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Abstracts of recently accepted papers

An Alternative to Unseen Companions to T Tauri Stars

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Emission at infrared to millimeter wavelengths from the prototypical pre–main-sequence star T Tauri is consistent with the existence of a low mass circumstellar disk around T Tauri. T Tauri's spectrum can be characterized as flat, but with a significant dip at mid-infrared wavelengths. Mid-infrared dips can result from gaps in the circumstellar disk, and such gaps are thought to imply the existence of unseen companions which produce the gaps through gravitational effects. We show here that mid-infrared dips in T Tauri star spectra may have a more prosaic cause, and may be simply the result of dust grain opacity and the vertical structure of a low mass circumstellar disk *without a gap.*

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Dust Emission Features in 3 μm Spectra of Herbig Ae/Be Stars

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Low and medium resolution spectra in the 3 μm region were obtained of 24 Herbig Ae/Be stars in a search for organic features from the dust around young stars. The 3.29 μm emission feature from aromatic hydrocarbons was detected for the first time in three objects, Lk Hα 25, XY Per, and AS 310. The width of the feature in Lk Hα 25 and XY Per corresponds to the narrow profile characteristic of material close to other young stellar objects. Two other stars, HD 245185 and HK Ori may have weak features. About 20 % of the Herbig Ae/Be stars surveyed to date have firmly detected 3.29 μm features. Among these stars, the feature-to-continuum contrast varies over a wide range; emission equivalent widths vary by a factor $\sim$ 20. The available data indicate that the 3.29 μm feature is more extended around Herbig Ae/Be stars of earlier spectral type, possibly due to dehydrogenization or destruction of the aromatics near these stars. Interpretation of the spectra in the optically thin limit suggests that the total number of aromatics excited by the stars is also greater around the earlier-type objects. The ratio of 3.29 μm feature flux to far-infrared flux, which is a measure of the abundance of aromatics relative to larger grains, shows less variation; however, there may be real abundance differences in some of the stars surveyed. If the small grains around Herbig Ae/Be stars have spectral properties like those seen in reflection nebulae, then they play a significant role in the total energy balance of these objects; they can radiate between 7 and 60 % of the far-infrared luminosity. No other Herbig Ae/Be stars observed to date have the strong 3.42 and 3.53 μm features seen in Elias 1 and HD 97048.

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"Spherical" Disks: Moving Towards a Unified Source Model for L1551

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To predict the effects of a disk on the spectral energy distribution of a deeply embedded protostar, we construct disk models with power-law temperature distributions ($T \propto r^{-q}$). We then use the spherically averaged disk emission as the central source for a spherical envelope, hence the term, "spherical" disk. We then calculate the predicted spectral energy distribution of the disk and envelope, using a spherically symmetric radiative transport code. Applying this procedure to L1551 IRS 5, we find that the predicted far-infrared flux is not very sensitive to the nature of the central source. The best source model is consistent with the far-infrared emission arising from the infalling region in an "inside-out" collapse model, independent of the nature of the central source. Disk models are superior to the star-only model when we try to match millimeter interferometer data. While disks with various q can reproduce the observed 2.7 mm interferometer flux, only an active disk ($q = 0.5$) can produce enough emission in a region small enough to match the observed 2.7 mm visibilities. However, if the disk is backwarmed by the envelope, even purely reprocessing disks can meet this constraint. All types of backwarmed disks are virtually indistinguishable in their millimeter properties. We find that all reasonable envelope models are sufficiently opaque in the mid-infrared to attenuate any disk model to a level well below the observations, unless the ratio of the mid-infrared to far-infrared dust opacities is similar to that in the dust model advocated by Mathis, Mezger, & Panagia (1983).

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Circular polarisation and variability in the spectra of Herbig Ae/Be stars. I. The Fe II 5018 Å and He I 5876 Å lines of AB Aurigae

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We present high resolution spectroscopic and spectro-polarimetric observations of the Fe II 5018 and He I 5876 Å lines in the pre-main sequence Herbig Ae star AB Aur.

No signal was detected in the circular polarisation (Stokes V) profile of the magnetically sensitive Fe II 5018 Å line, yielding upper limits of the order of 1 kG for the photospheric magnetic field. This upper limit is still much higher than the equipartition magnetic field at the photosphere, estimated to be 60 G.

