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Abstracts of recently accepted papers

The Polarized Water Maser in Orion: A Proto-planetary Ring ?

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We present observations of the polarized water maser-flare source in Orion during the last years of its life, when we found low intensity but very high polarization. We also propose a geometrical model in which the maser source is formed in the central part of an edge-on protoplanetary ring. This model expl the linear variation of the maser velocity with position, detected in VLBI observations, as the projection of the of the Keplerian orbital velocity in the of the line of sight. It also explain the brightness temperatures as the amplifi of the radiation emitted by the back part of the ring by the front of it. Variab will be due to inhomogeneities in the ring, strong emission will occur when dens clumps of material are aligned in the observer's direction, the life-time of thi emission will depend on the size of the clumps and their relative velocities. Polarization properties are possibly due to both geometry and magnetic fields. F the observed velocity gradient and from saturation considerations we derive a lo limit of 15 solar masses for the central star, a diameter for the ring of 80 AU width of 1.6 AU.

Accepted by The Astronomy and Astrophysics

Shocked molecular gas around the extremely young object IRAS03282+3035

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We present observations of the shock tracers H_2 and SiO around the young stellar object IRAS 03282+3035. This unusual low-luminosity (L approx 2 L_O) source drives a strong highly collimated CO outflow, and it is one of the youngest stellar objects known so far.

The near-infrared H_2 emission, tracing 2000 K gas, comes from extremely high-velocity CO bullets along the axis of the blueshifted lobe of the outflow. The millimeter SiO emission, tracing roughly 100 K gas, arises from lower-velocity material at the end of the outflow lobe.

The lack of high temperature and high velocity gas at the end of the outflow lobe indicates there is no bow-shock at the outflow termination. In the context of current jet models this appears to rule out a bow-shock driven by a steady-state jet. Possible explanations for the structure include a time-dependent jet or a jet dominated by turbulent entrainment.

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A Numerical Simulation of a Variable Velocity Jet

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An analysis of the simulation of a heavy, supersonic jet with periodic, supersonic variations in the magnitude of the outflow velocity has been presented. As was predicted by the analytical studies and also seen in previous numerical simulations, a jet head and several "internal working surfaces" (IWS) form.

We have followed the time-evolution of one IWS. We have derived analytic expressions describing how shock pairs in adiabatic and isothermal steady state knots separate as they flow away from the source. Direct measurements of the shock structure obtained from the numerical simulation show a growth behavior similar to the isothermal case.

Maps of the intensity in the Hα and [SII]6717+31 lines for jets are calculated and show the bow shapes present in observations reminiscent of the morphology observed in HH jets, as well as a clear distinction between high and low excitation regions.

Intensity vs. position plots of both Hα and [SII]6717+31 show that the peaks of emission which appear at each of the knots along the body of the jet are offset At the head of the jet the profiles change greatly with time, and at certain times these profiles look remarkably similar to the observations of HH111V (the leading "head" of the HH111 jet).

Finally, we have made "photometric" measurements of one knot as it moves away from the source. We find that both [SII] and Hα have a peak of greater emission near the source and then decrease. The Hα emission peaks closer to the source than the [SII] emission.

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Massive circumbinary discs and the formation of multiple systems

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The fragmentation of a circumbinary disc due to the interaction with the embedded binary is presented. Infall on to the disc is ongoing throughout this process, with the matter falling to a radius where the time-dependent binary potential is significant. The binary system drives both an $m = 1$ and an $m = 2$ mode into the disc. The $m = 1$ mode means that neither the centre of mass of the binary nor that of the surrounding disc are located at the centre of mass of the system. The dynamics of the combined non-axisymmetric modes allows the spiral arms to interact and collide. This collision results in the formation of a Jeans unstable condensation which subsequently collapses to form an additional companion. Two such companions are formed within three binary orbits.

This process can form companions in circumbinary discs of any size. It can account for the formation of coplanar triple and multiple systems once an initial binary is formed. It also suggests that if massive circumbinary discs are a common occurrence in protostellar evolution, then most binary systems will be members of higher order systems. Furthermore, the short time scale for fragmenting a circumbinary disc implies that such discs will be short lived and hence hard to detect.

