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Abstracts of recently accepted papers

General Analytic Results for Nonlinear Waves and Solitons in Molecular Clouds

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We study nonlinear wave phenomena in self-gravitating fluid systems, with a particular emphasis on applications to molecular clouds. This paper presents analytical results for one spatial dimension. We show that a large class of physical systems can be described by theories with a "charge density" $q(\rho)$; this quantity replaces the density on the right hand side of the Poisson equation for the gravitational potential. We use this formulation to prove general results about nonlinear wave motions in self-gravitating systems. We show that in order for stationary waves to exist, the total charge (the integral of the charge density over the wave profile) must vanish. This "no-charge" property for solitary waves is related to the capability of a system to be stable to gravitational perturbations for arbitrarily long wavelengths. We find necessary and sufficient conditions on the charge density for the existence of solitary waves and stationary waves. We study nonlinear wave motions for Jeans-type theories [where $q(\rho) = \rho - \rho_0$] and find that nonlinear waves of large amplitude are confined to a rather narrow range of wavelengths. We also study wave motions for molecular clouds threaded by magnetic fields and show how the allowed range of wavelengths is affected by the field strength. Since the gravitational force in one spatial dimension does not fall off with distance, we consider two classes of models with more realistic gravity: Yukawa potentials and a pseudo-two-dimensional treatment. We study the allowed types of wave behavior for these models. Finally, we discuss the implications of this work for molecular cloud structure. We argue that molecular clouds can support a wide variety of wave motions and suggest that stationary waves (such as those considered in this paper) may have already been observed.

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Is ESO Hα 279 a pre-main sequence binary ?

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We present 1–3.4μm near-IR array images of ESO Hα 279, the optical emission line star proposed to be the exciting source of the bipolar Herbig-Haro complex HH106/107 in Serpens. These images show the presence of a close, bright infrared stellar companion to ESO Hα 279 located 8.2$''$ due south. At 2μm, no other sources are seen within $\sim$1$'$ of these stars suggesting that ESO Hα 279 and its companion may form a pre-main sequence (PMS) binary. Our NIR photometry has shown that the optical emission line star, ESO Hα 279a, is a young, PMS object possessing a strong thermal excess beyond 2μm. Additionally, 2μm spectroscopy has revealed that ESO Hα 279a possesses very strong CO bandhead emission from 2.29–2.45μm indicative of the presence of an active accretion disk and/or molecular outflow. The companion source, ESO Hα 279b, was found to be extremely red with a J-K$\sim$7. Spectroscopy showed that it possesses strong CO bandhead absorption. From both the relative strengths of the dereddened spectral features and evidence provided by the near-IR photometry, we suggest that ESO Hα 279b is likely not a PMS companion to ESO Hα 279a, but rather it is a highly reddened (A_V=30–40) background M5 III giant.

This result emphasizes the extreme care that needs to be taken when using infrared imaging data to study the frequency of binaries amongst PMS stars.

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Using FU Orionis Outbursts to Constrain Self-Regulated Protostellar Disk Models

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One dimensional, convective, vertical structure models and one dimensional, time dependent, radial diffusion models are combined to create a self–consistent picture in which FU Orionis outbursts occur in young stellar objects (YSOs) as the result of a large scale, self–regulated, thermal ionization instability in the surrounding protostellar accretion disk. Although active accretion disks have long been postulated to be ubiquitous among low mass young stellar objects, few constraints have until now been imposed on physical conditions in these disks. By fitting the results of time dependent disk models to observed time scales of FU Orionis events, we estimate the magnitude of the effective viscous stress in the inner disk ($r \lesssim 1$ AU) to be, in accordance with an *ad hoc* "alpha" prescription, the product of the local sound speed, pressure scale height, and an efficiency factor α of 10^{-4} where hydrogen is neutral and 10^{-3} where hydrogen is ionized.