Both lines are spectacularly variable on a night-to-night basis. In particular, the Fe II 5018 Å line appears as a photospheric absorption line in one of our spectra, but as a variable emission line, usually composed of a flat-topped broad emission and a roughly triangular emission, in the other spectra. The He I 5876 Å line often includes a red absorption component and a blue emission component, but also often appears entirely in emission with a variable asymmetry.

We estimate the regions of formation of the two lines, with a very simplified treatment of ionization and excitation processes, and within the framework of existing models of the wind and chromosphere of AB Aur. We find that the Fe II 5018 Å line is formed in the bulk of the expanding chromosphere, while the He I 5876 Å line is formed at the very base of the wind/chromosphere complex.

Although the data presented here are not sufficient to fully interpret such a complex variability, we suggest the idea that it could be linked to the co-rotation of structures in the wind and chromosphere of AB Aur. The photospheric appearance of the Fe II 5018 Å line in one of our spectra may be due to a temporary change in the chromospheric physical conditions, like an increase of the temperature, followed by a return to "normal" conditions, with a time scale shorter than one day.

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Extremely High Velocity Outflows

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Extremely high velocity (EHV) wings, with full widths of 72 to 140 km s^{-1}, are seen on the CO $J = 3 \rightarrow 2$ lines toward W3 IRS 5, GL 490, NGC 2071, W28 A2 (G05.89–0.39), GL 2591, S140, and Cepheus A. Observations of ^{12}CO and ^{13}CO $J = 3 \rightarrow 2$ and $J = 2 \rightarrow 1$ lines indicate that optical depth generally decreases with increasing velocity separation from the ambient cloud velocity. Maps of the extremely high velocity ($|V - V_0| \gtrsim$ 20 km s^{-1}) and the high-velocity ($5 \lesssim |V - V_0| \lesssim$ 20 km s^{-1}) CO emission components show that the morphology of the two components is similar in W3 IRS 5 and W28 A2 but may be different in GL 2591, S140, and Cepheus A.

The results of our survey suggest that EHV wings are common around infrared sources of moderate to high luminosity [500 to (4×10^5) $L_\odot$] in dense regions. Line ratios imply that the EHV gas is usually optically thin and warm. Characteristic velocities range from 20 to 40 km s^{-1}, yielding timescales of 1600–4200 yr. Since most sources in this study are producing some ionizing photons, these short timescales suggest that neutral winds coexist with ionizing photons.

We examined two possible sources for the extremely high velocity CO emission: a neutral stellar wind; and swept-up or entrained molecular gas. Neither can be ruled out. If the high-velocity (HV) gas is swept up by a momentum-conserving stellar wind traced by the extremely high velocity CO emission, most of the C in the winds from luminous objects cannot be in CO. If the EHV and HV forces are equal, the fraction of C in a form other than CO increases with source luminosity and with the production rate of ionizing photons. This trend is natural in the stellar wind hypothesis, but models of winds around such luminous objects are needed. We consider other possible chemical states for the carbon in the stellar wind.

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The Molecular Cores in the L1287, AFGL 5142, and IRAS 20126+4104 Regions

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The NH_3 (J,K)=(1,1) and (2,2) line emission was mapped toward three regions with molecular outflows, L1287, AFGL 5142, and IRAS 20126+4104, using the Effelsberg 100 m telescope. Additional $C^{18}O$ (J=2→1) and CS (J=3→2) observations of L1287 were carried out with the IRAM 30 m telescope. For the three regions, the high-density molecular core, as traced by the ammonia emission, peaks very close to the position of the proposed powering sources of the outflows. In AFGL 5142 we favor the radio continuum source proposed by Torrelles et al. (1992b) as the powering source of the outflow. The molecular cores best resolved by the telescope beam are elongated perpendicularly to the outflow axis. The clearest elongation is seen in the most collimated outflow, L1287. For this source, a remarkable velocity gradient can be seen along the major axis of the high-density condensation, consistent with a rotation of the core. For L1287 and AFGL 5142 we find that the masses of the high-density cores are much higher than the masses of the outflows, indicating that the elongation of the cores cannot be a consequence of the interaction with the molecular outflow and that the cores can play an important role in the large scale collimation of the bipolar molecular outflows. For all the cores the molecular gas is probably heated by an internal source. In particular, in L1287 we find a local heating of the molecular gas and line broadening towards the position of the ammonia peak, indicating a physical association of the the high-density gas with the powering source of the outflow.