We speculate on the relevance of this process for stellar core collapse in supernova. The repetitive formation of binary neutron stars could be a significant source for gravitational radiation.

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Forbidden lines in Herbig Ae/Be stars The [O I] (1F) 6300.31 Å and 6363.79 Å lines. I. Observations and qualitative analysis.

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In a high resolution (R = 38000) spectroscopic survey of 33 Herbig Ae/Be stars we detected in 17 of them forbidden [O I] 6300.31 Å emission. Among them, 8 also show detectable [O I] 6363.79 Å emission. All of these stars, except one, possess forbidden lines, which are centered on the central wavelength in the star's rest-frame. They all have symmetric shapes and are broadened with velocities from 30 to 100 $km\,s^{-1}$.

The only star of the sample with asymmetric, blueshifted forbidden lines is R Mon, which is believed to be surrounded by a circumstellar accretion disk.

The observed forbidden line profiles of all stars except R Mon are inconsistent with models similar to those proposed for the formation of forbidden lines in the stellar or disk winds of T Tauri stars, involving an optically thick circumstellar disk hiding the receding hemisphere of the wind.

As one possible interpretation of these observations, we propose that the forbidden lines are formed in the outermost parts of a stellar wind; under this hypothesis, the presence of any optically thick circumstellar accretion disk seems incompatible with the observations.

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The Distortion of the near-IR Colours of Young Stars by Circumstellar Scattering

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It is shown that unresolved circumstellar scattering in YSOs can lead to distortions in their near-IR colours even in a simple spherical envelope approximation. The wavelength dependence of the scattering can give rise to apparent near-IR excesses and can result in significant underestimates of the optical depth in the envelope. Implications for YSO studies are briefly discussed.

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Multiple Outflow Episodes from Protostars: 3-D Models of Intermittent Jets

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We present fully three-dimensional simulations of supersonic, radiatively cooling intermittent jets with intermediate and long variability periods (that is, periods of the order of or longer than, the dynamical time scale of the jet, $\tau \geq \tau_{dy}$). Variations of intermediate period elucidate the formation and evolution of chains of internal regularly spaced radiative shocks, which in this work are identified with the observed emission knots of protostellar jets. Variations of long period elucidate the formation of multiple bow shock structures separated by long trails of diffuse gas, which resemble those observed in systems like HH111 and HH46/47. The time variability of the outflow is probably associated with observed irruptive events in the accretion process around the protostars. In our simulations, the outflow variations are produced by periodically *turning on* the outflow with a highly supersonic velocity and periodically *turning off* it to a low velocity regime. When a supersonic parcel finds the slow material that has been injected earlier, a double shock structure promptly develops: a *forward* shock sweeps up the slow material ahead of it and a *reverse* shock decelerates the fast material behind. The very high density contrast between the fast and slow portions of the flow causes the *reverse* shock to be much weaker than the *forward* shock so that line emission by gas between these shocks is essentially single peaked.

In the case of velocity variations of *intermediate* period, we find, as in previous work, that the shock structures form a train of regularly spaced emitting features which move away from the source with a velocity close to that of the outflow, have high radial motions, and produce low intensity spectra, as required by the observations. As they propagate downstream, the shocks widen and dissipate due to the expulsion of material sideways to the cocoon by the high pressure gradients of the postshock gas. This fading explains the most frequent occurence of knots closer to the driving source. The head structure of these outflows is very affected by interactions with the internal knots.

In the case of the *long* period velocity variability, our simulations have produced a pair of bow-shock-like structures separated by a trail almost starved of gas extending for many jet radii in agreement with the observations. The leading bow shock or working surface developed at the head of the jet has a similar structure to that of steady jets (e.g., Gouveia Dal Pino & Benz, 1993): the dense shell formed from the condensation of the shock-heated gas also fragments into a clumpy structure and becomes thermally unstable . Parts of the shell spill into the cocoon forming an extended narrow plug. The narrowing of the jet head causes some beam acceleration. The bow shock produced from the second injection propagates downstream on the diffuse tail behind the leading working surface. It has a double shock structure similar to the one of the leading working surface and on average propagates faster. The postshock radiative material also cools and forms a cold shell whose density is much smaller than that of the shell of the leading working surface. This result is consistent with observations that suggest that the emission of the internal working surface is of lower intensity and excitation than that of the leading working surface.