We hypothesize that all YSOs receive infall onto their outer disks which is steady (or slowly declining with time) and that FU Orionis outbursts are self-regulated, disk outbursts which occur *only* in systems which transport matter inward at a rate sufficiently high to cause hydrogen to be ionized in the inner disk. We estimate a critical mass flux of $\dot{M}_{\rm crit} = 5 \times 10^{-7}$ $M_\odot$/yr *independent of the magnitude of* α for systems with one solar mass, three solar radius central objects. Infall accretion rates in the range of $\dot{M}_{\rm in} = (1-10) \times 10^{-6}$ $M_\odot$/yr produce observed FU Orionis time scales consistent with estimates of spherical molecular cloud core collapse rates. Modeled ionization fronts are typically initiated near the inner edge of the disk and propagate out to a distance of several tens of stellar radii. Beyond this region, the disk transports mass steadily inward at the supplied constant infall rate. Mass flowing through the innermost disk annulus is equal to $\dot{M}_{\rm in}$ only in a time averaged sense and is regulated by the ionization of hydrogen in the inner disk such that long intervals (≈ 1000 yrs) of low mass flux: $(1-30) \times 10^{-8}$ $M_\odot$/yr, are punctuated by short intervals (≈ 100 yrs) of high mass flux: $(1-30) \times 10^{-5}$ $M_\odot$/yr. Time scales and mass fluxes derived for quiescent and outburst stages are consistent with estimates from observations of T Tauri and FU Orionis systems respectively.

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Twisting Magnetic Fields in the Core Region of OMC-1

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We present results of imaging polarimetry of the H_2 v=1-0 S(1) line in the core region of OMC-1. The polarization vectors are produced by dichroic absorption in a medium of aligned grains and therefore follow the direction of the magnetic field in the region. The magnetic field strength estimated from the dispersion of polarization vectors is $\sim$ 10 mG, which is sufficient to align the grains via the Davis-Greenstein mechanism. The presence of a twist in the direction of the magnetic field about the self luminous object IRc2 is clearly seen. We propose a model which requires the magnetic field to be poloidal outside the disk of IRc2, but which develops a significant transverse component close to the disk.

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Near-Infrared Observations of the HH 46/47 System

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We report here on molecular hydrogen (H_2 2.12μm), [FeII] (1.64μm), as well as broad band K imaging of the bipolar Herbig-Haro (HH) outflow HH 46/47. In contrast to the optical images (e.g. [SII]$\lambda\lambda$6716, 6731) a wealth of detail is seen in the counterflow direction south-west of the HH 46/47 source (IRS). The optical object HH 47C is perceived to be the apex of an extensive bow shock in H_2, which can be traced over more than one arcmin, and the counterjet is observed in unprecedented detail. The flow direction north-east of the source is relatively devoid of H_2 emission presumably because this portion of the outflow is moving out of the Bok globule. Nevertheless a few H_2 knots have been detected in the HH 46 region and we also have discovered a linear feature parallel to the HH 47A jet and offset by 4" to the north-west, which may be the northern boundary of its bow shock. HH 47A itself is also found to be associated with H_2 emission. HH 47A and several fainter knots along its jet are observed in [FeII] (1.64μm), as well as a bright knot at the base of the optical counterjet. The HH 46/47 source can be seen directly in our near-infrared images. In line with recent models, it is shown that the redshifted molecular outflow in this region is almost certainly entrained ambient gas in the HH 47C bow shock.

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Simulation of polarization maps. I. Protostellar envelopes

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We developed a Monte Carlo code for the computation of polarization maps. This code includes multiple scattering and allows the computation for arbitrary dust configurations. In our model, we consider both the radiation of the central energy source and the thermal emission of the circumstellar dust.

As one of the first applications of our code, we present polarization maps for 2D hydrodynamical models (for two time steps of evolution: 32010 and 86222 yr) of a 1 $M_\odot$ rotating molecular clump which evolved into a protostar surrounded by a disk and envelope (Yorke et al. 1993). For deriving the polarization patterns, we used two populations of the DL-MRN model – the diffuse ISM-population (radii between 0.005 and 0.25 μm) and a population with only larger grains (radii between 0.1 and 1 μm). We calculated the polarization maps for 11 wavelength bands between 0.55 μm (V) and 1.3 mm.

