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Abstracts of recently accepted papers

[O I] 6300Å emission in Herbig Ae/Be systems: signature of Keplerian rotation.

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We present high-spectral-resolution optical spectra of 49 Herbig Ae/Be stars in a search for the [O I] 6300Å line. The vast majority of the stars in our sample show narrow (FWHM < 100 km s^{-1}) emission lines, centered on the stellar radial velocity. In only three sources is the feature much broader (~ 400 km s^{-1}), and strongly blueshifted (-200 km s^{-1}) compared to the stellar radial velocity. Some stars in our sample show double-peaked line profiles, with peak-to-peak separations of ~ 10 km s^{-1}. The presence and strength of the [O I] line emission appears to be correlated with the far-infrared energy distribution of each source: stars with a strong excess at 60 μm have in general stronger [O I] emission than stars with weaker 60 μm excesses. We interpret these narrow [O I] 6300Å line profiles as arising in the surface layers of the protoplanetary disks surrounding Herbig Ae/Be stars. A simple model for [O I] 6300Å line emission due to the photodissociation of OH molecules shows that our results are in quantitative agreement with that expected from the emission of a flared disk if the fractional OH abundance is $\sim 5 \times 10^{-7}$. The shape of the double-peaked profile can be reproduced assuming Keplerian rotation of the circumstellar disk.

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Edge-on T Tauri stars

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Objectives. We study the optical spectral properties of the edge-on disk objects HH30*, HK Tau B, and HV Tau C. For comparison purposes we also observe both the classical T Tauri star HL Tau and the active late-type star LDN 1551-9.

Methods. We use the UVES echelle spectrograph at the ESO VLT to obtain two-dimensional high-resolution (R = 50 000) spectra. The observed wavelength range extends from 3280 to 4490 Å in the blue channel and from 4726 to 6722 Å in the red channel, with a gap from 5708 to 5817 Å.

Results. The spectra of all three observed edge-on disks consist of a T Tauri emission and absorption line spectrum with superimposed jet emission lines. Analysis of the spectra confirmed that the disks are completely opaque at visible wavelengths and that light from the central objects reaches us only via scattering layers above and below the disk planes. The central objects of our targets are found to be normal T Tauri stars showing moderate but different amounts of veiling of their photospheric spectra, indicating different accretion rates or evolutionary stages. Part of

the jet emission from edge-on systems is directly visible to us in the forbidden lines as well as in Hα and He I, a finding which contradicts the present paradigm of a pure magnetospheric accretion origin for the formation of hydrogen and helium emission lines in moderately active CTTSs.

Conclusions. We suggest that all classical T Tauri stars (CTTSs) show the observed morphology when viewed edge-on. From a comparison with those Taurus-Auriga CTTSs for which the inclination is reliably known, we conclude that the view angle of CTTS systems is one of the key parameters governing apparent Hα emission strength in the T Tauri class. We discuss the various possible formation regions for the Na I D lines and show that profiles similar to observed ones can be formed at the base of the disk wind.

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http://www.edpsciences.org/articles/aa/pdf/forthpdf/aa2217_forth.pdf

Star formation in unbound giant molecular clouds: the origin of OB associations?

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We investigate the formation of star clusters in an unbound GMC, where the supporting kinetic energy is twice as large as the cloud's self-gravity. This cloud manages to form a series of star clusters and disperse, all within roughly 2 crossing times (10 Myr), supporting recent claims that star formation is a rapid process. Simple assumptions about the nature of the star formation occurring in the clusters allows us to place an estimate for the star formation efficiency at about 5 to 10%, consistent with observations. We also propose that unbound clouds can act as a mechanism for forming OB associations. The clusters that form in the cloud behave as OB subgroups. These clusters are naturally expanding from one another due to unbound nature of the flows that create them. The properties of the cloud we present here are are consistent with those of classic OB associations.

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The Angular Momentum Content and Evolution of Class I and Flat-Spectrum Protostars

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We report on the angular momentum content of heavily embedded protostars based on our analysis of the projected rotation velocities (v sin is) of 38 Class I/flat spectrum young stellar objects presented in Doppmann (2005). After correcting for projection effects, we find that infrared-selected Class I/flat spectrum objects rotate significantly more quickly (median equatorial rotation velocity $\sim$ 38 km/sec) than Classical T Tauri stars (CTTSs; median equatorial rotation velocity $\sim$ 18 km/sec) in the ρ Ophiuchi and Taurus-Aurigae regions. Projected rotation velocity (v sin i) is weakly correlated with T_{eff} in our sample, but does not seem to correlate with Br γ emission (a common accretion tracer), the amount of excess continuum veiling (r_k), or the slope of the SED between the near and mid IR (α). The detected difference in rotation speeds between Class I/flat spectrum sources and CTTSs proves difficult to explain without some mechanism which transfers angular momentum out of the protostar between the two phases. Assuming Class I/flat spectrum sources possess physical characteristics (M_*,R_*,B_*) typical of pre-main sequence stars, fully disk locked Class I objects should have co-rotation radii within their protostellar disks that match well (within 30%) with

the predicted magnetic coupling radii of Shu et al (1994). The factor of two difference in rotation rates between Class I/flat spectrum and CTTS sources, when interpreted in the context of disk locking models, also imply a factor of 5 or greater difference in mass accretion rates between the two phases. A lower limit of $\dot{M} \sim 10^{-8}$ $M_{\odot}$/year for objects transitioning from the Class I/flat spectrum stage to CTTSs is required to account for the difference in rotation rates of the two classes by angular momentum extraction through a viscous disk via magnetic coupling.