A brief discussion on the possibility of these time-dependent intermittent jets to drive molecular outflows is also presented.

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Spectroscopic Evidence for Magnetospheric Accretion in Classical T Tauri Stars

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We have conducted a high resolution spectroscopic survey of 15 classical T Tauri stars covering a broad range of inferred disk accretion rates to study mass infall to the stellar surface. Spectral diagnostics of mass infall are line profiles exhibiting either redshifted absorption minima at velocities comparable to free fall or asymmetric emission profiles with more blue than red emission. Echelle spectra from the KPNO 4m have been used both (1) to extract residual line profiles of unparalleled sensitivity, free from contamination from underlying photospheric features. and (2) to determine the optical continuum "veiling" flux. Residual emission profiles of Balmer, Na D and He I lines are presented, along with simultaneously determined relative veiling fluxes.

In addition to spectral signatures of mass outflow in many stars, 14/15 of our sample exhibit one of our two spectral diagnostics of mass infall. Redshifted absorption minima are found in 13/15 stars, in at least one of the lines examined, with radial velocities of the redward edge of the absorption minimum between 200 to 300 km s^{-1}. Among these lines, redshifted absorption minima appear least often at Hα (2/15) and most frequently at Hδ (8/15) and Na D (9/15). The appearance of redshifted absorption minima is more likely at Hα when continuum veiling fluxes are low, and at He I λ5876 Å when continuum veiling fluxes are high. Although the upper Balmer lines show resolved redshifted *minima* in only half the sample of 15 stars, 13/15 stars exhibit a signficant blueward *asymmetry* in these lines, with a ratio of emission blueward to redward of line center ranging from 1.1 to 2.4. A similar blueward asymmetry is found at Hα, when the sample is restricted to stars with low continuum veiling fluxes.

Together, these results suggest that the Balmer emission lines form predominantly in infalling zones in most classical T Tauri stars. However, the near ubiquity of redshifted absorption minima, both in snapshot views of a large sample of stars and in temporal coverage of a limited number of stars, suggests an extensive magnetospheric structure which keeps infall zones in our view at all times.

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VLA Spectral Line Observations of the HII Complex G34.3+0.2

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Four HII regions have been previously detected toward the HII complex G34.3+0.2 in the radio continuum. Three of these regions (components A, B, and C) are ultra-compact. The fourth, G34.3+0.2 component D, is a $\approx 1'$ (1.1 pc at 3.8 kpc) diameter ring-like HII region. We have observed the H93α radio recombination line emission with $\approx 11''$ spatial resolution and the 1.3 cm water maser emission with $\approx 4''$ spatial resolution toward G34.3+0.2. The observed radio recombination line emission suggests that component D is an expanding shell source. The inferred expansion

velocity of 5 km s^{-1} gives a calculated lifetime of $\sim 10^5$ years. The continuum emission from the source is preferentially brightened on one side. We suggest that this asymmetric brightness distribution may be explained by the expansion of the HII region into an anisotropic medium. Alternatively, the increased brightness on the north-western side could be the result of the superposition of two different HII regions. The average LSR velocity of the shell source has been determined to be $\approx 53.9 \pm 0.1$ km s^{-1}. The observed spatial distribution of the H_2O masers in the G34.3+0.2 complex has identified two new regions of star formation which are not associated with any radio continuum emission.

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VLA Recombination Line Observations of the Cometary HII Region G34.3+0.2: Dynamics and Physical Properties

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We have observed the H93α radio recombination line emission toward the cometary HII region G34.3+0.2 component C. A velocity gradient with a total extent of ≈ 35 km s^{-1} is found in the H93α line emission perpendicular to the symmetry axis of the cometary HII region. A smaller velocity gradient is found parallel to the symmetry axis. The moving star bow shock model and the champagne outflow model have been suggested to explain observations of G34.3+0.2 component C. Neither model adequately matches the available velocity data.

