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Abstracts of recently accepted papers

The Degree of CO Depletion in Pre-stellar Cores

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We present new results on CO depletion in a sample of nearby pre-stellar cores, based on observations of the millimeter $C^{17}O$ and $C^{18}O$ lines and the 1.3 mm dust emission with the IRAM 30 m telescope. In most cases, the distribution of CO is much flatter than that of the dust, whereas other tracers, like N_2H^+, still probe the latter. In the centre of these objects, we estimate CO to be underabundant by a factor 4-15 depending on the cores. The CO underabundance is more pronounced in the central regions and appears to decrease with increasing distance from the core centre. This underabundance is most likely due to the freezing out of CO onto the dust grains in the cold, dense parts of the cores. We find evidence for an increase of the CO depletion degree with the core density.

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Preprint available at: `http://arXiv.org/abs/astro-ph/0205154`

The Highly Collimated HH 92 Jet and Parsec-Scale Outflow from IRAS 05399-0121

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We report the discovery of a 4 pc long bipolar Herbig-Haro outflow driven by a 10 $L_\odot$ Class-I source, IRAS 05399-0121, which is deeply embedded within a sub-mm dust condensation in the LBS 30 cloud core in the Orion B molecular cloud north of NGC 2024. A highly collimated low-excitation jet, HH 92, emerges from an asymmetric infrared reflection nebula and breaks into a cluster of well resolved Hα–bright bow shocks about 2.5 arcmin northwest of the source. We propose that the well known objects HH 90 and 91, and some previously uncataloged shocks which lie along the axis of the HH 92 jet, trace a single giant outflow lobe $\sim$ 3 pc in length. The object HH 93, which lies about 10 arcmin southeast of HH 92, traces the counterflow.

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High Resolution 4.7 μm Keck/NIRSPEC Spectra of Protostars. II: Detection of the ^{13}CO Isotope in Icy Grain Mantles

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The high resolution (R=25,000) infrared M band spectrum of the massive protostar NGC 7538 : IRS9 shows a narrow absorption feature at 4.779 μm (2092.3 cm^{-1}) which we attribute to the vibrational stretching mode of the ^{13}CO isotope in pure CO icy grain mantles. This is the first detection of ^{13}CO in icy grain mantles in the interstellar medium. The ^{13}CO band is a factor of 2.3 narrower than the apolar component of the ^{12}CO band. With this in mind, we discuss the mechanisms that broaden solid state absorption bands. It is shown that ellipsoidally shaped pure CO grains fit the bands of both isotopes at the same time. Slightly worse, but still reasonable fits are also obtained by CO embedded in N_2–rich ices and thermally processed O_2–rich ices. In addition, we report new insights into the the nature and evolution of interstellar CO ices by comparing the very high resolution multi-component solid ^{12}CO spectrum of NGC 7538 : IRS9 with that of the previously studied low mass source L1489 IRS. The narrow absorption of apolar CO ices is present in both spectra, but much stronger in NGC 7538 : IRS9. It is superposed on a smooth broad absorption feature well fitted by a combination of CO_2 and H_2O–rich laboratory CO ices. The abundances of the latter two ices, scaled to the total H_2O ice column, are the same in both sources. We thus suggest that thermal processing manifests itself as evaporation of apolar ices only, and not the formation of CO_2 or polar ices. Finally, the decomposition of the ^{12}CO band is used to derive the ^{12}CO/^{13}CO abundance ratio in apolar ices. A ratio of ^{12}CO/^{13}CO=71$\pm$15 (3σ) is deduced, in good agreement with gas phase CO studies ($\sim$77) and the solid $^{12}CO_2/^{13}CO_2$ ratio of 80$\pm$11 found in the same line of sight. The implications for the chemical path along which CO_2 is formed are discussed.

