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Abstracts of recently accepted papers

Mass loss in pre-main sequence stars via coronal mass ejections and implications for angular momentum loss

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We develop an empirical model to estimate mass-loss rates via coronal mass ejections (CMEs) for solar-type pre-main-sequence (PMS) stars. Our method estimates the CME mass-loss rate from the observed energies of PMS X-ray flares, using our empirically determined relationship between solar X-ray flare energy and CME mass: $\log(M_{\rm CME}\ [{\rm g}]) = 0.63 \times \log(E_{\rm flare}[{\rm erg}]) - 2.57$. Using masses determined for the largest flaring magnetic structures observed on PMS stars, we suggest that this solar-calibrated relationship may hold over 10 orders of magnitude in flare energy and 7 orders of magnitude in CME mass. The total CME mass-loss rate we calculate for typical solar-type PMS stars is in the range 10^{-12}–10^{-9} $M_\odot$ yr^{-1}. We then use these CME mass-loss rate estimates to infer the attendant angular momentum loss leading up to the main sequence. Assuming the CME outflow rate for a typical $\sim$1 $M_\odot$ T Tauri star is $< 10^{-10}$ $M_\odot$ yr^{-1}, the resulting spin-down torque is too small during the first $\sim$1 Myr to counteract the stellar spin-up due to contraction and accretion. However, if the CME mass-loss rate is greater than $\sim 10^{-10}$ $M_\odot$ yr^{-1}, as permitted by our calculations, the CME spin-down torque may influence the stellar spin evolution after an age of a few Myr.

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`http://dept.astro.lsa.umich.edu/~aarnio/preprints/AMS2012.pdf`

From Prestellar to Protostellar Cores II. Time Dependence and Deuterium Fractionation

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We investigate the molecular evolution and D/H abundance ratios that develop as star formation proceeds from a dense-cloud core to a protostellar core, by solving a gas-grain reaction network applied to a 1-D radiative hydrodynamic model with infalling fluid parcels. Spatial distributions of gas and ice-mantle species are calculated at the first-core stage, and at times after the birth of a protostar. Gas-phase methanol and methane are more abundant than CO at radii $r \lesssim 100$ AU in the first-core stage, but gradually decrease with time, while abundances of larger organic species increase. The warm-up phase, when complex organic molecules are efficiently formed, is longer-lived for those fluid parcels in-falling at later stages. The formation of unsaturated carbon chains (warm carbon-chain chemistry) is also more effective in later stages; C^+, which reacts with CH_4 to form carbon chains, increases in abundance as the envelope density decreases. The large organic molecules and carbon chains are strongly deuterated, mainly due to high D/H ratios in the parent molecules, determined in the cold phase. We also extend our model to simulate simply the chemistry in circumstellar disks, by suspending the 1-D infall of a fluid parcel at constant disk radii. The species CH_3OCH_3 and $HCOOCH_3$ increase in abundance in $10^4 - 10^5$ yr at the fixed warm temperature; both also have high D/H ratios.

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Two-Stage Fragmentation for Cluster Formation: Analytical Model and Observational Considerations

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Linear analysis of the formation of protostellar cores in planar magnetic interstellar clouds shows that molecular clouds exhibit a preferred length scale for collapse that depends on the mass-to-flux ratio and neutral-ion collision time within the cloud. We extend this linear analysis to the context of clustered star formation. By combining the results of the linear analysis with a realistic ionization profile for the cloud, we find that a molecular cloud may evolve through two fragmentation events in the evolution toward the formation of stars. Our model suggests that the initial fragmentation into clumps occurs for a transcritical cloud on parsec scales while the second fragmentation can occur for transcritical and supercritical cores on subparsec scales. Comparison of our results with several star forming regions (Perseus, Taurus, Pipe Nebula) shows support for a two-stage fragmentation model.