The computed maps agree with the typical features of the observed polarization maps of circumstellar regions around young stellar objects (YSOs). The grains in the optically thin lobes scatter the light only once. Therefore, the radiation from these lobes is strongly polarized and has a centro-symmetric polarization pattern. For the inner regions of the dust disk which are optically thick, the polarization vectors are aligned and parallel to the disk plane. In the optically thin outer disk regions, the pattern is centro-symmetric again. The computed maps give evidence that the particles are larger than assumed in the standard MRN model.

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The Massive Molecular Outflow from CRL 2136 IRS 1

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Maps of rotational CO emission toward the star formation region CRL 2136 reveal an arcmin-scale bipolar outflow that appears to be driven by the massive young stellar object IRS 1. The projected outflow axis is roughly perpendicular to the disk plane previously inferred from near-infrared images and polarization maps. High-velocity wings are present in both ^{12}CO and ^{13}CO spectra, suggesting the ^{12}CO optical depths in the outflowing gas are large; we estimate the high-velocity gas contains $\sim 50 M_{\odot}$, making this molecular outflow one of the more massive known. We find that the region within $\sim 1'$ of CRL 2136 constitutes a significant concentration of the molecular mass in the ambient cloud.

Submillimeter photometry and mapping shows that CRL 2136 is a strong, extended source of continuum emission. The emission likely arises with grains heated to $40 - 60$ K by IRS 1. Comparison of the estimated thermal dust mass ($\sim 1 M_{\odot}$ within $\sim 8''$ of IRS 1), the mass in high-velocity gas, and the scattering dust mass we derived previously suggests that the gas-to-dust mass ratio in the outflow is between ~ 10 and ~ 100, where the value depends on what proportion of the submillimeter emission originates with dust in the ambient cloud and/or circumstellar disk.

The apparent extreme youth of IRS 1 compared with the dynamical age of the outflow, and the tremendous mass of swept-up molecular material, suggests the outflow began early in the formation of the young stellar object and implies the outflow cannot be radiatively driven. We present evidence that infall toward IRS 1 is ongoing; transfer of angular momentum from this infalling material may drive the outflow.

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Circumstellar Gas Around the Exciting Source of the HH83 Jet

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HH83 was observed by the Nobeyama Millimeter Array in the CS J=2-1 transition. The main CS cloud consists of a bar-like feature ~ 15" long and two ridges extending in the NW direction from the northern and southern ends of the bar. The orientation of the bar is nearly perpendicular to the jet axis. Its position, morphology, and velocity structure suggest it to be a rotating circumstellar disk around the driving source of the HH jet, HH83IRS. We have estimated its size and mass to be 7000 AU and 0.4 $M_{\odot}$, respectively. Narrow gulf-like distribution of CS emission, which consists of the bar and two ridges, indicates the presence of a small elongated hollow opening toward the northwest from HH83IRS. The structure of this hollow is well correlated with the base of the jet and near-infrared nebulosity. A possibility that this hollow acts as a de Laval nozzle in collimating the HH jet is suggested. The asymmetric CS distribution around HH83IRS is also discussed.

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The Enigmatic T Tauri Radio Source

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We have analyzed eight high angular resolution radio images of T Tauri obtained with the VLA between 1987 and 1990. Our objectives were to confirm a report that the radio emission is variable and circularly polarized, to determine whether this behavior originates in the optically-visible star (T Tauri) or in the infrared source lying $0.''6$ to its south, and to identify plausible emission mechanisms.
No variability or circular polarization was detected in the radio emission associated with the optical component down to levels of $\approx$10%. Its weak 3.6 cm flux ($\approx$1 mJy) can be accounted for in terms of free-free wind emission with an ionized mass-loss rate of $\dot{M} = 3.7 \times 10^{-8}$ $M_{\odot}$ yr^{-1}, which is near the maximum allowed by Alfvén-driven wind models. In sharp contrast, the 3.6 cm emission of the IR source is variable ($\approx$4 - 7 mJy) on timescales of $\leq$3 days and circularly polarized at low levels of $\approx$3 - 5%. The polarization changed from left to right circular during a period of stronger radio emission, similar to behavior that has been seen in active late-type stars (RS CVns). This behavior, along with other information, shows that the radio emission of the infrared source is nonthermal and of magnetic origin. The detection of magnetic activity in this optically invisible (and presumably quite young) IR source sparks new interest