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preprints available at www.astro.caltech.edu/$\sim$acab/publ.html

Evolution of the Solar Nebula. V. Disk Instabilities with Varied Thermodynamics

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Disk instability is a promising mechanism for explaining the rapid formation of the gas and ice giant planets in our Solar System as well in extrasolar planetary systems. Disk instability involves the formation of self-gravitating clumps in marginally gravitationally unstable protoplanetary disks on time scales of $\sim$ 1000 years. We present here the results of a suite of disk instability models calculated with a three dimensional, gravitational hydrodynamics code. The models explore the effects of varying the thermodynamical assumptions, the initial degree of gravitational instability, and the numerical spatial resolution. For all models, the disk has an initial mass of 0.091 $M_\odot$ inside 20 AU, in orbit around a 1 $M_\odot$ protostar. The most realistic models are calculated with an energy equation and diffusion approximation radiative transfer, which produces results intermediate between those of models with a locally isothermal or locally adiabatic thermodynamic response to the growth of azimuthal density perturbations. Locally adiabatic models suppress the growth of clumps, while radiative transfer models permit the formation of clumps similar to those in locally isothermal models. Vertical convection is identified as the primary means for cooling the midplane in the models with radiative transfer. These models suggest that the disk instability mechanism is capable of rapidly forming self-gravitating protoplanets in marginally unstable disks with a mass similar to that inferred for the solar nebula and for other protoplanetary disks. Assuming that the protoplanets survive their subsequent evolution, the likelihood that all protoplanetary disks pass through a phase of marginal gravitational instability might then imply a high frequency of extrasolar giant planets.

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Constraints on the Circumstellar Disk Masses in the IC 348 Cluster

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A $5.2' \times 5.2'$ region toward the young cluster IC 348 has been imaged in the millimeter continuum at $4.0'' \times 4.9''$ resolution with the OVRO interferometer to a RMS noise level of 0.75 mJy beam^{-1} at 98 GHz. The data are used to constrain the circumstellar disk masses in a cluster environment at an age of ~ 2 Myr. The mosaic encompasses 95 known members of the IC 348 cluster with a stellar mass distribution that peaks at 0.2-0.5 $M_\odot$. None of the stars are detected in the millimeter continuum at an intensity level of 3σ or greater. The mean observed flux for the ensemble of 95 stars is 0.22 ± 0.08 mJy. Assuming a dust temperature of 20 K, a mass opacity coefficient of $\kappa_o = 0.02$ cm^2 g^{-1} at 1300 μm, and a power law index of $\beta = 1$ for the particle emissivity, these observations imply that the 3σ upper limit to the disk mass around any individual star is 0.025 $M_\odot$, and that the average disk mass is 0.002 ± 0.001 $M_\odot$. The absence of disks with masses in excess of 0.025 $M_\odot$ in IC 348 is different at the $\sim 3\sigma$ confidence level from Taurus, where $\sim 14\%$ of the stars in an optically selected sample have such disk masses. Compared with the minimum mass needed to form the planets in our solar system (~ 0.01 $M_\odot$), the lack of massive disks and the low mean disk mass in IC 348 suggest either that planets more massive than a few Jupiter masses will form infrequently around 0.2-0.5 $M_\odot$ stars in IC 348, or that the process to form such planets has significantly depleted the disk of small dust grains on time scales less than the cluster age of ~ 2 Myr.

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On the massive star contents of Cygnus OB2

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We present a near-infrared spectroscopy survey of a large area centered on the Cygnus OB2 association aiming at constraining its massive star contents. Our goal is to establish a nearly complete list of O-type members of the association, both to examine recent claims based on starcounts that suggest a richer contents than previously thought, and to provide a suitable database for further studies of the entire high-mass end of one of the richest associations of the Galaxy. The target selection is based on the JHK photometry published in the 2MASS all-sky survey. We identify 46 new early-type candidates, most of them expected to be O-type stars, plus 16 new stars with emission in Brγ and often in other lines as well, characteristic of evolved massive stars undergoing intense mass loss. We also present spectra of three luminous stars with CO overtone emission, one of them having also intense H_2 emission and being associated with compact nebulosity. By considering our findings, those of other authors, and plausible completeness corrections, we estimate the number of O-type stars or stars having evolved from a O-type progenitor to be 90-100, slightly below, but compatible with, most recent starcounts estimates by Knödlseder (2000, A&A, 360, 539). These results support the notion that Cygnus OB2 may be considered as a young globular cluster. The lists of new members that we provide, in particular those with emission lines, should be a useful resource for future investigations of Cygnus OB2 itself, as well as of very massive stellar evolution by providing a nearby, abundant sample of stars sharing a common environment.