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Resolved Debris Discs Around A Stars in the Herschel DEBRIS Survey

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The majority of debris discs discovered so far have only been detected through infrared excess emission above stellar photospheres. While disc properties can be inferred from unresolved photometry alone under various assumptions for the physical properties of dust grains, there is a degeneracy between disc radius and dust temperature that depends on the grain size distribution and optical properties. By resolving the disc we can measure the actual location of the dust. The launch of Herschel, with an angular resolution superior to previous far-infrared telescopes, allows us to spatially resolve more discs and locate the dust directly. Here we present the nine resolved discs around A stars between 20 and 40 pc observed by the DEBRIS survey. We use these data to investigate the disc radii by fitting narrow ring models to images at 70, 100 and 160 μm and by fitting blackbodies to full spectral energy distributions. We do this with the aim of finding an improved way of estimating disc radii for unresolved systems. The ratio between the resolved and blackbody radii varies between 1 and 2.5. This ratio is inversely correlated with luminosity and any remaining discrepancies are most likely explained by differences to the minimum size of grain in the size distribution or differences in composition. We find that three of the systems are well fit by a narrow ring, two systems are borderline cases and the other four likely require wider or multiple rings to fully explain the observations, reflecting the diversity of planetary systems.

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Molecular gas and stars in the translucent cloud MBM 18 (LDN 1569)

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We investigate star formation in translucent, high-latitude clouds.
Our aim is to understand the star-formation history and rate in the solar neighbourhood.
We used spectroscopic observations of newly found candidate Hα emission-line stars to establish their pre-main-sequence nature. The environment was studied through molecular line observations of the cloud (MBM 18/LDN 1569) in which the stars are presumably embedded.
Ten candidate Hα emission-line stars were found in an objective grism survey of a $\sim$ 1 square degree region in MBM 18, of which seven have been observed spectroscopically in this study. Four of these have weak ($\mid$ W(Hα) $\mid$ $\lesssim$ 5 Å) Hα emission, and six out of seven have spectral types M1−M4 V. One star is of type F7-G1 V, and has Hα in absorption. The spectra of three of the M-stars may show an absorption line of LiI, although none of these is an unambiguous detection. The M-stars lie at distances between $\sim$60 pc and 250 pc, while most distance determinations of MBM 18 found in the literature agree on $120 - 150$ pc. For the six M-stars a good fit is obtained with pre-main-sequence isochrones indicating ages between 7.5 and 15 Myr. The mass of the molecular material, derived from the integrated ^{12}CO(1–0) emission, is $\sim$ 160 M$_\odot$ (for a distance of 120 pc). This is much smaller than the virial mass ($\sim 10^3$ M$_\odot$), and the cloud is not gravitationally bound. Using a clump-finding routine, we identify 12 clumps from the CO-data, with masses between 2.2 and 22 M$_\odot$. All clumps have a virial mass at least six times higher than their CO-mass, and thus none are in gravitational equilibrium. A similar situation is found from higher-resolution CO-observations of the northern part of the cloud.
Considering the relative weakness or absence of the Hα emission, the absence of other emission lines, and the lack of clear LiI absorption, the targets are not T Tauri stars. With ages between 7.5 and 15 Myr they are old enough to explain the lack of lithium in their spectra. Based on the derived distances, some of the stars may lie inside the molecular cloud. From the fact that the cloud as a whole, as well as the individual clumps, are not gravitationally bound, in combination with the ages of the stars we conclude that it is not likely that (these) stars were formed in MBM 18.