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The Origin of Massive O-type Field Stars. Part II: Field O stars as runaways

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In two papers we try to confirm that all Galactic high-mass stars are formed in a cluster environment, by excluding that O-type stars found in the Galactic field actually formed there. In de Wit et al. (2004) we presented deep K-band imaging of 5 arcmin fields centred on 43 massive O-type field stars that revealed that the large majority of these objects are single objects. In this contribution we explore the possibility that the field O stars are dynamically ejected from young clusters, by investigating their peculiar space velocity distribution, their distance from the Galactic plane, and their spatial vicinity to known young stellar clusters. We (re-)identify 22 field O-type stars as candidate runaway OB-stars. The statistics show that $4 \pm 2\%$ of all O-type stars with $V < 8^m$ can be considered as formed outside a cluster environment. Most are spectroscopically single objects, some are visual binaries. The derived percentage for O-type stars that form isolated in the field based on our statistical analyses is in agreement with what is expected from calculations adopting a universal cluster richness distribution with power index of $\beta = 1.7$, assuming that the cluster richness distribution is continuous down to the smallest clusters containing one single star.

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http://www-laog.obs.ujf-grenoble.fr/~dewit/Papers.html

Centrally condensed turbulent cores: Massive stars or fragmentation?

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We present numerical investigations into the formation of massive stars from turbulent cores of density gradient $\rho \propto r^{-1.5}$. The results of five hydrodynamical simulations are described, following the collapse of the core, fragmentation and the formation of small clusters of protostars. We generate two different initial turbulent velocity fields corresponding to power-law spectra $P \propto k^{-4}$ and $P \propto k^{-3.5}$, and apply two different initial core radii. Calculations are included for both completely isothermal collapse, and a non-isothermal equation of state above a critical density (10^{-14}gcm^{-3}). Our calculations reveal the preference of fragmentation over monolithic star formation in turbulent cores. Fragmentation was prevalent in all the isothermal cases. Although disc fragmentation was largely suppressed in the non-isothermal runs due to the small dynamic range between the initial density and the critical density, our results show that some fragmentation still persisted. This is inconsistent with previous suggestions that turbulent cores result in the formation of a single massive star. We conclude that turbulence cannot be measured as an isotropic pressure term.

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The Relationship between Class I and Class II Methanol Masers

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The Australia Telescope National Facility Mopra millimetre telescope has been used to search for 95.1-GHz class I methanol masers towards sixty-two 6.6-GHz class II methanol masers. A total of twenty-six 95.1-GHz masers were detected, eighteen of these being new discoveries. Combining the results of this search with observations reported in the literature, a near complete sample of sixty-six 6.6-GHz class II methanol masers has been searched in the 95.1-GHz transition, with detections towards 38 per cent (twenty-five detections ; not all of the sources studied in this paper qualify for the complete sample, and some of the sources in the sample were not observed in the present observations).

There is no evidence of an anti-correlation between either the velocity range, or peak flux density of the class I and II transitions, contrary to suggestions from previous studies. The majority of class I methanol maser sources have a velocity range that partially overlaps with the class II maser transitions. The presence of a class I methanol maser associated with a class II maser source is not correlated with the presence (or absence) of main-line OH or water masers. Investigations of the properties of the infrared emission associated with the maser sources shows no significant difference between those class II methanol masers with an associated class I maser and those without. This may be consistent with the hypothesis that the objects responsible for driving class I methanol masers are generally not those that produce main-line OH, water or class II methanol masers.

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On the existence of three-dimensional hydrostatic and magnetostatic equilibria of self-gravitating fluid bodies

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We develop an analytical spectral method to solve the equations of equilibrium for a self-gravitating, magnetized fluid body, under the only hypotheses that (a) the equation of state is isothermal, (b) the configuration is scale-free, and (c) the body is electrically neutral. All physical variables are represented as series of scalar and vector spherical harmonics of degree l and order m, and the equilibrium equations are reduced to a set of coupled quadratic algebraic equations for the expansion coefficients of the density and the magnetic vector potential. The method is general, and allows to recover previously known hydrostatic and magnetostatic solutions possessing axial symmetry. A linear perturbation analysis of the equations in spectral form show that these basic axisymmetric states, considered as a continuos sequence with the relative amount of magnetic support as control parameter, have in general no neighboring nonaxisymmetric equilibria. This result lends credence to a conjecture originally made by H. Grad and extends early results obtained by E. Parker to the case of self-gravitating magnetized bodies. The only allowed bifurcations of this sequence of axisymmetric equilibria are represented by distortions with dipole-like angular dependence ($l = 1$) that can be continued into the nonlinear regime. These new configurations are either (i) azimuthally asymmetric ($m = \pm 1$) or (ii) azimuthally symmetric but without reflection symmetry with respect to the equatorial plane ($m = 0$). It is likely that these configurations are not physically acceptable solutions for isolated systems, but represent instead the manifestation of a general *gauge freedom* of self-similar isothermal systems. To the extent that interstellar clouds can be represented as isolated magnetostatic equilibria, the results of this study suggest that the observed triaxial shapes of molecular cloud cores can be interpreted in terms of weakly damped Alfvèn oscillations about an equilibrium state.