G34.3+0.2 components A & B are found near G34.3+0.2 C. The continuum spectral indices of components A & B are consistent with that expected for an ionized wind outflow. We suggest a qualitative model for the region where the ionizing star of the cometary HII region G34.3+0.2 C photoevaporates material from a hot ultracompact molecular core found just to the east of the continuum emission. Interaction between the ionized gas of the cometary HII region and winds from components A and B may explain many of the current observations.

We have also mapped the $6_{16} \rightarrow 5_{23}$ transition of H_2O toward G34.3+0.2. We find strong H_2O maser emission within a $\approx 50'' \times 30''$ region. Some of the H_2O masers are projected onto sources of radio continuum emission, but others are found well separated from radio continuum emission.

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10 μm Imaging of UZ Tau: Evidence for Circumstellar Disk Clearing Due to a Close Companion Star

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We present 10 μm images of the multiple T Tauri star system UZ Tau taken with the Berkeley mid-infrared array camera at UKIRT and evidence that UZ Tau E and W are a common proper motion pair. The mid-infrared emission is resolved for the first time into the two components UZ Tau E and UZ Tau W. The mid-infrared excess deduced for UZ Tau W appears to be much lower than that observed for UZ Tau E. This excess emission is consistent with an optically thin circumstellar disk in the case of UZ Tau W, whereas UZ Tau E's excess is consistent with an optically thick disk. We suggest that the close binary star pair in UZ Tau W is responsible for the observed difference between UZ Tau E and W's mid-infrared excess. In the proposed model, the binary star interacts with the local circumstellar disk environment and clears out much of the material inside its orbital radius ($\approx$50 AU). As a result, the hot dust, observed at mid-infrared wavelengths, in UZ Tau W is suppressed compared to its "wider" companion UZ Tau E. This scenario can also plausibly account for differences observed in UZ Tau E's and UZ Tau W's optical line strengthes and profiles.

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Further Mid-Infrared Study of the ρ Ophiuchi Cloud Young Stellar Population: Luminosities and Masses of Pre-Main-Sequence Stars

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We present a new mid-infrared photometric study of the ρ Ophiuchi young stellar population which includes data for 56 objects. The sources for this study were largely selected from a $K < 10$ magnitude limited sample in order to reduce the bias of the previous IRAS-selected survey of the cloud. This sample was supplemented with fainter sources that are very red as well as sources that also have radio-continuum emission. The $K < 10$ sources are found to have spectral energy distributions predominantly similar to those of reddened T Tauri stars (Class II), while the other sources are mostly either embedded (Class I) or else have little or no circumstellar material (Class III). We develop an empirical technique for estimating the bolometric luminosities of Class II sources from their near-IR data and use it to estimate the luminosities of our newly-observed Class II YSOs. Most of the newly identified Class II sources have $L \approx 1L_\odot$, and several low-luminosity Class I sources are also found. The suspected luminosity segregation between SED classes is reinforced; we find an excess of Class I sources at intermediate ($\sim 10L_\odot$) luminosities. Comparisons with Taurus-Auriga YSOs suggest that these high Class I luminosities may be entirely attributable to a higher mass accretion rate in the ρ Ophiuchi cloud. We estimate an embedded YSO phase lifetime of approximately $2 \pm 1 \times 10^5$ yr, which is comparable to that of the Taurus-Auriga clouds. We estimate the masses of the Class II and III cloud population by comparing source luminosities to pre-main-sequence stellar models and find the mean Class II mass to be $1.0M_\odot$.

