, Arizona State University, Department of Physics and Astronomy, PO Box 871504, Tempe, AZ 85287-1504. Both application letters and reference letters are preferred via edmail to Joelina.Peck@asu.edu. AA/EOE

ATTN: Ms. Joelina Peck
ARIZONA STATE UNIVERSITY
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Tempe, AZ 85287-1504
U.S.A.
Main Department Telephone: 480-965-3561

phyast.info@asu.edu
http://phy.asu.edu/

New Books

Hot Star Workshop III:
The Earliest Stages of Massive Star Birth

Edited by Paul A. Crowther

These are the proceedings of a workshop held in Boulder, Colorado, on 6-8 August 2001, which brought together 112 scientists and students from 18 countries. While the formation of low mass stars is becoming gradually better understood, the question of massive star birth is still very poorly understood, to the extent that there is even no agreement on whether the fundamental process is accretion or mergers. A wealth of new observational and theoretical efforts have invigorated the field, and the present book gives a fresh overview of these latest results.

The book is dividided into 5 parts:

I. The Earliest, Deeply Embedded Phase

II. Young Stellar Objects

III. Competing Formation Mechanisms

IV. Clustered Star Formation

V. Poster Papers

The book contains 29 papers, including the following 9 reviews, as well as 55 poster papers:

The Formation and Early Evolution of Massive Stars *E. Churchwell*

Early Phases and Initial Conditions for Massive Star Formation *N.J. Evans II, Y.L. Shirley, K.E. Mueller, C. Knez*

Ultracompact HII Regions *S. Kurtz*

The Pillars of the Second Generation *N.R. Walborn*

Theory of Formation of Massive Stars via Accretion *H.W. Yorke*

The Formation of Massive Stars through Stellar Collisions *I.A. Bonnell*

Observational Constraints on the Formation of Massive Stars *J. Bally*

The Formation of Massive Stars and Star Clusters *J.C. Tan & C.F. McKee*

Massive Star Birth in the Inner Galaxy: Obscured Massive Star Clusters *R.D. Blum, P.S. Conti, A. Damineli, E. Figueredo*

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Meetings

High Resolution Infrared Spectroscopy in Astronomy

European Southern Observatory - Garching b. Muenchen, Germany

Nov 18-21, 2003

Background and aims:

Infrared spectroscopy at a resolution of a few km/s offers a unique tool to study rotational-vibrational transitions of many abundant molecules as well as important atomic lines in a multitude of interesting astrophysical environments. Applications include the possible direct detection of exoplanets, measurements of the abundances and magnetic fields of stars, studies of ISM chemistry and the kinematics of stars and gas in galactic centers.

The ESO VLT will shortly be equipped with two unique spectrometers which not only offer this high spectral resolution but also spatial resolutions of ~ 0.2".

- CRIRES, an adaptive optics fed 1-5μm spectrograph with R $\sim$ 100.000
- VISIR, including a mode with R $<$ 30.000 between 8-13μm

The aims of this workshop are to:

- present the latest status of the high-resolution infrared spectroscopic capabilities of the VLT and other observatories
- provide an opportunity to present recent results
- bring together the community interested in the application of high resolution infrared spectroscopy and to foster new collaborations
- provide ESO with feedback in the phase when operating and data reduction software is being defined and coded

Registration:

Absolute deadline via the Web page is August 30th 2003 but please note that earlier registration is advised as the number of participants is limited to 110 for space reasons.

Scientific Advisory Committee:
Bengt Gustafsson (Uppsala, chair), Catherine de Bergh (Meudon), Ewine van Dishoeck (Leiden), Artie Hatzes (Tautenburg), Ken Hinkle (Tucson), Ulli Käufl (ESO), Alan Moorwood (ESO, co-chair)

Local Organizing Committee:
H.U. Käufl, R. Siebenmorgen, C. Stoffer, P. Bristow

Web site: http://www.eso.org/gen-fac/meetings/ekstasy2003