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Discovery of Extremely Embedded X-ray Sources in the R Coronae Australis Star Forming Core

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With the *XMM-Newton* and *Chandra* observatories, we detected two extremely embedded X-ray sources in the R Corona Australis (R CrA) star forming core, near IRS 7. These sources, designated as X_E and X_W, have X-ray absorption columns of $\sim 3\times10^{23}$ cm^{-2} equivalent to $A_V \sim 180^m$. They are associated with the VLA centimeter radio sources 10E and 10W, respectively. X_W is the counterpart of the near-infrared source IRS 7, whereas X_E has no K-band counterpart above 19.4^m. This indicates that X_E is younger than typical Class I protostars, probably a Class 0 protostar or in an intermediate phase between Class 0 and Class I. The X-ray luminosity of X_E varied between $29 <$ log $L_X < 31.2$ ergs s^{-1} on timescales of 3–30 months. X_E also showed a monotonic increase in X-ray brightness by a factor of two in 30 ksec during an *XMM-Newton* observation. The *XMM-Newton* spectra indicate emission from a hot plasma with $kT \sim 3$–4 keV and also show fluorescent emission from cold iron. Though the X-ray spectrum from X_E is similar to flare spectra from Class I protostars in luminosity and temperature, the light curve does not resemble the lightcurves of magnetically generated X-ray flares because the variability timescale of X_E is too long and because variations in X-ray count rate were not accompanied by variations in spectral hardness. The short-term variation of X_E may be caused by the partial blocking of the X-ray plasma, while the month-long flux enhancement may be driven by mass accretion.

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The stellar mass spectrum from non-isothermal gravoturbulent fragmentation

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The thermodynamic state of star-forming gas determines its fragmentation behavior and thus plays a crucial role in determining the stellar initial mass function (IMF). We address the issue by studying the effects of a piecewise polytropic equation of state (EOS) on the formation of stellar clusters in turbulent, self-gravitating molecular clouds using three-dimensional, smoothed particle hydrodynamics simulations. In these simulations stars form via a process we call gravoturbulent fragmentation, i.e., gravitational fragmentation of turbulent gas. To approximate the results of published predictions of the thermal behavior of collapsing clouds, we increase the polytropic exponent γ from 0.7 to 1.1 at a critical density n_c, which we estimated to be $2.5 \times 10^5\,\mathrm{cm}^{-3}$. The change of thermodynamic state at n_c selects a characteristic mass scale for fragmentation M_{ch}, which we relate to the peak of the observed IMF. A simple scaling argument based on the Jeans mass M_J at the critical density n_c leads to $M_{ch} \propto n_c^{-0.95}$. We perform simulations with $4.3 \times 10^4\,\mathrm{cm}^{-3} < n_c < 4.3 \times 10^7\,\mathrm{cm}^{-3}$ to test this scaling argument. Our simulations qualitatively support this hypothesis, but we find a weaker density dependence of $M_{ch} \propto n_c^{-0.5\pm0.1}$. We also investigate the influence of additional environmental parameters on the IMF. We consider variations in the turbulent driving scheme, and consistently find M_J is decreasing with increasing n_c. Our investigation generally supports the idea that the distribution of stellar masses depends mainly on the thermodynamic state of the star-forming gas. The thermodynamic state of interstellar

gas is a result of the balance between heating and cooling processes, which in turn are determined by fundamental atomic and molecular physics and by chemical abundances. Given the abundances, the derivation of a characteristic stellar mass can thus be based on universal quantities and constants.

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A near-infrared survey for new low-mass members in α Per

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We present a near-infrared (K'-band) survey of 0.7 square degree area in the α Persei open cluster (age = 90 Myr, distance = 182 pc) carried out with the Omega-Prime camera on the Calar Alto 3.5-m telescope. Combining optical data (R_c and I_c) obtained with the KPNO/MOSA detector and presented in Stauffer et al. (1999) with the K' observations, a sample of new candidate members has been extracted from the optical-infrared colour-magnitude diagram. The location of these candidates in the colour-colour diagram suggests that two-thirds of them are actually reddened background giants. About 20 new candidate members with masses between 0.3 and 0.04 $M_\odot$ are added to the $\sim$400 known α Per cluster members. If they are indeed α Per members, four of the new candidates would be brown dwarfs. We discuss the advantages and drawbacks of the near-infrared survey as compared to the optical selection method. We also describe the outcome of optical spectroscopy obtained with the Twin spectrograph on the Calar Alto 3.5-m telescope for about 30 candidates, including selected members from the optical sample presented in Barrado y Navascués et al. (2002) and from our joint optical/infrared catalogue. These results argue in favour of the optical selection method for this particular cluster.