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High Resolution Observations of a New Ammonia Maser Line in G9.62+0.19

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We present interferometric observations of the $NH_3(5,5)$ inversion line toward the HII region complex G9.62+0.19 which confirm the discovery of maser action in this transition. At the present time G9.62+0.19 is the only known source where this maser occurs. The maser is unresolved; an upper limit to its size is $0.5''$ corresponding to a lower limit on the brightness temperature of 10^4 K. The $NH_3(5,5)$ maser is coincident with a weak continuum source and a water maser. Emission from thermal ammonia consisting of two clumps is detected $\approx 8''$ south of the maser position. The thermal ammonia clumps are elongated toward the position of the $NH_3(5,5)$ maser and form part of a linear structure of length ≈ 0.6 pc, outlined by maser emission in several molecular lines, highly excited ammonia and ultracompact HII regions.

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Photoevaporation of Disks Around Massive Stars and Application to Ultracompact HII Regions

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Young massive stars produce sufficient Lyman continuum photon luminosity Φ_i to significantly affect the structure and evolution of the accretion disks surrounding them. A nearly static, ionized, isothermal 10^4 K atmosphere forms above the neutral disk for disk radii $r < r_g = 10^{15} M_1$ cm, where $M_* = 10\ M_\odot M_1$ is the stellar mass. For $r \geq r_g$ the diffuse field created by hydrogen recombinations to the ground state in the photoionized gas above the disk produces a steady evaporation at the surface of the disk, and this HII gas flows freely out to the ISM (the "disk wind"). The detailed structure depends on the mass loss rate $\dot{M}_w$ of the fast, ≥ 1000 km s^{-1}, *stellar* wind from the massive star. A critical mass loss rate $\dot{M}_{cr}$ is defined such that the ram pressure of the stellar wind equals the thermal pressure of the HII atmosphere at r_g. In the weak stellar wind solution, $\dot{M}_w < \dot{M}_{cr}$, the diffuse photons from the atmosphere above r_g produce a photoevaporative mass loss rate from the disk at $r \geq r_g$ of order $1\times10^{-5}\ \Phi_{49}^{1/2} M_1^{1/2}\ M_\odot$/yr, where $\Phi_i = 10^{49}\Phi_{49}$ s^{-1}. The resulting slow (10-50 km s^{-1}) ionized outflow, which persists for $\geq 10^5$ years for disk masses $M_d \sim 0.3 M_*$, may explain the observational characteristics of *unresolved*, ultracompact HII regions.

In the strong stellar wind solution, $\dot{M}_w > \dot{M}_{cr}$, the ram pressure of the stellar wind blows down the atmosphere for $r < r_g$ and allows the stellar photons to penetrate to greater radii and smaller heights. A slow, ionized outflow produced mainly by diffuse photons is again created for $r > r_g$; however, it is now dominated by the flow at r_w ($> r_g$), the radius at which the stellar wind ram pressure equals the thermal pressure in the evaporating flow. The mass loss rate from the disk is of order $6 \times 10^{-5} \dot{M}_{w-6} v_{w8} \Phi_{49}^{-1/2}$ M$_\odot$ yr^{-1}, where $\dot{M}_{w-6} = \dot{M}_w/10^{-6}$ M$_\odot$ yr^{-1} and $v_{w8} = v_w/1000$ km s^{-1} is the stellar wind velocity. The resulting outflow, which also persists for $\geq 10^5$ years, may explain many of the more extended ($r \geq 10^{16}$ cm) ultracompact HII regions. Both the weak-wind and the strong-wind models depend entirely on *stellar* parameters (Φ_i, M_*, $\dot{M}_w$), and are independent of disk parameters as long as an extended ($r >> r_g$), neutral disk exists. We compare both weak-wind and strong-wind model results to the observed radio free-free spectra and luminosities of ultracompact HII regions and to the interesting source MWC349.

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ASCA Observations of Hard X-ray Emission from the Rho Ophiuchi Dark Cloud