in clarifying its evolutionary status.
Sensitive 3.6 cm images reveal weak emission extending $\approx 1''$ west of T Tau that is probaly associated with high-velocity shock-excited gas flowing toward HH-1555. We find no radio evidence for a third component in the system.

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Ambiguities of Parametrized Dust Disk Models for Young Stellar Objects

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We present a detailed study of the parameter space of circumstellar dust disk models for young stellar objects. Fitting the observed spectral energy distributions of FU Ori and DN Tau the problem of finding the best χ^2-fit in a topologically complicated multidimensional parameter space is solved using a special Metropolis algorithm. The proposed automated fitting method is of simple structure, stable, and of general use for all kinds of fitting problems.

Comparing the resulting disk parameters with earlier estimates we discuss methods used in recent papers to deduce constraints directly from the fit. In all cases we find a global ambiguity in acceptable fits.

The only constraints we find for FU Ori are a temperature index limit of $q < 0.7$, $\beta > 1$ for the opacity index, and a total disk mass of 1/10 $M_\odot$ with an order of magnitude variation. For the spectrum of DN Tauri we find acceptable fits with inner radii $r_i < 1.6$ AU, $q < 0.65$, and density indices $p < 1.6$.

This qualifies some of the previously found constraints, since the used methods did not sufficiently cover the entire parameter space.

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A Submillimetre Continuum Survey of Pre-Protostellar Cores

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Results are presented of a submillimetre continuum survey of twenty-one Myers cores which have no known infra-red (near-IR or *IRAS*) associations – the so-called 'starless cores'. ^{13}CO maps show that seventeen of the cores have structure in the form of one or more clumps, with significant departures from spherical symmetry. The clumps were surveyed in the submillimetre continuum, but only twelve were detected. In all cases no more than one clump in each of the Myers cores was detected in the continuum, no matter how many ^{13}CO clumps it contained. Five of the clumps were mapped in the continuum, to demonstrate that they are true emission peaks. The continuum peaks were not always exactly coincident with the ^{13}CO peaks, indicating that the ^{13}CO may be optically thick.

For the first time a size difference was found between the starless cores and the cores with IRAS sources: the continuum clumps in the centres of starless cores are all less centrally peaked and more diffuse than the equivalent continuum clumps previously found in Myers cores with IRAS sources. Nevertheless, the starless cores are more centrally condensed than a constant-density sphere. Mass and density estimates show that the continuum peaks are true density peaks, of $\sim 10^5$–10^6 cm^{-3}.

Photometry of the clumps shows that they have insufficient bolometric luminosities to be consistent with the earliest phase of accreting protostars predicted by the Standard Protostellar Model. The lifetimes of the clumps derived from statistical considerations are shown to be too long for the cores to be undergoing free-fall collapse, but are consistent with ambipolar diffusion timescales. All of the clumps were found to have masses close to their virial masses, as expected during the quasi-static ambipolar diffusion phase.

The starless cores with submillimetre continuum detections are therefore hypothesised to be pre-protostellar in nature, and sites of future star formation. However, none of the mapped clumps shows the steep, $\rho(r) \propto r^{-2}$, power-law radial density profile predicted by the Standard Protostellar Model. All have profiles which flatten out near their centres. This means either that the cores have not yet reached this stage in their evolution, or that cores do not achieve such steep density profiles prior to star formation, due to support by some other mechanism, such as a magnetic field.

Previous observations may have failed to observe this flattening, due to their lower angular resolution. The radial profiles of the continuum clumps are, however, consistent with those predicted by a more recent theory of magnetic support of cores during ambipolar diffusion.