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http://www.eso.org/~fcomeron/cygob2.ps

G24.78+0.08: a cluster of high-mass (proto)stars

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We present the results of high angular resolution observations at millimeter wavelengths of the high-mass star forming region G24.78+0.08, where a cluster of four young stellar objects is detected. We discuss evidence for these to be high-mass (proto)stars in different evolutionary phases. One of the sources is detected only in the continuum at 2 and 2.6 mm and we suggest it may represent a good candidate of a high-mass protostar.

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Brown Dwarfs and the TW Hya Association

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I report the results of a survey for low-mass ($0.030 > M > 0.013 M_{\odot}$) brown dwarfs in the direction of the TW Hya association using 2MASS. Two late-M dwarfs show signs of low surface gravity and are strong candidates to be young, very-low-mass ($M \approx 0.025 M_{\odot}$) brown dwarfs related to the TW Hya association. 2MASSW J1207334-393254 is particularly notable for its strong Hα emission. The numbers of detected brown dwarfs is consistent with the substellar mass function in richer star formation environments. Newly identified late-M and L dwarfs in the field are also discussed. Unusual objects include an L dwarf with strong Hα emission, a possible wide M8/M9 triple system, and a possible L dwarf companion to an LHS star.

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Near-infrared imaging of the environment of 6.7-GHz methanol masers

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Near-infrared images at I, J, H and K bands were made of 12 southern 6.7 GHzmethanol maser sources. Astrometry accurate to 0.5 arcsec was obtained. The positions of known HII regions, water masers, hydroxyl masers, and mid- and far-infrared objects in the region are examined in order to try to determine the nature of the methanol maser source. Deeply embedded NIR sources were found close to seven out of fourteen maser sites. In three cases, no NIR source, HII region, water maser or hydroxyl maser could be found in likely association with the methanol masers.

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Molecular Hydrogen Outflows in W51

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We present the results of a deep search for the molecular hydrogen shock fronts associated with young stellar outflows in the giant molecular cloud and massive star forming region W51. A total of 14 outflows were identified by comparing images in the H and K bands and in a narrow-band filter centered on the H_2 1–0 S(1) line at 2.122 μm. A few of the newly discovered outflows were subsequently imaged at higher spatial resolution in the S(1) filter; one outflow was also imaged in the 1.644 μm emission line of [FeII]. For two of the outflows, high-resolution echelle spectroscopy in the H_2 1–0 S(1) line was obtained using NIRSPEC at Keck. For one outflow additional high resolution spectra were obtained in the [FeII] line and in Brγ. The largest and best studied outflow shock front shows a remarkably broad [FeII] line, an unusual high-velocity component in Brγ, and comparably narrow line widths in the H_2 1–0 S(1) line. A scenario involving high-velocity shocks and UV excitation of pre-shock material is used to explain these spectra.

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$C^{18}O$ abundance in the nearby globule Barnard 68