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A search for hot massive extrasolar planets around nearby young stars with the adaptive optics system NACO

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We report on a survey devoted for the search of exo-planets around young and nearby stars carried out with NACO at the VLT. The detection limit for 28 among the best available targets vs. the angular separation from the star is presented. The non-detection of any planetary mass companion in our survey is used to derive, for the first time, the frequency of the upper limit of the projected separation planet-stars. In particular, we find that in 50% of cases, no 5M_J planet (or more massive) has been detected at projected separations larger than 14 AU and no 10M_J planet (or more massive) has been detected at projected separations larger than 8.5 AU. In 100% of cases, these values increase to 36 AU and 65 AU respectively. The excellent sensitivity reached by our study leads to a much lower upper limit of the projected planet-star separation compared with previous studies. For example, for the β Pictoris group, ($\sim$12 Myr), we did not detect any 10M_J planet at distances larger than 15 AU. A previous study carried out with 4 m class telescopes put an upper limit for 10M_J planets at $\sim$60 AU. For our closest target (V2306 Oph - d = 4.3 pc) it is shown that it would be possible to detect a 10M_J planet at a minimum projected separation from the star of 1 AU and a 5M_J planet at a minimum projected separation of 3.7 AU. Our results are discussed with respect to mechanisms explaining planet formation and migration and to forthcoming observational strategies and future planet finder observations from the ground.

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http://www.mpia.de/homes/masciadr

Multi-Scale Magnetic Fields in Star-Forming Regions: Interferometric Polarimetry of the MMS6 Core of OMC-3

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We present the first interferometric observations of linearly polarized emission toward the OMC-3 region of the Orion A cloud. We have observed the MMS6 protostellar core at 1.3 mm with the Berkeley-Illinois-Maryland Association (BIMA) array, achieving a resolution of 4.3 arcsec × 3.0 arcsec. We find that the polarization angle measured changes systematically across the core, orienting along a dust extension to the northwest. The polarization angle is oriented similarly to the 850 and 350 μm polarized emission measured by the SCUBA and Hertz polarimeters. A polarization hole is detected as is typical of polarized emission data toward cores. Since the BIMA data are insensitive to structure on spatial scales of > 40 arcsec, the emission detected is dominated by the core and not the Integral-shaped filament in which it is embedded. Observations of CO $J = 2 - 1$ reveal CO emission potentially associated with the core, but no outflow signature is detected. Utilizing the Chandrasekhar-Fermi method, we have used the dispersion in the polarization vectors to estimate a field strength of 640 μG in the plane of the sky, assuming a corrective Q-factor of 0.5. Applying the measurement of the inclination of the field to the line-of-sight of Houde et al. (2004), a total field strength of 680 μG is derived. Despite highly non-thermal linewidths, kinetic energy density is found to be insufficient to support this core against gravitational collapse. Magnetic energy density, when combined with the predominantly turbulent kinetic energy density, is comparable to the effects of gravity, but its value is highly dependent on the applied Q-factor to a degree that the core may be sub-critical or super-critical. The preservation of the field geometry from large to small scale in this core is consistent with observations of a second protostellar core in a filamentary cloud in Orion B.

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http://astron.berkeley.edu/~ brenda/preprints.html

Hubble Space Telescope NICMOS Imaging of W3 IRS 5: A Trapezium in the Making?

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We present *Hubble Space Telescope* NICMOS imaging of W3 IRS 5, a binary high-mass protostar. In addition to the two protostars, NICMOS images taken in the F222M and F160W filters show three new 2.22 μm sources with very red colors; these sources fall within a region 5600 AU in diameter, and are coincident with a ~ 100 $M_\odot$, dense molecular clump. Two additional point sources are found within $0.4''$ (800 AU) of one of the high-mass protostars; these may be stellar companions or unresolved emission knots from an outflow. We propose that these sources constitute a nascent Trapezium system in the center of the W3 IRS 5 cluster containing as many as five proto-OB stars. This would be the first identification of a Trapezium still deeply embedded in its natal gas.

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New results on the massive star-forming region S106 by BEAR spectro-imagery