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Near-infrared Imaging Polarization Study of M17

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We conducted wide-field ($\sim 8' \times 8'$) JHK_s imaging polarimetric observations toward the massive star formation region M17. The southern H II bar is identified as large-scale infrared reflection nebula (IRN) illuminated by the OB stars in the cluster center, while the northern bar shows polarization originated from dichroic extinction. Three small-scale bipolar IRN with centro-symmetric polarization patterns were identified, and their illuminating sources, embedded young stellar objects (YSOs), are most likely the driving sources of bipolar outflows. JHK_s polarizations of point sources in M17 show wavelength dependence of polarization of dichroic extinction in the general interstellar medium, indicating $\alpha \sim 1.8$ for the empirical relation $P \propto \lambda^{-\alpha}$ of interstellar polarization. The distribution of polarization angle shows two peaks at 170° and 110°, indicating a non-uniform magnetic field structure in M17. The direction of magnetic field in the cluster region is south-north. While the magnetic field in the H II region is between $100° \sim 140°$, roughly perpendicular to the Galactic disk. Such configuration indicates that the magnetic field in the cluster region are twisted from the primordial orientation in the cluster formation. The magnetic field in the southern bar has total strength of $\sim 230\mu$G and is 40° inclined to the plane of the sky. The outflows driven by YSOs in M17 show poor relation with the surrounding magnetic fields. This fact implies that the magnetic field in M17 does not dominate the orientations of protostars.

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http://pasj.asj.or.jp/v64/n5/640110/640110.pdf

Water and Methanol Maser Activities in the NGC 2024 FIR 6 Region

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The NGC 2024 FIR 6 region was observed in the water maser line at 22 GHz and the methanol class I maser lines at 44, 95, and 133 GHz. The water maser spectra displayed several velocity components and month-scale time variabilities. Most of the velocity components may be associated with FIR 6n, while one component was associated with FIR 4. A typical life time of the water-maser velocity-components is about 8 months. The components showed velocity fluctuations with a typical drift rate of about 0.01 km/s/day. The methanol class I masers were detected toward FIR 6. The methanol emission is confined within a narrow range around the systemic velocity of the FIR 6 cloud core. The methanol masers suggest the existence of shocks driven by either the expanding H II region of FIR 6c or the outflow of FIR 6n.

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Synthetic observations of first hydrostatic cores in collapsing low-mass dense cores. II. Simulated ALMA dust emission maps

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First hydrostatic cores are predicted by theories of star formation, but their existence has never been demonstrated convincingly by (sub)millimeter observations. Furthermore, the multiplicity in the early phases of the star formation process is poorly constrained. The purpose of this paper is twofold. First, we seek to provide predictions for ALMA dust continuum emission maps from early Class 0 objects. Second, we show to what extent ALMA will be able to probe the fragmentation scale in these objects. Following our previous paper (Commerçon et al. 2012, hereafter Paper I), we post-processed three state-of-the-art radiation-magneto-hydrodynamic 3D adaptive mesh refinement calculations to compute the emanating dust emission maps. We then produce synthetic ALMA observations of the dust thermal continuum from first hydrostatic cores. We present the first synthetic ALMA observations of dust continuum emission from the first hydrostatic cores. We analyze the results given by the different bands and configurations and we discuss for which combinations of the two the first hydrostatic cores would most likely be observed. We also show that observing dust continuum emission with ALMA will help in identifying the physical processes occurring within collapsing dense cores. If the magnetic field is playing a role, the emission pattern will show evidence of a pseudo-disk and even of a magnetically driven outflow, which pure hydrodynamical calculations cannot reproduce. The capabilities of ALMA will enable us to make significant progress towards understanding the fragmentation at the early Class 0 stage and discovering first hydrostatic cores.