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We have studied the radial variation of the CO abundance in the nearby isolated globule Barnard 68 (B68). For this purpose, B68 was mapped in the three rotational lines ^{13}CO($J = 1$–0), C^{18}O($J = 1$–0) and C^{18}O($J = 2$–1). Using the recent discovery of Alves et al. (2001) that the density structure of B68 agrees with the prediction for a pressure bound distribution of isothermal gas in hydrostatic equilibrium (Bonnor-Ebert sphere), we show that the flat CO column density distribution can be explained by molecular depletion. By combining the physical model with the observed CO column density profile, it was found that the density dependence of the CO depletion factor f_d can be well fitted with the law $f_\mathrm{d} = 1 + \mathrm{const.}\, n(\mathrm{H_2})$, which is consistent with an equilibruim between the accretion and the desorption processes. In the cloud centre, between 0.5 % and 5 % of all CO molecules are in the gas phase. Our observations suggest a kinetic temperature of $\approx$8 K. In combination with the assumption that B68 is a Bonnor-Ebert sphere this leads to a distance of 80 pc. The cloud mass consistent with these values is 0.7 $M_\odot$, considerably less than previously estimated. We find in B68 no clear deviance of the near-infrared reddening efficiency of dust grains per unit H_2 column density with respect to values derived in diffuse clouds.

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Deep Near Infrared Survey Toward M17 Region

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We conducted a deep JHKs band imaging survey of the M17 region, using the near-infrared camera, Simultaneous 3-color InfraRed Imager for Unbiased Survey (SIRIUS), mounted on the InfraRed Survey Facility (IRSF) 1.4m telescope at South African Astronomical Observatory. This survey covers an area of ∼200 square arcmin with 10σ limiting magnitudes of J∼18.7, H∼18.2, and Ks∼17.5. The near infrared (NIR) images reveal an unprecedented view of the region. The NIR nebulae are highly structured, with two nebular bars corresponding to but a little larger than the HII region defined by Felli et al. 1984, constructing a conical shape. Fine structures are found all over the nebular area. The central region contains a congregation of intermediate to high mass stars. From the slope of Ks band luminosity function (KLF) and the frequency of young stellar objects (YSOs) we infer that the central cluster has an age less than 3 Myr. The central OB cluster provides tremendous energy that heats and ionizes its surrounding materials, triggering the star formation of second generation in the nebular bars. The second generation stars are so numerous that could affect the star formation efficiency in the whole region. To the southwest of the central cluster and the nebular bars, where a giant molecular cloud core is located, a large number of red stars are detected. We argue that these red stars are most probably associated YSOs with intrinsic color excesses, not normal field stars reddened by the molecular cloud in front of them. Being located beyond the photo-dissociation region, the star forming process in the molecular region could be independent of the impact by the central cluster.

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http://jets.pmo.ac.cn/preprints.html

D/HD transition in Photon Dominated Regions (PDR)

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We present the basic features of a steady state chemical model of Photon Dominated Regions (PDR), where the deuterium chemistry is explicitly introduced. The model is an extension of a previous PDR model (Abgrall et al. (A&A, 1992), Le Bourlot et al. (A&A, 1993) and Le Bourlot (A&A, 2000)) in which the microscopic processes relative to HD have been incorporated. The J-dependent photodissociation probabilities have been calculated and included in the statistical equilibrium of the rotational levels of HD where the latest collision molecular data are also introduced. The thermal balance is calculated from the equilibrium between the different heating and cooling processes. We introduce a standard model of density $n_H = 500$ cm^{-3} embedded in the Interstellar Standard Radiation Field (ISRF) from which we derive the main properties of HD in PDR. The D/HD transition does not depend only on the density, radiation field but also on the chemical processes and especially on the dust formation efficiency . In standard radiation field conditions, the D/HD transition occurs in a narrow range of visual extinctions as long as density is less than 1000 cm^{-3} and HD is formed through the $D^+ + H_2$ reaction. At higher densities a logarithmic dependence of the location of the transition is derived. The model is applied both to ultraviolet absorption observations from the ground rotational state of HD performed in diffuse and translucent clouds and infrared emission detectable at high densities and for high ultraviolet radiation fields coming from the bright surrounding stars.