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The S140 Core: Aperture Synthesis HCO^+ and SO Observations

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We present 5″–8″ resolution images of the S140 region in the HCO^+ J=1–0 and SO $J_K=2_2–1_1$ lines. The maps encompass the well-known S140 dense core, bipolar outflow, and photodissociation region. Unlike previous aperture synthesis maps of molecular tracers in this source, the HCO^+ images, constructed from a combination of Hat Creek millimeter array data and NRAO 12 meter telescope data, show significant structure in the dense gas associated with the embedded cluster. The brightest emission in the HCO^+ maps arises from the periphery of the bipolar flow, suggesting the limb brightened edges of a cavity with an apex at IRS 1. Although HCO^+ abundance variations might be expected as a result of shock processing, comparisons with CO isotope data indicate no significant differences between the ambient material and the low velocity outflow (< 10 km s^{-1}). The SO maps provide evidence for variations of at least an order of magnitude in SO column density in the quiescent gas on 10″ scales, with localized enhancements to the north and west of the embedded cluster. SO emission was not detected at velocities characteristic of the outflow. No compact 89 GHz continuum emission was detected from the IRS sources to a 3σ limit of 60 mJy, consistent with previous measurements.

In an appendix, we discuss the effect of "holes" in the (u, v) sampling on synthesis imaging extended molecular emission. We derive expressions to quantify the effects of holes for gaussian and uniform disk source distributions. We note that while synthesis observations are often said to be "sensitive" to structures on scales λ/S_{min}, where S_{min} is the length of the shortest baseline, the central brightness recovered from a gaussian distribution characterized by FWHM $= \lambda/S_{min}$ is only about 3%. If the S140 HCO^+ data is typical of molecular cloud sources, then the central hole gives rise to more significant image distortions than many scattered outer holes.

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Circumstellar Dust Emission Models

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We present the wavelength dependent absorption coefficient $\mathcal{K}_\lambda$, the scattering coefficient σ_λ, the albedo ω_λ, and the average cosine of the scattering phase function g_λ between 0.0912 μm and 1000 μm for four ISM grain models. These grain models are used in a radiation transfer code to calculate the properties of dust shells surrounding a newly formed O star. For each dust shell model a distribution of 25 grain sizes and 2 compositions were used in our calculations. The spectral type of the central star (O6 ZAMS), the geometry (shell), and circumstellar density distribution (constant) are the same in all models, so that different model predictions result entirely from differences in grain properties. For each grain type the models predict the emergent spectral energy distribution with wavelength, the optical depth with wavelength, and the mean dust temperature with distance from the central star. In addition, we find the emitted envelope flux (total flux minus the direct stellar contribution) included within an angular radius θ for several wavelengths between 2.2 μm and 100 μm. It is found that large differences in the emitted spectrum can occur when grains with different optical constants and size distributions are used.

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A [C II] 158 μm Line Map of the ρ Ophiuchi Cloud

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A detailed map of the [C II] 158 μm line emission from the ρ Ophiuchi dark cloud has been obtained using a balloon-borne telescope: *BICE*. The [C II] emission is extended throughout the cloud (8 pc $\times$ 6 pc), indicating that UV radiation in the cloud is not localized but ubiquitously distributed. The peak of the emission corresponds to the position of the highly reddened B2V star HD147889. The ratio $I_{[\mathrm{CII}]}/I_{\mathrm{bol}}$ in the ρ Ophiuchi cloud is higher than those found in active star-forming regions with O-type stars, which indicates a higher gas heating efficiency in the ρ Ophiuchi cloud. Since the scale length of the [C II] emission in the core region is much larger than that expected in homogeneous clouds, the cloud structure must be highly clumpy to allow UV radiation to penetrate the cloud and form an extended C^+ region.