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Variable redshifted He I absorption lines in BM And

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We have discovered variable He I absorption lines with red-shifts of about 100 km s^{-1} in the T Tauri star BM Andromedae. The presence of He I is quite unexpected, since BM And has a largely unveiled G8V spectrum, moderate Hα emission (E.W. of 8-25 Å), and a normal UV-excess. The higher Balmer lines show inverse P Cygni Balmer profiles whenever He I is in absorption and have the same absorption line velocities. All of these lines come and go during our observations without any sign of significant velocity changes. We interpret these features as the result of very hot material falling onto the star at a rate of at least $10^{-9}\,M_\odot\,yr^{-1}$. We have also seen this direct indication of accretion in a few other WTTSs whose properties are quite close to those of BM And.

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Sequential Star Formation in Taurus Molecular Cloud 1

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We discuss the fragmentation of a filamentary cloud on the basis of a 1-dimensional hydrodynamical simulation of a self-gravitating gas cloud. The simulation shows that dense cores are produced with a semi-regular interval in space and time from one edge to the other. At the initial stage the gas near one of the edges is attracted inwards by gravity and the accumulation of the gas makes a dense core near the edge. When the dense core grows in mass up to a certain amount, it gathers gas from the other direction. Accordingly the dense core becomes isolated from the main cloud and the parent filamentary cloud has a new edge. This cycle repeats and the fragmentation process propagates towards the other edge. The propagation speed is a few tens of percent larger than the sound speed. According to the theory, the age difference for the northwest-most and southeast-most cores in TMC-1 is estimated to be 0.68 pc/0.6 km s^{-1} $= 10^6$ y. The estimated age difference is consistent with that obtained from the chemical chronology.

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Large scale structure of the R Coronae Australis cloud core

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We report the results of $C^{18}O(J = 1 - 0)$ mapping with the 15-m Swedish-ESO Submillimeter Telescope (SEST) of the nearby R Coronae Australis dark cloud. A region of size $40' \times 10'$, corresponding to 1.6×0.4 pc has been mapped with a spatial resolution of 0.03 pc, and a more extended region has been mapped with a coarser grid in order to outline the general distribution of the dense material. We estimate the total gas mass for the high column density region (with $N(H_2) > 10^{22}\,cm^{-2}$) to be 120 $M_\odot$. The mapped region can be divided roughly into two parts with contrasting properties of the sub-condensations. The northwestern dense gas region, known as "the R CrA core", consists of several clumps which appear to be breaking up. The R CrA core, with a diamater of $25'$ and a mass of 54 $M_\odot$, has a central hole and seems to be rotating differentially around its centre of mass, located in the hole. These features have remarkable similarity with the simulation results of Monaghan & Lattanzio (1991) for the collapse of a cooling, rotating sphere. We therefore suggest that the R CrA core is actually a fragmented disk. In the southeastern "tail" of the cloud, we have found a quiescent dense core, which to our knowledge is not associated with any young stars. This clump is probably the centre of a massive H I to H_2 conversion region (Llewellyn et al. 1981), and a likely site of future star formation.

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NGC 6611: A Cluster Caught in the Act