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http://aristote.biophy.jussieu.fr/MIS

Polarimetric variations of binary stars. IV. Pre-main-sequence spectroscopic binaries located in Taurus, Auriga, and Orion

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We present polarimetric observations of 14 pre-main-sequence (PMS) binaries located in the Taurus, Auriga, and Orion star forming regions. The majority of the average observed polarizations are below 0.5%, and none are above 0.9%. After removal of estimates of the interstellar polarization, about half the binaries have an *intrinsic* polarization

above 0.5%, even though most of them do not present other evidences for the presence of circumstellar dust. Various tests reveal that 77% of the PMS binaries have or possibly have a variable polarization. LkCa 3, Par 1540, and Par 2494 present detectable periodic and phase-locked variations. The periodic polarimetric variations are noisier and of a lesser amplitude (∼0.1%) than for other types of binaries, such as hot stars. This could be due to stochastic events that produce deviations in the average polarization, a non-favorable geometry (circumbinary envelope), or the nature of the scatterers (dust grains are less efficient polarizers than electrons). Par 1540 is a Weak-line T Tauri Star, but nonetheless has enough dust in its environment to produce detectable levels of polarization and variations. A fourth interesting case is W 134, which displays rapid changes in polarization that could be due to eclipses. We compare the observations with some of our numerical simulations, and also show that an analysis of the periodic polarimetric variations with the Brown, McLean, & Emslie (BME) formalism to find the orbital inclination is for the moment premature: non-periodic events introduce stochastic noise that partially masks the periodic low-amplitude variations and prevents the BME formalism from finding a reasonable estimate of the orbital inclination.

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NICMOS Images of the GG Tau Circumbinary Disk

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We present deep, near-infrared images of the circumbinary disk surrounding the pre–main-sequence binary star, GG Tau A, obtained with NICMOS aboard the Hubble Space Telescope. The spatially resolved proto-planetary disk scatters ∼1.5% of the stellar flux, with a near-to-far side flux ratio of ∼1.4, independent of wavelength, and colors that are comparable to the central source ($\Delta\left(M_{F110W} - M_{F160W}\right) = 0.10 \pm 0.03$, $\Delta\left(M_{F160W} - M_{F205W}\right) = -0.04 \pm 0.06$); all of these properties are significantly different from the earlier ground-based observations. New Monte Carlo scattering simulations of the disk emphasize that the general properties of the disk, such as disk flux, near side to far side flux ratio and integrated colors, can be approximately reproduced using ISM-like dust grains, without the presence of either circumstellar disks or large dust grains, as had previously been suggested. A single parameter phase function is fitted to the observed azimuthal variation in disk flux, providing a lower limit on the median grain size of $a > 0.23\,\mu$m. Our analysis, in comparison to previous simulations, shows that the major limitation to the study of grain growth in T Tauri disk systems through scattered light lies in the uncertain ISM dust grain properties. Without explicit determination of the scattering properties it is not possible to differentiate between geometric, scattering and evolutionary effects. Finally, we use the 9 year baseline of astrometric measurements of the binary to solve the complete orbit, assuming that the binary is coplanar with the circumbinary ring. We find that the estimated 1σ range on disk inner edge to semi-major axis ratio, $3.2 < R_{in}/a < 6.7$, is larger than that estimated by previous SPH simulations of binary-disk interactions.

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X-ray Emission near the Substellar Limit: The σ Orionis and Taurus Star Forming Regions

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We have carried out an extensive search for X-ray emission from young, very low-mass objects near and beyond the substellar limit, making use of archived *ROSAT* PSPC and HRI observations pointed at Brown Dwarfs and Brown Dwarf candidates in the young σ Orionis and Taurus-Auriga associations. In σ Ori we identify three Brown Dwarf candidates with X-ray sources; in Taurus-Auriga we add one further X-ray detection of a Brown Dwarf to the list published earlier. We combine this data with all previously X-ray detected Brown Dwarfs and Brown Dwarf candidates in young stellar associations and star forming regions to perform a study of stellar activity parameters on the as yet

largest sample of young, very low mass objects. A similar relation between X-ray and bolometric luminosity, and Hα emission, respectively, as is known for T Tauri stars seems to hold for young objects down to the substellar limit, too. No signs for a change in X-ray activity are found on the transition to substellar masses.