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Dissertation Abstracts

The Dynamics of Protostellar Disks: Time Dependent Accretion through Protostellar Disks

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Although active accretion disks are thought to be ubiquitous among low mass young stellar objects (YSOs), few constraints are imposed on physical conditions in these disks. Time scales of FU Orionis events (dramatic outbursts thought to occur in all YSOs) are used to estimate the magnitude of the disk's viscosity. We propose that disks which receive steady infall, $\dot{M}_{in}$, at a rate greater than the critical value: $\dot{M}_{crit} = 5 \times 10^{-7}$ $M_\odot$/yr, for which hydrogen ionizes in the disk will be subject to thermally triggered, repetitive accretion outbursts.

Results from one dimensional convective vertical structure and radial time dependent diffusion calculations create a self-consistent picture in which FU Orionis outbursts occur due to self-regulated ionization fronts propagating radially out to several tenths of an AU. With viscous efficiency α between 10^{-3} and 10^{-4}, disk models with one solar mass central objects accreting $(1 - 10) \times 10^{-6}$ $M_\odot$/yr (consistent with estimates of molecular cloud core collapse rates) display FU Orionis outburst behavior and time scales. Beyond 1/4 AU modeled disks transport mass steadily inward at the input rate: $\dot{M}_{in}$, while inner regions are regulated by the thermal instability such that long intervals ($\approx$ 1000 yrs) of low mass flux: $(1 - 30) \times 10^{-8}$ $M_\odot$/yr, are punctuated by short intervals ($\approx$ 100 yrs) of high mass flux: $(1 - 30) \times 10^{-5}$ $M_\odot$/yr.

The model is substantiated by black body fits to time dependent models which display spectral features characteristic of observed objects. The rise time of Fuor V1515 Cyg is matched by a self-regulated outburst model. The rapid rise times of FU Ori and V1057 Cyg require the application of modest perturbations. That after peak light in V1057 Cyg short wavelength radiation decayed more rapidly than 2–5μm radiation is naturally explained if mass flux dropped in the inner disk ($r < 1/4$ AU) while remaining steady in the outer disk. The decrease in line width seen after peak light in V1057 Cyg may be accounted for by the decreasing Keplerian velocity encountered by the outward propagating ionization front. We suggest that FU Orionis outbursts primarily occur to systems during the embedded phase with ages less than several $\times 10^5$ yrs. Evidence is reviewed which suggests that HL Tau is a system subject to FU Orionis type outbursts which is currently quiescent.

Optical Outflows associated with Herbig Ae/Be Stars

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Optical outflows, i.e. Herbig–Haro (HH) objects and jets, have only recently been found to be associated with high luminosity ($> 50 L_{\odot}$) young stars, such as the Herbig Ae/Be stars. In this thesis, using deep narrow band CCD imaging, the regions about three Herbig Ae/Be stars, V380 Ori, LkHα 198 and V376 Cas, together with one high luminosity embedded infrared source, Cepheus A, have been examined in detail. In most cases, these young stellar objects have been known or have been suspected in the past to be associated with HH objects. However, each of these regions is found to be considerably more complex than previously thought with the detection of at least twenty new HH objects, many of which are examined spectroscopically. For LkHα 198, a companion star (LkHα 198B) is found $5''$ to its northeast which drives its own optical outflow. A jet is also seen to emanate from LkHα 198 and the presence of these two outflows in close proximity, not only explains many of the existing observations such as polarimetric measurements, but also draws into question previous interpretations for the molecular outflow source and the presence of a far infrared halo about LkHα 198. For V376 Cas a number of nearby HH emission knots are reported, some of which may be associated.

Perhaps one of the most remarkable discoveries is that of a HH "loop" to the east of Cepheus A. Taken together with the HH complex GGD 37 to the west of Cepheus A, it is argued that one observes here a bipolar poorly collimated wind, orientated East–West in the plane of the sky. A similar emission line "loop" structure is also observed to the west of V380 Ori and, while it is clear that this "loop" and the molecular outflow to the east delineate a bipolar poorly collimated wind, it is unclear whether the more distant components of the "loop" are HH or HII emission. Importantly, the presence of LiIλ6708 in the spectrum of V380 Ori, suggests that it is not a Herbig Ae/Be star but is in fact a T-Tauri star. The high luminosity of the star and the HH emission seen nearest to it, is taken as evidence of a variable poorly collimated wind which emanates from V380 Ori and is interacting with a cavity left over from some previous outburst. A poorly collimated HH component is also seen for LkHα 198 in addition to its jet, and using all the observations made here and those collected from existing data, it seems increasingly more obvious that optical outflows *are more poorly collimated* from higher rather than lower luminosity sources (e.g. the Classical T-Tauri stars).