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The Japan-U.S. X-ray satellite ASCA obtained broad-band (0.5 – 12 keV) images and spectra of the heavily-extincted central region of the Rho Ophiuchi dark cloud in August 1993. The 38 ksec observation yielded at least eleven detections (S/N $\geq$ 3), including the X-ray bright T Tauri star DoAr 21 and embedded infrared sources with no optical counterparts. Hard X-rays up to $\approx$ 8 keV were detected from DoAr 21 (whose light curve shows no significant variability down to time bins of 4 min), and from a flaring source that lies in a dense infrared field. The spectrum of the brightest source, DoAr 21, shows a possible sulfur emission line at 2.46 keV, and a two-temperature solar-abundance Raymond-Smith fit gives kT$_1$ = 0.5 ($\pm$0.1) keV and kT$_2$ = 1.8 ($\pm$0.3) keV, with log N$_H$ = 22.3 cm^{-2}. Since the line emission is weak, a 1T bremsstrahlung model gives an equally good fit with kT = 1.6 keV and log N$_H$ = 22.04 cm^{-2}. In addition to the discrete detections, we find evidence for hard unresolved emission from the cloud core that is most likely the integrated contribution of a number of deeply-embedded young stars below the detection limit.

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Analysis of a cold cloud fragment

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We present CO and CS data of the recently discovered protostar candidate HH24 MMS in the Orion region for which submm/mm continuum observations of the dust yielded an angular size of $\approx 15''$, a temperature of about 10K and gave evidence for gravitational instability.

The new molecular line data indicate that the source is a *cold* spot in an extended molecular cloud because the CO line temperature is higher than the color temperature of the dust. In contrast to its appearance in the dust continuum,

the source is not prominent in $C^{18}O$ nor in CS suggesting that the molecules are partially frozen out. There is no indication of a strong outflow in CO. Mass estimates from $C^{18}O$ are roughly a hundred times lower than from the mm/submm dust emission. The large discrepancy is probably a combined effect of molecular underabundance and an enhanced absorption coefficient of the dust at 1mm.

Furthermore, we calculate theoretical profiles of CO and CS for a cloud core like HH24 MMS in order to identify observable spectral signatures for collapse. We find that the most promising clue will come from CS lines observed with a resolution that is a factor 3 higher than the present data. Such transitions are expected to show an absorption feature that shifts to progressively larger velocities with increasing j–number. The present observations of $C^{18}O$ and CS are in accord with this model.

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On the Analysis of Para-Ammonia Observations

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The intensities and optical depths of the (1,1), (2,2) and (2,1) inversion transitions of ammonia can be calculated quite accurately without solving the equations of statistical equilibrium. A two temperature partition function suffices. The excitation of the K-ladders can be approximated by using a temperature obtained from a two-level model with the (2,1) and (1,1) levels. Distribution of populations between the ladders is described with the kinetic temperature. This enables one to compute the (1,1) and (2,1) inversion transition excitation temperatures and optical depths. To compute the (2,2) brightness temperatures, the fractional population of the (2,2) doublet is computed from the population of the (1,1) doublet using the "true rotation temperature", which is calculated using a three-level model with the (2,1), (2,2) and (1,1) levels. In spite of some iterative steps, the calculation is quite fast.

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Cepheus A HW2: A Powerful Thermal Radio Jet

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At angular resolution of $\sim 1''$ the Cepheus A-East radio source is known to consist of 16 compact components clustered within a 25" radius region, most of which are aligned in string-like structures. We present multi-frequency VLA radio continuum observations of Cep A HW2, the elongated radio object believed to be associated with the most luminous ($\sim 10^4\ L_\odot$) source in the region. In the frequency range from 1.5 to 43 GHz, we find that its flux density increases with frequency as $\nu^{0.69}$, while the angular size of its major axis decreases with frequency as $\nu^{-0.57}$. The above frequency dependences are very close to the theoretical values of $\nu^{0.6}$ and $\nu^{-0.7}$ expected for a biconical thermal jet and make Cep A HW2 the best example known of this type of object. We suggest that Cep A HW2 is responsible for at least part of the complex outflow and excitation phenomena observed in the region. The estimated ionized mass loss rate in this source, $\sim 8 \times 10^{-7}\ M_\odot$ year^{-1}, is about 100 times larger than the value expected for a star of the same luminosity in the main sequence.

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The Puzzling Distribution of the High-Density Molecular Gas in HH 1-2: A Contracting Interstellar Toroid?