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Preprint available at http://www.xray.mpe.mpg.de/ stelzer/publications.html

A twisted jet from R Mon

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We present the results of long-slit and integral-field spectroscopy of the R Mon Herbig-Haro jet. The data were obtained with the 6m telescope. A slightly curved jet of 16 arcsec in length is evident in [SII] lines. Maps of radial velocities and electron densities are shown. The difference between radial velocities on the sides of the jet as well as the density distribution can be considered as an indication of presence of the helical shock structure in the jet. This structure, having a DNA-like appearance, abruptly changes direction near the edges, which could account for the observed velocity variations. Radial velocities were determined also for the several knots in the HH 39 group. The kinematics of the system as a whole also suggests the precession of the outflow.

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The rich 6 to 9 μm spectrum of interstellar PAHs

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IR spectroscopy provides a valuable tool for the characterisation and identification of interstellar molecular species. Here, we present 6–9 μm spectra of a sample of reflection nebulae, HII regions, YSOs, evolved stars and galaxies that show strong unidentified infrared bands, obtained with the SWS spectrograph on board ISO. The IR emission features in this wavelength region show pronounced variations. 1) The 6.2 μm feature shifts from 6.22 to 6.3 μm and clearly shows profile variations. 2) The 7.7 μm complex is comprised of at least two subpeaks peaking at 7.6 and one longwards of 7.7 μm. In some cases the main peak can apparently shift up to 8 μm. Two sources do not exhibit a 7.7 μm complex but instead show a broad emission feature at 8.22 μm. 3) The 8.6 μm feature has a symmetric profile in all sources and some sources exhibit this band at slightly longer wavelengths. For the 6.2, 7.7 and 8.6 μm features, the sources have been classified independently based on their profile and peak position. The classes derived for these features are directly linked with each other. Sources with a 6.2 μm feature peaking at $\sim$ 6.22 μm exhibit a 7.7 μm complex dominated by the 7.6 μm component. In contrast, sources with a 6.2 μm profile peaking longwards of 6.24 μm show a 7.7 μm complex with a dominant peak longwards of 7.7 μm and a 8.6 μm feature shifted toward the red. Furthermore, the observed 6–9 μm spectrum depends on the type of object. All ISM-like sources and a few PNe and Post-AGB stars belong to the first group while isolated Herbig AeBe stars, a few Post-AGB stars and most PNe belong to the second group. We summarise existing laboratory data and theoretical quantum chemical calculations of the modes emitting in this wavelength region of PAH molecules. We discuss the variations in peak position and profile in view of the exact nature of the carrier. We attribute the observed 6.2 μm profile and peak position to the combined effect of a PAH family and anharmonicity with pure PAHs representing the 6.3 μm component and substituted/complexed PAHs representing the 6.2 μm component. The 7.6 μm component is well reproduced by

both pure and substituted/complexed PAHs but the 7.8 μm component remains an enigma. In addition, the exact identification of the 8.22 μm feature remains unknown. The observed variations in the characteristics of the IR emission bands are linked to the local physical conditions. Possible formation and evolution processes that may influence the interstellar PAH class are highlighted.

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Jet/cloud collision, 3D gasdynamic simulations of HH 110

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We present 3D, gasdynamic simulations of jet/cloud collisions, with the purpose of modelling the HH 270/110 system. From the models, we obtain predictions of Hα and H_2 1-0 s(1) emission line maps, which qualitatively reproduce some of the main features of the corresponding observations of HH 110. We find that the model that better reproduces the observed structures corresponds to a jet that was deflected at the surface of the cloud ~ 1000 yr ago, but is now boring a tunnel directly into the cloud. This model removes the apparent contradiction between the jet/cloud collision model and the lack of detection of molecular emission in the crossing region of the HH 270 and HH 110 axes.