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We have combined optical CCD photometry and spectroscopy with infrared imaging photometry to study the young cluster NGC 6611. We use these data to derive improved values for the reddening law ($R = 3.75$) and the distance modulus ($m - M$=11.5), and to construct a physical H-R diagram from which we can probe the ages, masses, and evolutionary states of this stellar ensemble. The H-R diagram shows a strong population of high-mass stars, the most massive of which has a mass of roughly $80\mathcal{M}_{\odot}$, similar to what we find in other Galactic and Magellanic Cloud clusters and associations. The age of the massive stellar population in NGC 6611 is approximately 2 million years, with an age spread of, perhaps, a million years, although the data are also consistent with there being *no* discernible age spread among the most massive stars. However, the H-R diagram does reveal that one star of somewhat lower mass ($30\mathcal{M}_{\odot}$) must have formed approximately 6 million years ago. The upper end of the mass function of NGC 6611 is found to have a slope of $\Gamma = -1.1 \pm 0.3$, indistinguishable from a Salpeter slope, and similar to what we have found in other Galactic associations, but shallower than what we have found in the Magellanic Clouds. Our most significant result, however, is that we catch this cluster in the act of forming intermediate mass (3-8 $\mathcal{M}_{\odot}$) stars. This is the first well-established case where large numbers of intermediate-mass stars have been seen on their way to the zero-age main sequence. That intermediate mass pre-main sequence stars are indeed present is evidenced both by their location above the zero-age main sequence in the H-R diagram, and in some cases by their spectroscopic and infrared signatures of (possibly remnant protostellar) circumstellar material. The pre-main sequence population ranges from as young as 0.25 million years to at least 1 million years of age. We find an highly unusual number (27) of emission-line stars, which appear quite similar in their optical and infrared continuum and optical spectroscopic properties to "classical Be/Ae" stars (as opposed to Herbig Be/Ae stars). Our data are inconsistent with the traditional interpretation that *these* "classical Be/Ae" stars are slightly evolved stars undergoing mass loss. Instead, we offer the conjecture that these may be young stars whose circumstellar disks have become optically *thin*, and produce Balmer emission lines. The infrared data do indicate a number of stars, particularly amongst the embedded sample, whose colors are consistent with those of stars thought to be surrounded by optically *thick* circumstellar accretion disks. The identification of such disks around young massive stars continues to be rare, and implies that the disk survival times around intermediate and high mass stars are much shorter ($< 0.5\ Myr$) than those of disks surrounding lower mass stars.

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Starlight polarization by dust in Bok globule B5

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The decrease of the wavelength of maximum polarization, λ_{max}, with the increase of the angular distance of stars from the center of Bok globule B5, ϕ, has been found by Bhatt (1986, MNRAS 222, 383). This correlation was explained as a result of the segregation of dust grains. We have made the photometric and polarimetric observations of stars in the region of B5 and found that the dependence of λ_{max} on ϕ can be interpreted alternatively as follows: when ϕ increases the relative contribution of the interstellar polarization to observed one increases, and hence the wavelength dependence of polarization degree determinated by dust in the globule ($\lambda_{max} \simeq 0.8$–1.0μm) is transformed into that of diffuse interstellar medium with $\lambda_{max} \simeq 0.6\mu$m. Thus, one cannot yet believe that the correlation is an observational evidence for the dust segregation in globules.

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Hubble Space Telescope Images of the Subarcsecond Jet in DG Tau

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We have applied a new restoration technique to archival [O I], Hα, and continuum HST images of DG Tau. The restored [O I] and Hα images show that DG Tau has a jet with a projected length of 25 AU and width $\leq$10 AU, and is already collimated at a projected distance of $\sim$ 40 AU (0.25$''$) from the star. Such a narrow width and short collimation distance for a stellar jet places important constraints on theoretical models of jet formation.

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Luminous Radio-Quiet Sources in W3(Main)

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We have resolved the 450–800 μm emission from the W3(Main) star forming region into three major peaks, using an 8$''$ beam on the James Clerk Maxwell Telescope (JCMT). One of the submillimeter sources is identified with W3-IRS5, a well-known candidate protostar. However, to our surprise, we find that none of the submillimeter peaks coincides with any of the prominent compact HII regions in the area. We estimate that the three submillimeter sources together contribute 35–50% of the total bolometric luminosity of the region and speculate that the contribution of luminous radio-quiet sources to the total luminosity of HII region/molecular cloud complexes may be larger than is often assumed.

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Disks around PMS Binary Systems: The Case of Haro 6-10

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This paper presents sub-arcsecond KLM images of the pre-main-sequence binary Haro 6-10 obtained with the CIRCUS IR camera attached to the CFHT. They are the first images where both components of the Haro 6-10 binary system are resolved. We confirm the results by Leinert & Haas (1989), obtained from 1-D speckle interferometry, that the projected separation of the two stars is 1$''$.25 at position angle 356^o. It is shown that extended emission is present and that it traces a large dust envelope *common* to both stars. We also present new polarization measurement. Models of the observations suggest that Haro 6-10 is surrounded by a flat (axis ratio of at least 10:1) circumbinary envelope with a plane similar to the binary's equatorial plane. Kinematic information is lacking to assess that this flat envelope can be called a (rotationally supported) disk, but we suggest that Haro 6-10 may well represent a case of a binary system surrounded by a circumbinary disk of gas and dust.