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We have performed a mosaic analysis of the region containing the HH 1-2 system. We combined five fields of NH_3(1,1) and (2,2) spectral line observations using the VLA in its D configuration. This mosaic analysis allowed us to recover $\sim$ 80% of the total NH_3(1,1) flux obtained with single-dish observations. The total mass of the molecular gas in the region is estimated to be $\sim 52\ [\frac{X_{NH_3}}{10^{-8}}]^{-1}$ $M_\odot$. We find two remarkable elongated structures of $\sim$ 0.4 pc ($\sim 3'$) in size, approximately parallel to each other, while oriented almost perpendicular to the HH 1-2 outflow and the magnetic field in the region. The major axes of these elongated structures are displaced $\sim 20''$ northwest and $\sim 10''$ southeast of VLA 1, respectively. There is a velocity difference of $\sim$ 2 km s^{-1} between the two structures, but there is no significant velocity gradient along the major axis of either structures. Molecular gas at intermediate velocities between the velocities of the two elongated structures is found at their northeastern and southwestern ends. The exciting source of the HH 1-2 outflow may be physically closer to the elongated molecular structure displaced to the southeast of VLA 1, since the gas temperature is higher there, $T_K \simeq 18$ K. The kinematical and spatial distribution of the elongated structures with respect to the [SII] emission of the HH 1-2 system, the blueshifted motions of HH 1 with respect to HH 2, the ambient velocities observed at the ends of the elongated structures, and finally the gradient observed along the minor axis of the southeastern elongated structures, are *consistent* with a scenario where these two elongated structures represent the two halves of a *contracting* self-gravitating interstellar toroid seen almost edge-on, with the southeastern side in the *foreground* and *redshifted* with respect to the northwestern side. We favor an scenario where the star formation processes in the HH 1-2 region have produced at least two concentric flattened structures surrounding VLA 1, one with an interstellar size of $\sim$ 0.4 pc, and the other one two order of magnitude smaller ($\leq 10^3$ AU). This smaller structure, not evident in our data, is required to collimate the jet from VLA 1. Within this scenario, the HH 1-2 system would represent a case where the idea that inflow and outflow are taking place simultaneously in young stellar objects is supported.

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IRAS Images of Nearby Dark Clouds

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We have investigated ≈100 nearby molecular clouds using the extensive, all-sky database of *IRAS*. The clouds in this study cover a wide range of physical properties including visual extinction, size, mass, degree of isolation, homogeneity and morphology. *IRAS* 100μm and 60μm co-added images were used to calculate the 100μm optical depth of dust in the clouds. By comparison with ^{12}CO and ^{13}CO observations, we convert the dust optical depth images to column density of H_2. From the optical depth images we locate the edges of dark clouds and the dense cores inside them. We have identified a total of 43 "*IRAS* clouds" (regions with $A_V > 2$) which contain a total of 255 "*IRAS* cores" (regions with $A_V > 4$) and we catalog their physical properties. We find that the clouds are remarkably filamentary, and that the cores within the clouds are often distributed along the filaments. The largest cores are usually connected to other large cores by filaments. We have developed selection criteria to search the *IRAS* Point Source Catalog for stars that are likely to be associated with the clouds and we catalog the *IRAS* sources in each cloud or core. Optically visible stars associated with the clouds have been identified from the Herbig and Bell catalog. From these data we characterize the physical properties of the clouds including their star formation efficiency.

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Spectral Variations of T Tauri stars

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Although it can now be taken for granted that T Tauri stars accrete matter from circumstellar disks, the way in which the matter is ultimately accreted by the star is still under discussion. Boundary layer models, as well as models of magnetic accretion are considered. Since the very inner part of the disk, the star, and the boundary layer or the accretion shock radiate mainly in the optical, it is necessary to investigate this wavelength region. Optical spectra of classical T Tauri stars consist of emission lines superimposed on a late-type photospheric spectrum, but the photospheric lines in T Tauri stars are much weaker than the lines of main sequence stars of the same spectral type. This is generally attributed to the presence of an additional continuum which veils the photospheric spectrum of the star, which may be be the emission of the boundary layer, or the emission of the immediate vicinity of an accretion shock. *The aim of this work is to give additional information on the nature of the region that emits the veiling continuum by investigating the correlations between the veiling and line fluxes in time serieses of T Tauri stars.* For this work a time series of 27, 117, and 89 spectra of BM And, DI Cep and DG Tau, were taken in 9, 13, and 12 nights, using the Echellette-Spectrograph of the 2.2m telescope on Calar Alto, Spain. These T Tauri stars were selected because of their different of levels of activity. The spectra cover the whole region between 3200Å and 11 000Å with a resolution of about $\Delta\lambda/\lambda = 3000$.