Application of infrared two-dimensional speckle interferometry to the study of the young stars

Eric Tessier

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Ph.D degree awarded: November 1993

Atmospheric turbulence limits the angular resolution of a telescope to about one arcsecond. Speckle interferometry is a diffraction-limited imaging technique, which gives access to the full resolution of the telescope (which is a function of its diameter). The implementation of a speckle mode on an infrared camera (CIRCUS) used at the focus of a 3.6 meter telescope (TCFH) is described; in the thermal near infrared, we obtain a resolution of 0.2 arcseconds. Since the array detector that equipped the camera has a high readout noise but a large storage capacity, speckle interferometry observations have been done at the wavelengths where the thermal emission noise is dominant, i.e., beyond 3 microns. For example, the limiting magnitude in the L band (3.8 microns) is ranging from 6 to 8 depending on turbulence conditions.

I developed a user-friendly interface in order for the observer to control the acquisition and to get in real time either shift-and-add images or the power spectrum and the visibility of the source.

I made available a data post-processing package (under IRAF) to build the complex visibility of the observed source. The modulus is computed from image power spectra using the method proposed by Labeyrie (1970) with seeing calibrations. A Gauss-Newton and gradient-conjugate algorithm is used to extract the phase from several sub-planes of the images cross-spectra. The shift-and-add method is also available. Image reconstruction is obtained by CLEAN and Lucy methods.

Speckle observations of T Tauri stars carried out to detect infrared companions are presented. As a first result, there seems to be no systematic correlation between an infrared excess and the presence of an infrared companion among T Tauri stars. For example, RY Tau, which is the archetype of T tauri star with a flat IR spectrum has not revealed any companion. The binarity nature of DD Tau is established, both components have a strong IR excess. Z CMa binarity is confirmed on our data in the M band but the disk observed in adaptative optics in L and M is not seen down to a level of 5%. Other stars are carefully examined.

Two other astrophysical programs currently using speckle data are shown.

First Announcement

IAUNAM Meeting on

CIRCUMSTELLAR DISKS, OUTFLOWS AND STAR FORMATION

28 November—2 December 1994
Cozumel, México

AIM:

To bring together recent theoretical and observational results on the circumstellar environments of young stars, with particular emphasis on disks, envelopes and collimated outflows.

TOPICS:

Theoretical models and multiwavelength observations of

- Molecular cloud cores
- Gravitational collapse and disk formation
- Atomic and molecular outflows
- Herbig-Haro objects and complexes
- Jets from young stars
- Winds from disks and young stars
- Disks and envelopes around young stars
- FU Orionis outbursts

FORMAT:

The conference will consist of invited review talks of 1 hour duration, which will give a broad and thorough overview of the topics of the meeting, together with further invited talks lasting 30 minutes on the current research of the speakers. Contributions from participants are welcome in the form of posters, for which ample time will be allocated for viewing.

LOCATION:

Cozumel is the largest island off Mexico's Caribbean coast and is famous for its beautiful coral reefs. In prehispanic times it was a place of pilgrimage for Mayan women, who came to worship Ixchel, goddess of the Moon. The island has an international airport and accommodation will be available in the hotel in which the conference will be held. The registration fee for the conference is expected to be around 100 US dollars, which will include the conference dinner and a copy of the proceedings.

Scientific Advisory Committee

J. Cantó (IAUNAM, México)
P. Ho (CFA, USA)
L. Rodríguez (IAUNAM, México)
N. Calvet (CIDA, Venezuela)
S. Lizano (IAUNAM, México)
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