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As a typical example of interaction of a massive star with its parent cloud, the close environment of S106 IR in the star-forming region S106 was observed at high spectral resolution ($\sim 16\,\mathrm{km\,s^{-1}}$). Integral field spectroscopy with BEAR, an imaging Fourier transform spectrometer (FTS), on a field of ~ 40 arcsec in diameter, in the H_2 1-0 S(1), 2-1 S(1), Brγ, HeI and [FeIII] lines. From the data several maps were obtained: intensity, velocity and linewidth in the Brγ and the H_2 1-0 S(1) line, 1-0 S(1)/2-1 S(1) line ratio, and continuum emission at $2.1\,\mu$m. From the latter, about twenty low-mass stars were detected with photometry in this band, and an estimate of their mass was made leading to the conclusion that S106 is a site of formation of mainly sub-solar mass stars. The intensity structure of the excited molecular gas H_2 was found to be clumpy while the velocity is almost uniformely at $v_{LSR} \simeq 1.5\,\mathrm{km\,s^{-1}}$ except to the south where the velocity reaches up to $15\,\mathrm{km\,s^{-1}}$ in a zone limited by the long edge of a rectangular hole in the emission. The H_2 line ratio map with values from 1 to 9 implies that UV-absorption and shocks are participating in the excitation process. A PDR model with a temperature of 37,00 K for S106 IR was used to retrieve the H_2 gas density and temperature. The density was found to vary between 1 and $3.5\times10^5\,\mathrm{cm^{-3}}$ with corresponding temperatures between 660 and 1,240 K. The study of the linewidth distribution indicates for most of the gas a supersonic turbulence with a mean contribution to the observed profiles of $\geq 6\,\mathrm{km\,s^{-1}}$. Turbulence is likely to be responsible for the observed clumpy structure of the excited gas. Point-like spots with a linewidth as high as $30\,\mathrm{km\,s^{-1}}$ in one position are detected, which may be vortices in the molecular gas.
The HII region probed by Brγ shows a broad range of velocity, from -45 to $+80\,\mathrm{km\,s^{-1}}$, organized in velocity structures that correspond to two pairs of large, bipolar outflows originating from the massive source, not directed along the axis of the HII region. Emission lines of HeI and [FeIII] are detected in a bright area to the southwest of S106 IR, with point-like structures suggesting photoevaporating clumps. From the velocity data, a 3-D model of the environment of S106 IR is proposed. S106 is an example of an evolved HII region seen face-on. The central source located at the edge of its parent molecular cloud has carved an expanding cylinder of turbulent, atomic gas of $\simeq 0.1$ pc in radius. This massive object was formed by an accretion disk process. The disk is still present and the bipolar outflows are remnants of the massive star activity. A time scale of 1,400 yrs is estimated for the most recent event. A thin and quiescent clumpy layer of warm H_2 marks the transition of the HII region to the molecular cloud. From the data, there are locally no signs of ongoing star formation.

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CO Emission and Absorption toward V1647 Ori (McNeil's Nebula)

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We present high-resolution infrared spectra of V1647 Ori, the illuminating star of McNeil's Nebula, which reveal the presence of hot and cold gas phase CO, and ices of CO and H_2O. The emission lines of ^{12}CO (1-0), (2-1), and (3-2) likely originate from $\sim$2500 K gas in an inner accretion disk region where substantial clearing of dust has occurred. The width of the emission lines increase with increasing J-value, suggesting that the hottest CO gas we detect is located closest to the central star. The narrower widths of the low-J CO emission lines are indicative of more distant, cooler material in the inner disk. Superposed on the low J lines emission lines are narrow ^{12}CO absorption components, which are typical of cold interstellar cloud material at a temperature of $\sim$18 K. The very low column density and very cold temperature for the absorbing gas suggest that we are viewing the central star through intervening material within the L1630 cloud and that the disk is oriented nearly face-on. The Doppler shift of the cold CO is offset from the hot

gas by 6 ± 2 km s^{-1}, so it is likely that the very cold CO originates in a foreground cloud rather than the circumstellar material surrounding v1647 Ori. Model fits to the strong H_2O and CO ice absorption bands are consistent with cold (<20 K) amorphous water ice ($\tau = 0.65$) and predominantly apolar CO ice ($\tau = 0.58$). The CO and H_2O ices are unprocessed (unannealed), similar to the ices in dense clouds.

Accepted by ApJ for May 2005

The Fractal Dimension of Projected Clouds

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The interstellar medium seems to have an underlying fractal structure which can be characterized through its fractal dimension. However, interstellar clouds are observed as projected two-dimensional images, and the projection of a tri-dimensional fractal distorts its measured properties. Here we use simulated fractal clouds to study the relationship between the tri-dimensional fractal dimension (D_f) of modeled clouds and the dimension resulting from their projected images. We analyze different fractal dimension estimators: the correlation and mass dimensions of the clouds, and the perimeter-based dimension of their boundaries (D_{per}). We find the functional forms relating D_f with the projected fractal dimensions, as well as the dependence on the image resolution, which allow to estimate the "real" D_f value of a cloud from its projection. The application of these results to Orion A indicates in a self-consistent way that $2.5 \leq D_f \leq 2.7$ for this molecular cloud, a value higher than the result $D_{per} + 1 \simeq 2.3$ some times assumed in literature for interstellar clouds.

Accepted by ApJ

Available at astro-ph/0501573

The analysis of magnetic field measurements of T Tau

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It is shown that the existence of hot accretion spots at the surface of T Tau practically has no effect on the accuracy of estimation of its magnetic field strength at photospheric level.

We also found that one can interpret results of T Tau's photospheric magnetic field strength measurements carried out via different methods in the frame of the following alternative: 1) if T Tau's inclination angle $i \leq 10°$, then magnetic field of the star may be dipolar with the angle between rotational and magnetic axes is near 85°; 2) if it will be found (e.g. from interferometric observations) that $i > 10°$, then magnetic field of T Tau is essentially non-dipolar or/and non-stationary.