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Complete ionisation of the neutral gas: why there are so few detections of 21-cm hydrogen in high redshift radio galaxies and quasars

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From the first published $z \gtrsim 3$ survey of 21-cm absorption within the hosts of radio galaxies and quasars, Curran et al. (2008b) found an apparent dearth of cool neutral gas at high redshift. From a detailed analysis of the photometry, each object is found to have a $\lambda = 1216$ Å continuum luminosity in excess of $L_{1216} \sim 10^{23}$ W Hz^{-1}, a critical value above which 21-cm has never been detected at any redshift. At these wavelengths, and below, hydrogen is excited above the ground state so that it cannot absorb in 21-cm. In order to apply the equation of photoionsation equilibrium, we demonstrate that this critical value also applies to the ionising ($\lambda \leq 912$ Å) radiation. We use this to show, for a variety of gas density distributions, that upon placing a quasar within a galaxy of gas there is *always* an ultra-violet luminosity above which all of the large-scale atomic gas is ionised. While in this state the hydrogen cannot be detected nor engage in star formation. Applying the mean ionising photon rate of all of the sources searched, we find, using canonical values for the gas density and recombination rate coefficient, that the observed critical luminosity gives a scale-length (3 kpc) similar that of the neutral hydrogen (H I) in the Milky Way, a large spiral galaxy. Thus, this simple, yet physically motivated, model can explain the critical luminosity ($L_{912} \sim L_{1216} \sim 10^{23}$ W Hz^{-1}), above which neutral gas is not detected. This indicates that the non-detection of 21-cm absorption is not due to the sensitivity limits of current radio telescopes, but rather that the lines-of-sight to the quasars, and probably the bulk of the host galaxies, are devoid of neutral gas.

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The Protocluster G18.67+0.03: A Test Case for Class I CH_3OH Masers as Evolutionary Indicators for Massive Star Formation

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We present high angular resolution Submillimeter Array (SMA) and Karl G. Jansky Very Large Array (VLA) observations of the massive protocluster G18.67+0.03. Previously targeted in maser surveys of GLIMPSE Extended Green Objects (EGOs), this cluster contains three Class I CH_3OH maser sources, providing a unique opportunity to test the proposed role of Class I masers as evolutionary indicators for massive star formation. The millimeter observations reveal bipolar molecular outflows, traced by ^{13}CO(2-1) emission, associated with all three Class I maser sources. Two of these sources (including the EGO) are also associated with 6.7 GHz Class II CH_3OH masers; the Class II masers are coincident with millimeter continuum cores that exhibit hot core line emission and drive active outflows, as indicated by the detection of SiO(5-4). In these cases, the Class I masers are coincident with outflow lobes, and appear as clear cases of excitation by active outflows. In contrast, the third Class I source is associated with an ultracompact HII region, and *not* with Class II masers. The lack of SiO emission suggests the ^{13}CO outflow is a relic, consistent with its longer dynamical timescale. Our data show that massive young stellar objects associated only with Class I masers are not necessarily young, and provide the first unambiguous evidence that Class I masers may be excited by both young (hot core) and older (UC HII) MYSOs within the same protocluster.

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Discovery of Two New Class II Methanol Maser Transitions in G 345.01 + 1.79

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We have used the Swedish ESO Submillimetre Telescope (SEST) to search for new class II methanol maser transitions towards the southern source G 345.01+1.79. Over a period of 5 days we observed 11 known or predicted class II methanol maser transitions. Emission with the narrow line width and characteristic velocity of class II methanol masers (in this source) was detected in 8 of these transitions, two of which have not previously been reported as masers. The new class II methanol maser transitions are the $13_{-3} - 12_{-4}\,E$ transition at 104.1 GHz and the $5_1 - 4_2\,E$ transition at 216.9 GHz. Both of these are from transition series for which there are no previous known class II methanol maser transitions. This takes the total number of known class II methanol maser series to 10, and the total number of transitions (or transition groups) to 18. The observed 104.1 GHz maser suggests the presence of two or more regions of masing gas with similar line of sight velocities, but quite different physical conditions. Although these newly discovered transitions are likely to be relatively rare, where they are observed combined studies using the Australia Telescope Compact Array and the Atacama Large Millimeter Array offer the prospect to be able to undertake multi-transition methanol maser studies with unprecedented detail.