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Long-slit spectroscopy and direct imaging of the PMS objects GGD33 and V350 Cep in NGC 7129

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We present CCD images and long-slit spectra of the nebulous object GGD33 and of the T Tauri star V350 Cep in the star formation region NGC 7129. The data suggest that GGD33a is a T Tauri star and likely the illuminating source of the whole GGD33. Evidence of variability of GGD 33a is presented. Double-peaked [SII] emission lines are observed in GGD33a. The high-velocity component of the [SII] emission could be related to a HH jet-like outflow observed very close to the star. V350 Cep is embedded in reflection nebulosity. High velocity mass outflow, detected through its blueshifted Hα emission, seems to emanate from V350 Cep. The spectrum of V350 Cep presents a large number of permitted emission lines, but, excluding [SII], no forbidden emission lines have been identified in our spectra

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Observations of Circumstellar Disks at Centimeter Wavelengths

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We present results of a search for centimeter wavelength dust emission from five embedded young stellar objects and three T Tauri stars. Emission was detected from all of the embedded objects; in three of the five objects, this emission is identified as arising from ionized gas, probably associated with stellar winds. In two cases, NGC 1333 IRAS 4A and 4B, dust emission is suspected to be responsible for between 20 and 100 percent of the λ=1.3 cm flux. Emission was detected from only one of the T Tauri stars, RY Tau; it is presently unclear if this emission arises from ionized gas or dust. Using standard circumstellar disk models for the dust emission associated with T Tauri stars, the upper limits to the centimeter wavelength fluxes for DL Tau and GG Tau can be used to constrain the properties of the circumstellar dust. Assuming a power law form for the dust emissivity ($\epsilon \propto \nu^{\beta}$), the upper limits require that β, as measured from millimeter to centimeter wavelengths, is greater than 0.8 for DL Tau and greater than 1.6 for GG Tau. These values of β are considerably larger than values measured at submillimeter wavelenghts in the same sources ($\beta \sim 0.0$). If the dust emissivity is described as a two part power law corresponding to two different values of β, as is suggested for dust in the interstellar medium, the GG Tau data indicate that the value of β changes around λ=2 mm. This change occurs at an order of magnitude greater wavelength than that proposed for interstellar dust and may reflect the growth of grain size in the circumstellar environment.

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Protostellar Hydrodynamics: Constructing and Testing a Spatially and Temporally Second-Order Accurate Method. II. Cartesian Coordinates

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In the preceeding paper, Boss & Myhill 1992, we described the derivation and testing of a spherical coordinate-based scheme for solving the hydrodynamic equations governing the gravitational collapse of nonisothermal, nonmagnetic, inviscid, radiative, three-dimensional protostellar clouds. Here we discuss a cartesian coordinate-based scheme based on the same set of hydrodynamic equations. As with the spherical coordinate-based code, the cartesian coordinate-based scheme employs explicit Eulerian methods which are both spatially and temporally second-order accurate. We begin by describing the hydrodynamic equations in cartesian coordinates and the numerical methods used in this particular code. Following Finn & Hawley 1989, we pay special attention to the proper implementation of high-order accuracy, finite difference methods. We evaluate the ability of the cartesian scheme to handle shock propagation problems, and through convergence testing, we show that the code is indeed second-order accurate. To compare the cartesian scheme discussed here with the spherical coordinate-based scheme discussed in Boss & Myhill 1992, the two codes are used to calculate the standard isothermal collapse test case described by Bodenheimer & Boss 1981. We find that with the improved codes, the intermediate bar-configuration found previously disappears, and the cloud fragments directly into a binary protostellar system. Finally, we present the results from both codes of a new test for nonisothermal protostellar collapse.

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H_2O masers associated with dense molecular clouds and ultracompact HII regions. II: The extended sample.

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We present water maser observations towards a sample of candidate compact molecular cores selected on the basis of their far-infrared colours according to the criteria specified in a previous paper (Palla et al. 1991). We have extended our initial sample to objects with flux at 60 μm below 100 Jy. Our results confirm the existence of a sharp cutoff in H_2O detections for $\log_{10}(F_{25}/F_{12}) < 0.57$. We demonstrate that sources above this threshold are likely to be associated with ultracompact HII regions, whereas the rest of the sample is probably made of high mass (proto)stars with only a minor contamination of young HII regions.

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The influence of ice-coated grains on protostellar spectra

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Information about protostellar sources obtained by fit calculations contain a number of uncertanties due to our poor knowledge of the properties of dust grains in dense clouds. ¿From the results of recent observational and theoretical studies of dust in dense regions we construct a new dust model that consists of amorphous carbon grains and ice-coated silicate grains.