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astro-ph/0502353

Search for new T Tauri stars in the Cepheus-Cassiopeia region

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The Cepheus-Cassiopeia star-forming region has been searched for new T Tauri stars (TTSs) based on the ROSAT all

sky survey (RASS). Optical spectroscopic observations were carried out toward 45 GSC stellar counterparts of RASS sources looking for the Li absorption line (6708 Å), a sign of youth. The detection of this line resulted in finding 11 to 16 new TTSs in this region. Using follow-up optical photometric observations and evolutionary models the nature of the Li-rich stars is revealed to be young low-mass stars. The majority of the young stars is separated from the ^{13}CO molecular clouds by ~ 10 pc, significantly larger than in Chamaeleon. A group of the new TTSs are isolated from the CO clouds and distributed inside the previously suggested CO void. The possible formation scenarios including the interaction with the supernova shock for the isolated TTSs are discussed.

Accepted by Astronomy & Astrophysics

`http://www.astro.uni-jena.de/~tatihara/research.html`

Upper limit on the gas density in the β Pictoris system

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We investigate the effect of gas drag on the dynamics of the dust particles in the edge-on β Pictoris disc to derive an upper limit on the mass of gas in this system. Our study is motivated by the large uncertainties on the amount of gas in the β Pictoris disc currently found in the literature. The dust particles are assumed to originate from a colliding annulus of planetesimals peaking around 100 AU from the central star. We consider the various gas densities that have been inferred from independent observing techniques and we discuss their impact on dust dynamics and on the disc profile in scattered light along the midplane. We show that the observed scattered light profile of the disc cannot be properly reproduced if the hydrogen gas number density at 117 AU exceeds $10^4\,\mathrm{cm}^{-3}$. This corresponds to an upper limit on the total gas mass of about$0.4\,\mathrm{M}_\oplus$ assuming the gas density profile inferred by Brandeker et al. (2004) and thus to a gas to dust mass ratio smaller than 1.

Accepted by Astron. and Astrophys.

http://xxx.lanl.gov/PS_cache/astro-ph/pdf/0502/0502450.pdf

Probing the circumstellar structures of T Tauri stars and their relationship to those of Herbig stars

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We present Hα spectropolarimetry observations of a sample of 10 bright T Tauri stars, supplemented with new Herbig Ae/Be star data. A change in the linear polarisation across Hα is detected in most of the T Tauri (9/10) and Herbig Ae (9/11) objects, which we interpret in terms of a compact source of line photons that is scattered off a rotating accretion disk. We find consistency between the position angle (PA) of the polarisation and those of imaged disk PAs from infrared and millimetre imaging and interferometry studies, probing much larger scales. For the Herbig Ae stars AB Aur, MWC 480 and CQ Tau, we find the polarisation PA to be perpendicular to the imaged disk, which is expected for single scattering. On the other hand, the polarisation PA aligns with the outer disk PA for the T Tauri stars DR Tau and SU Aur and FU Ori, conforming to the case of multiple scattering. This difference can be explained if the inner disks of Herbig Ae stars are optically thin, whilst those around our T Tauri stars and FU Ori are optically thick. Furthermore, we develop a novel technique that combines known inclination angles and our recent Monte Carlo models to constrain the inner rim sizes of SU Aur, GW Ori, AB Aur, and CQ Tau. Finally, we consider the connection of the inner disk structure with the orientation of the magnetic field in the foreground interstellar medium: for FU Ori and DR Tau, we infer an alignment of the stellar axis and the larger magnetic field direction.

Accepted by MNRAS

Sulphur chemistry and molecular shocks: the case of NGC1333-IRAS2

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We present SO and SO_2 observations in the region of the low mass protostar IRAS2/NGC1333. The East-West outflow originating from this source has been mapped in four transitions of both SO and SO_2. In addition, CS observations published by Langer et al. (1996) have been used. We compute the SO, SO_2 and CS column densities and the physical conditions at several positions of the outflow using LTE and a non-LTE LVG approximations. The SO_2/SO and CS/SO abundance ratios are compared with the theoretical predictions of a chemical model adapted to the physical conditions in the IRAS2 outflow.

The SO_2/SO abundance ratios are constant in the two lobes of the outflow whereas CS/SO is up to 6 times lower in the shocked gas of the East lobe than in the West one. The comparison with the chemical model allow us to constrain the age of the outflow produced by IRAS2 to be $\leq 5 \times 10^3$ yr. We find low densities and temperatures for the outflow of IRAS2 ($< 10^6$ cm^{-3} and ≤ 70 K) from SO and SO_2 emission probably because the two molecules trace the cooled entrained material. The East lobe of the outflow shows denser gas compared with the West lobe. Finally, we discuss some constraints on the depleted form of sulphur.