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An unbiased H_2 survey for protostellar jets in Orion A II. The infrared survey data

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We have made an unbiased imaging survey of a 1.2 square degree area in the Orion A giant molecular cloud searching for molecular hydrogen emission line features seen in the v=1–0 S(1) line at a wavelength of 2.12 μm originating in shocks in outflows from young stellar objects. This survey provides for the first time an unbiased census of outflows over a significant portion of a giant molecular cloud, and yields a sample of outflows free from selection effects and with all objects located at roughly the same, well-known distance. In this paper, we present the data gathered in the course of the survey, provide a comprehensive list of all molecular hydrogen emission features found, and give a list of the 76 candidate outflows identified in the data set.

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On the master equation approach to diffusive grain-surface chemistry: the H, O, CO system

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We have used the master equation approach to study a moderately complex network of diffusive reactions occurring on the surfaces of interstellar dust particles. This network is meant to apply to dense clouds in which a large portion of the gas-phase carbon has already been converted to carbon monoxide. Hydrogen atoms, oxygen atoms, and CO molecules are allowed to accrete onto dust particles and their chemistry is followed. The stable molecules produced are oxygen, hydrogen, water, carbon dioxide (CO_2), formaldehyde (H_2CO), and methanol (CH_3OH). The surface abundances calculated via the master equation approach are in good agreement with those obtained via a Monte Carlo method but can differ considerably from those obtained with standard rate equations.

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Injection of Radioactivities into the Forming Solar System

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Meteorite studies have revealed the presence of short-lived radioactivities in the early solar system. The current data suggests that the origin of at least some of the radioactivities requires contribution from recent nucleosynthesis at a stellar site. This sets a strict time limit on the time available for the formation of the solar system and argues for the theory of the triggered origin of the solar system. According to this scenario, the formation of our planetary system was initiated by the impact of an interstellar shock wave on a molecular cloud core. The shock wave originated from a nearby explosive stellar event and carried with it radioactivities produced in the stellar source. In addition to triggering the collapse of the molecular cloud core, the shock wave also deposited some of the freshly synthesized radioactivities into the collapsing system. The radioactivities were then incorporated into the first solar system solids, in this manner leaving a record of the event in the meteoritic material. The viability of the scenario can be investigated through numerical simulations studying the processes involved in mixing shock wave material into the collapsing system. The high-resolution calculations presented here show that injection occurs through Rayleigh-Taylor instabilities, the injection efficiency is approximately 10%, and temporal and spatial heterogeneities in the abundances of the radioactivities may have existed at the time of their arrival in the forming solar system.

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Near infrared molecular hydrogen emission in the NGC 2264 IRS1 region

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Molecular hydrogen v = 1-0 S(1) narrow band imaging revealed a cluster of 4, or probably 5, highly collimated H_2 emission jets and many isolated H_2 emission knots in the NGC 2264 IRS1 region. Jets 1 and 2 each consists of a bright and 2 faint knots. Jet 2 is shifted towards northeast relative to jet 1, therefore, they are probably two distinct flows. Jet 3 is a short jet and jet 4 consists of a bright knot and several faint knots. Knots I-K may constitute the fifth jet in the region. The relationship between these infrared outflows and the millimeter and submillimeter sources in the region, NGC 2264 MMS1-5, is discussed. Our detection of infrared outflows suggests that MMS1-5 are all in the protostar stage of their evolution. The high collimation of jets 1-4 may have important implication for the formation of intermediate and high mass stars.

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Arcsecond Images of CH_3CN Toward W75N

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CH_3CN (J=6-5) was observed with a resolution of 2" toward W75N using the BIMA interferometer. Two continuum sources were detected at 3 mm, designated MM1 and MM2 in previous studies. Alignment of two mm continuum sources with the outflow axis from MM1 suggests that these continuum sources may be the result of the outflow interacting with the interstellar medium. MM1 is coincident with compact CH_3CN emission. CH_3CN was not detected toward MM2. The distribution of optical depth (τ_L) is derived. An excitation analysis was not done because of large line optical depths.

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ftp.astro.wisc.edu/outgoing/watson/papers/w75n.pdf

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