Using 32 template stars the spectral types of the stars were determined, which is found to remain unchanged during the whole time series. The wavelengths of all photospheric lines are in agreement with a single doppler shift ($\pm 6km/s$), which is taken as the systemic velocity. It is thus assumed that the low excitation lines are indeed the photospheric lines of the star and the veiling is an additional continuum source. The spectrum of the veiling continuum is determined by subtracting a flux calibrated, scaled template spectrum from the flux calibrated, deredened T Taui star spectrum. The spectra of the veiling continuum exhibit a strong, variable Balmer Jump, but no Pashen Jump is seen.

H_α is the only emission line in the spectrum of BM And, all other Balmer lines and the lines of He I appear in absorption, and are redshifted by at least 100 km/s. While the correlation between H_α and the veiling continuum is high, the correlation between all redshifted absorption lines and the veiling continuum is very low. From a comparison of observed and computed profiles of He I it is concluded that this line might form close to an accretion shock, and so should the higher Balmer. Since no redshifted absorption component is seen in H_α, the emission component must be optically thick, and should then be formed at a larger distance from the star than the redshifted absorption components, and hence the veiling continuum. The observations of BM And clearly show that the magnetic model is valid in this case, but the veiling continuum is not the emission of the accretion shock itself.

DG Tau and DI Cep show the same kind of behavior. All emission lines have correlation factors between about 0.3 and 0.8. The highest correlations are found in the Balmer lines and low excitation Fe I and Fe II lines. There are no delay effects between the lines, all lines reach their maxima and minima at the same time. From the large Balmer decrement, and calculation of the Balmer lines and the veiling continuum in a simple slab model, it is concluded that the emitting region that is responsible for the emission lines and the veiling continuum has a temperature of 10 000 K, and a density of $3 * *10^{18} m^{-3}$ or less. In the slab geometry this corresponds to an emitting region which is at least 10 000 km ($\approx 0.01 R_*$) thick. It can thus be concluded that the region emitting the veiling continuum is relatively large and thin.

FIRST ANNOUNCEMENT

Conference on

SHOCKS IN ASTROPHYSICS

Jan. 9 – 12, 1995
Manchester, United Kingdom

Scientific Organizing Committee

T. Millar (UMIST), A. Raga (UMIST), J. Dyson (Manchester), D. Flower (Durham) and S. Falle (Leeds)

Topics

This meeting will cover different aspects of ISM shock waves : the theory and observations of molecular and atomic HD and MHD shocks, particle acceleration, instabilities, and the mechanisms for the formation of shocks (in stellar outflows, PNe, SN remnants, flows in AGN).

Organization

UMIST and the University of Manchester, in conjunction with Collaborative Computational Project No. 7 (CCP7) of the SERC, are planning to hold a conference in UMIST on the topic of astrophysical shock waves. We intend to follow the structure of previous meetings, allowing a significant portion of time, probably 1 hour, to the invited speakers for presentation and discussion, with a number of oral contributions and poster papers.

Invited Speakers

K.-H. Böhm, P. Brand and J. Meaburn : optical and IR observations of ISM shock waves
S. Cabrit and R. Padman : observations and theory of molecular outflows.
T. Hartquist : MHD shocks
B. Draine : shock destruction of interstellar grains
E. Roueff : atomic and molecular data for shock wave models
J. Raymond : SN remnants
S. Falle : shock instabilities
L. Drury : particle acceleration in shocks J. Dyson : flows in AGN

Location

The conference will take place in the UMIST campus, which is located near the Manchester city centre.

Contact Address for further information

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