Accepted by A&A

http://www.physics.ohio-state.edu/ wakelam/aea-iras2-sulphur.pdf

Abstracts of papers in Nature and Science

Because of embargoes on preprints for Nature and Science, abstracts for these two journals will be accepted for papers that have already been published

A Dynamical Calibration of the Mass-Luminosity Relation at Very Low Stellar Masses and Young Ages

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Mass is the most fundamental parameter of a star, yet it is also one of the most difficult to measure directly. In general, astronomers estimate stellar masses by determining the luminosity and using the 'mass-luminosity' relationship, but this relationship has never been accurately calibrated for young, low-mass stars and brown dwarfs. Masses for these low-mass objects are therefore constrained only by theoretical models. A new high-contrast adaptive optics camera enabled the discovery of a young (50 million years) companion only 0.156 arcseconds (2.3 AU) from the more luminous (>120 times brighter) star AB Doradus A. Here we report a dynamical determination of the mass of the newly discovered low-mass companion AB Dor C, whose mass is 0.090±0.005 solar masses. Given its measured 1-2 micrometre luminosity, we have found that the standard mass-luminosity relations overestimate the near-infrared luminosity of such objects by about a factor of ∼2.5 at young ages. The young, cool objects hitherto thought to be substellar in mass are therefore about twice as massive, which means that the frequency of brown dwarfs and planetary mass objects in young stellar clusters has been overestimated.

Appeared in Nature vol. 433, p.286, 2005

New Jobs

Adaptive Optics Post-Doctoral Position at UCLA

The Department of Physics and Astronomy at University of California Los Angeles invites applications for a post-doctoral research position in adaptive optics. The successful applicant will join Prof. Andrea Ghez's group, which currently carries out research on the Galactic center, the formation of low mass stars and brown dwarfs, and the formation and evolution of circumstellar disks. This work is carried out primarily at the W. M. Keck 10-m telescopes. Applicants interested in any of the above areas are welcome to apply.

A PhD in astronomy or physics and previous experience in the general area of high spatial resolution is preferable. The initial appointment is for two years, with the possibility of a third year, beginning in the Fall 2005. To apply, send your curriculum vitae, a letter of application, and 3 letters of reference to

Prof. Andrea Ghez
Department of Physics and Astronomy
UCLA
Los Angeles, CA 90095-1547

by May 1, 2005.

For further information contact Andrea Ghez (ghez@astro.ucla.edu). UCLA is an affirmative action/equal opportunity employer; women and members of minorities are especially encouraged to apply for these positions.

ASTROPHYSICS GROUP
SCHOOL OF PHYSICS AND ASTRONOMY

PhD POSITIONS IN ASTROPHYSICS

The Astrophysics Group within the School of Physics and Astronomy at the University of Manchester has openings for two fully-funded PhD students in the fields of Molecular Astrophysics, Star Formation and the Late Stages of Stellar Evolution, starting on or before October 1st 2005. The Group, which includes G A Fuller, M D Gray, T J Millar and A Zijlstra, has research interests in all branches of molecular astrophysics including theory and observation of the physics and chemistry of interstellar clouds and circumstellar regions, the formation of stars, the late stages of stellar evolution, the properties of interstellar dust and the origin and propagation of maser radiation. We use a variety of telescopes around the world to prosecute our research.

PPARC-Funded Studentship
This post is primarily directed at UK candidates holding, or expecting to obtain a 2.1 honours degree or better. The position is available from October 1st 2005 for a period of three years. Candidates interested in this position should apply as soon as possible using the University's online procedures at: http://www.eps.manchester.ac.uk/graduateschool/ or via an application form which can be downloaded from the Graduate School web site.

Early Stage Researcher
This post is funded by the Marie Curie Research Training Network on 'The Molecular Universe' and is available immediately for a period of three years. Nationality restrictions on this position make it very unlikely that a UK citizen will be appointed. This post is associated with a research project on the formation of complex organic molecules in photon-dominated regions in a collaboration with the Observatoire de Paris and the successful applicant will be expected to spend an extended period in Paris. Candidates interested in this post should send a CV and arrange for two letters of reference to be sent to the address below by March 31st 2005.

Further details of these posts can be found on the Group webpages at: http://jupiter.phy.umist.ac.uk/ or by contacting Professor T J Millar, School of Physics and Astronomy, University of Manchester, Sackville Street Building, PO Box 88, Manchester M60 1QD, UK (Tel. 0161-306-3677, e-mail: Tom.Millar@manchester.ac.uk)

Postdoctoral Research Position in Star and Planet Formation

The Institute for Astronomy (IfA) at the University of Hawaii invites applications for a postdoctoral research position in star and planet formation located in Honolulu, Hawaii. The successful applicant will collaborate with Dr. Michael Liu on observational research on the formation and evolution of low-mass stars, brown dwarfs, extrasolar planets, and/or circumstellar disks. Applicants with interest and experience in any of these areas are encouraged to apply. This position is supported by funding from NSF, NASA, and the Alfred P. Sloan Foundation.

Demonstrated expertise in optical and/or infrared observational astronomy is essential. Experience with wide-field surveys and/or high resolution imaging and ability to work at 14,000 feet are desireable, but not mandatory. The successful applicant will have full access to optical, IR, and sub-millimeter telescopes at Mauna Kea Observatories, through the IfA's guaranteed share of observing time. By their starting date, candidates should have obtained a PhD degree in astronomy, physics or equivalent area relevant to the science themes described above.