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The Star Formation Rate of Turbulent Magnetized Clouds: Comparing Theory, Simulations, and Observations

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The role of turbulence and magnetic fields is studied for star formation in molecular clouds. We derive and compare six theoretical models for the star formation rate (SFR) – the Krumholz & McKee (KM), Padoan & Nordlund (PN), and Hennebelle & Chabrier (HC) models, and three multi-freefall versions of these, suggested by HC – all based on integrals over the log-normal distribution of turbulent gas. We extend all theories to include magnetic fields, and show that the SFR depends on four basic parameters: 1) virial parameter $\alpha_{\rm vir}$, 2) sonic Mach number $\mathcal{M}$, 3) turbulent forcing parameter b, which is a measure for the fraction of energy driven in compressive modes, and 4) plasma $\beta = 2\mathcal{M}_{\rm A}^2/\mathcal{M}^2$ with the Alfvén Mach number $\mathcal{M}_{\rm A}$. We compare all six theories with MHD simulations, covering cloud masses of 300 to $4 \times 10^6\,\mathrm{M_{sol}}$ and Mach numbers $\mathcal{M} = 3$–50 and $\mathcal{M}_{\rm A} = 1$–∞, with solenoidal ($b = 1/3$), mixed ($b = 0.4$) and compressive turbulent forcing ($b = 1$). We find that the SFR increases by a factor of four between $\mathcal{M} = 5$ and 50 for compressive turbulent forcing and $\alpha_{\rm vir} \sim 1$. Comparing forcing parameters, we see that the SFR is more than $10\times$ higher with compressive than solenoidal forcing for $\mathcal{M} = 10$ simulations. The SFR and fragmentation are both reduced by a factor of two in strongly magnetized, trans-Alfvénic turbulence compared to hydrodynamic turbulence. All simulations are fit simultaneously by the multi-freefall KM and multi-freefall PN theories within a factor of two over two orders of magnitude in SFR. The simulated SFRs cover the range and correlation of SFR column density with gas column density observed in Galactic clouds, and agree well for star formation efficiencies SFE = 1–10% and local efficiencies $\epsilon = 0.3$–0.7 due to feedback. We conclude that the SFR is primarily controlled by interstellar turbulence, with a secondary effect coming from magnetic fields.

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Evidence for Grain Growth in Molecular Clouds: A Bayesian Examination of the Extinction Law in Perseus

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We investigate the shape of the extinction law in two 1-degree square fields of the Perseus Molecular Cloud complex. We combine deep red-optical (r, i, and z-band) observations obtained using Megacam on the MMT with UKIDSS near-infrared (J, H, and K-band) data to measure the colours of background stars. We develop a new hierarchical Bayesian statistical model, including measurement error, intrinsic colour variation, spectral type, and dust reddening, to simultaneously infer parameters for individual stars and characteristics of the population. We implement an efficient MCMC algorithm utilising generalised Gibbs sampling to compute coherent probabilistic inferences. We find a strong correlation between the extinction (Av) and the slope of the extinction law (parameterized by Rv). Because the majority of the extinction toward our stars comes from the Perseus molecular cloud, we interpret this correlation as evidence of grain growth at moderate optical depths. The extinction law changes from the diffuse value of Rv = 3 to the dense cloud value of Rv = 5 as the column density rises from Av = 2 mags to Av = 10 mags. This relationship is similar for the two regions in our study, despite their different physical conditions, suggesting that dust grain growth is a fairly universal process.

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The Absence of Cold Dust around Warm Debris Disk Star HD 15407A

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We report *Herschel* and *AKARI* photometric observations at far-infrared (FIR) wavelengths of the debris disk around the F3V star HD 15407A, in which the presence of an extremely large amount of warm dust ($\sim$ 500–600 K) has been suggested by mid-infrared (MIR) photometry and spectroscopy. The observed flux densities of the debris disk at 60–160 μm are clearly above the photospheric level of the star, suggesting excess emission at FIR as well as at MIR wavelengths previously reported. The observed FIR excess emission is consistent with the continuum level extrapolated from the MIR excess, suggesting that it originates in the inner warm debris dust and cold dust ($\sim$ 50–130 K) is absent in the outer region of the disk. The absence of cold dust does not support a late heavy bombardment-like event as an origin of the large amount of warm debris dust around HD 15047A.