The model is based on new refractive indices of amorphous carbon and ice-coated silicate grains. Our model of the "dirty ice" assumes a mixture of H_2O and NH_3 ice with inclusions of amorphous carbon. The optical constants are calculated using effective-medium theory. We determine the opacities of core-mantle-particles with varying mantle thickness and pollution by spherical Mie calculations and investigate the effects on the spectrum of a embedded source.

The different models for the core-mantle-particles are used to fit the observed spectra of two protostellar sources and to determine the envelopes masses of these objects. We find considerable differences in the masses obtained from different dust models.

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The Jet/Environment Density Ratio of Stellar Jets

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The jet-to-environment density ratio is one of the most important, and possibly the most uncertain of the parameters of jets from young stars. We present a simple method for determining this density ratio, which can be used for objects in which the bow shock and the terminal Mach disk (or "jet shock") in the head of the jet are observationally resolved in Hα and [S II] 6717+31 narrowband images. Our method also yields values for the shock velocities of the bow shock and the jet shock.

An application of this method to the HH 111 observations of Reipurth, Raga and Heathcote (1992) gives a jet-to-environment density ratio of 23 at the position of HH 111 V. The values obtained for the shock velocities are $v_{js} \approx 25$ km/s and $v_{bs} \approx 110$ km/s for the jet shock and for the bow shock (respectively). The obtained density ratio and shock velocities are consistent with ram pressure balance across the working surface, which gives credibility to the identification of the jet shock and bow shock emission in the HH 111 V observations.

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The Exciting Source of the Herbig-Haro 111 Jet Complex: VLA Detection of a One-sided Radio Jet

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Using the VLA in the D configuration we observed 28 fields containing Herbig-Haro objects, at 3.6 and 2-cm. We detected 23 sources at 3.6-cm, most of which are background objects. In the regions of HH 111 and HH 24/26 we detected sources with positive spectral indices. The radio source detected in the HH 111 region is associated with the powering star of this collimated Herbig-Haro flow. High-angular resolution ($\sim 0\farcs2$) VLA observations of this source made in the A configuration at 3.6-cm reveal that it is a one-sided radio jet very well aligned with the optical jet. The radio source in the HH 24/26 field coincides spatially with an infrared star in the region, SSV 61, which is not related to the HH objects. A few other sources, which lie close to HH objects, are briefly discussed. Combining the results of the present and previous surveys of HH sources suggests that about one third of these objects are detected in the radio continuum, with a strong tendency for the sources of the more spectacular HH flows to be detected.

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Preliminary results from a millimetre continuum survey in search of the youngest protostars

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This survey was commenced in order to investigate an all sky sample of dense molecular clouds for evidence of very young protostellar objects (VYPOs). It is part of a ground based preparatory programme for targeting likely candidate VYPOs for observations with the Infrared Space Observatory (ISO). The chances of detecting such objects, in isolated clouds with no signs of point sources from visible to IRAS wavelengths, was not thought to be high. Nevertheless, in the first observing run, several detections were made at levels of 3σ to 4σ, and are reported here-in.

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Molecular Cloud Core and CS Outflow Associated with Haro 4-255 FIR

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The region containing the two young stellar objects, Haro 4-255 and Haro 4-255 FIR, has been studied through single-dish and aperture-synthesis CS (1–0) observations. We have detected an intense CS outflow, whose FWZI velocity extent is about 9 km s^{-1}, in the single-dish observations. The distribution of the blue CS lobe is appreciably different from the blue CO lobe, whereas the distribution of the red CS lobe is similar to that of the red CO lobe. The CS abundance in this outflow lobe seems to be enhanced nearly by one order of magnitude, although that in the quiescent gas shows a more normal value. The mass of the CS outflow is one order of magnitude larger than that of the CO outflow, while the mechanical luminosity of the CS outflow is smaller than that of the CO outflow. The aperture-synthesis data show no counterpart to the CS outflow but contain two emission features which correspond to two local intensity maxima seen in the single-dish map. One of these features extends from Haro 4-255 to Haro 4-255 FIR: it might represent a density maximum in the molecular cloud core. The blueshifted emission of the CS outflow is less prominent, probably because it is impeded by the densest portion of the core.

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