The initial appointment is for two years, subject to performance. Subsequent funding for additional years is available and will depend on performance. The position is available immediately, but the start date is flexible and can be anytime within 2005. The annual salary will be approximately $53,000 per year and will include support for research activities.

Applicants should submit a CV, statement of research, and three letters of recommendation to:

Dr. Michael Liu
Institute for Astronomy
University of Hawaii
2680 Woodlawn Drive
Honolulu, HI 96822
USA

Applications received by May 1 will receive full consideration. Further details may be obtained from mliu@ifa.hawaii.edu. EEO/AA.

Postdoctoral Research Associate, Astrophysics Group

THE UNIVERSITY OF MANCHESTER
SCHOOL OF PHYSICS AND ASTRONOMY
(REF EPS/077/05)

The Astrophysics Group at the University of Manchester announces the availability of a PPARC funded postdoctoral research position in the area of star formation. The Astrophysics Group is based on the central Manchester campus of the University and has research interests in all branches of molecular astrophysics (http://jupiter.phy.umist.ac.uk/).

The star formation research in the group is focused on the study of both low and high mass young stars, star forming cores and circumstellar disks. The successful applicant for the star formation position will work with Dr. G. Fuller on the observational study and modelling of high mass star formation. Experience with submillimetre and infrared astronomy and interferometry will be an advantage, however applicants with experience in all areas of star formation studies are encouraged to apply.

Informal enquires should be directed to Dr. G. Fuller (Gary.Fuller@manchester.ac.uk, +44 (0)161 306 3653).

The position is for an initial 3 year period starting 1 Oct 2005.

Application forms and further particulars are available at http://www.manchester.ac.uk/vacancies or from EPS HR Office, The University of Manchester, Sackville Street Building, Manchester, M60 1QD, Tel: 0161 275 8837; Fax: 0161 306 4037 or email : eps-hr@manchester.ac.uk. Closing date: 1st May 2005. Please quote reference.

The University will actively foster a culture of inclusion and diversity and will seek to achieve true equality of opportunity for all members of its community.

Meetings

We are pleased to open registration for **"Star Formation in the Era of Three Great Observatories"**, a workshop sponsored by the Chandra X-ray Center, Co-Sponsored by The Spitzer Science Center and organized primarily by the CXC Director's Office.

The Workshop will be help July 13-15, 2005 in Cambridge Massachusetts at the Sheraton Commander Hotel.

The goal of the workshop is to review topics in star-formation which are inherently multiwavelength, and to both define the current state of knowledge and the points of current controversy where new observations are most needed. We plan to focus on topics for which the Great Observatories have the most to contribute during this unique period of simultaneous operation. We will also consider observations from other facilities as well as theoretical work. We anticipate coverage of galactic and local-group star forming regions and potentially galaxies of the local group. We hope to come away with a list of future strategies and goals to be presented to NASA and the project leaders of each of the three telescopes.

The early registration and abstract deadline is May 6.

Please register at: http://cxc.harvard.edu/stars05/registration/registration.ht ml

There is no registration fee. Late registration will close when we reach 120 people or June 3. There will be room for 48 posters which will be displayed for the whole length of the meeting. Speakers are requested to use a common presentation file format, such as pdf, postscript, or Powerpoint. We hope to be able to post most of the talks on the meeting web site as PDF files.

SCIENCE TOPICS
The ISM
Protostars
Disk Evolution
Rotation/saturation/dynamos
Clustering/populations
Multi telescope studies in the Orion Star Forming complex and other star Forming regions

There will be splinter sessions on Disk Evolution, Rotation, Populations and other selected topics.

Confirmed and probable Speakers (As of March 1):
Lori Allen (CfA)
Bernhard Brandl (Leiden)
Eric Feigelson (Penn State)
Marc Gagne (West Chester College)
Lee Hartmann (CfA)
Paul Ho (CfA)
Thierry Montmerle (CEA-Saclay)
Debra Padgett (IPAC/JPL)
Steve Strom (NOAO)
Fred Walter (SUNY-Stony Brook)
Harold Yorke (IPAC/JPL)

There is time and space for contributed talks and posters but space is limited to about 100 participants.

The Scientific Organizing Committee Scott Wolk (CfA) Chair, Jeremy Drake (CfA), Nancy Evans (CfA), Dave Huenemoerder (MIT), Ray Jayawardhana (University of Toronto), Claus Leitherer (STSci), Tom Megeath (CfA), Norbert Schulz (MIT), John Stauffer (Spitzer Science Center), Leisa Townsley (PSU), George Rieke (University of Arizona)

Information will be updated at our web page **http://cxc.harvard.edu/stars05/**

MODEST-6, the 6th conference on MOdeling DEnse STellar systems, will take place at Northwestern University (Chicago, IL) this summer, on August 29-31, 2005 (Mon-Wed). The conference will cover all aspects of star cluster research, including observations of young star clusters and super star clusters, star cluster formation, star formation in clusters, initial mass functions, stellar dynamics, numerical simulations and N-body techniques, hydrodynamics, stellar collisions, etc.

More information is available online at **http://www.astro.northwestern.edu/MODEST6/**

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/ .

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.