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Collisional Excitation of the [CII] Fine Structure Transition in Interstellar Clouds

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We analyze the collisional excitation of the 158 microbn (1900.5 GHz) fine structure transition of ionized carbon in terms of line intensities produced by simple cloud models. The single C+ fine structure transition is a very important coolant of the atomic interstellar medium and of photon dominated regions in which carbon is partially or completely in ionized form. The [CII] line is widely used as a tracer of star formation in the Milky Way and other galaxies. Excitation of the [CII] fine structure transition can be via collisions with hydrogen molecules, atoms, and electrons. Velocity-resolved observations of [CII] have become possible with the HIFI instrument on Herschel and the GREAT instrument on SOFIA. Analysis of these observations is complicated by the fact that it is difficult to determine the optical depth of the [CII] line due to the relative weakness and blending of the components of the analogous transition of 13C+. We discuss the excitation and radiative transition of the [CII] line, deriving analytic results for several limiting cases and carry out numerical solutions using a large velocity gradient model for a more inclusive analysis. We show that for antenna temperatures up to 1/3 of the brightness temperature of the gas kinetic temperature, the antenna temperature is linearly proportional to the column density of C+ irrespective of the optical depth of the transition.This is appropriately referred to as the effectively optically thin (EOT) approximation. We review the critical densities for excitation of the [CII] line by various collision partners, briefly analyze C+ absorption, and conclude with a discussion of C+ cooling and how the considerations for line intensities affect the behavior of this important coolant of the ISM.

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Solar system genealogy revealed by extinct short-lived radionuclides in meteorites

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Little is known on the stellar environment and the genealogy of our Solar System. Short-lived radionuclides (SLRs, mean life τ smaller than 100 Myr) that were present in the solar protoplanetary disk 4.56 Gyr ago could potentially

provide insights into that key aspect of our history, were their origin understood. Previous models failed in providing a reasonable solution for explaining the abundance of two key SLRs, ^{26}Al (τ_{26} = 1.1 Myr) and ^{60}Fe (τ_{60} = 3.7 Myr) at the birth of the Solar System by requiring unlikely astrophysical conditions. Our aim is to propose a coherent and generic solution based on the most recent understanding of star-forming mechanisms. Iron-60 in the nascent Solar System is shown to have been produced by a diversity of supernovae belonging to a first generation of stars in a Giant Molecular Cloud. Aluminum-26 is delivered into a dense collected shell by a single massive star wind belonging to a second star generation. The Sun formed in the collected shell as part of a third stellar generation. Aluminum-26 yields used in our calculation are based on new rotating stellar models in which ^{26}Al is present in stellar winds during the star main sequence rather than during the Wolf Rayet phase only. Our scenario eventually constrains the time sequence of the formation of the two stellar generations which just preceded the Solar System formation, as well as the number of stars born in these two generations. We propose a generic explanation to account for the past presence of SLRs in the nascent Solar System, based on a collect, injection and collapse mechanism, occurring on a diversity of spatial/temporal scales. In that model, the presence of SLRs with a diversity of mean lives in the solar protoplanetary disk is nothing else but the fossilized record of sequential star formation within a hierarchical interstellar medium (ISM). We identify the genealogy of our Solar System three star generations backwards. In particular, we show that our Sun was born together with a few hundred stars in a dense collected shell situated at a distance of 5-10 pc of a parent massive star having a mass larger than about 30 solar masses, and belonging to a cluster containing $\sim$ 1200 stars.

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Discovery of an outflow of the very low-mass star ISO 143

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We discover that the very young very low-mass star ISO 143 (M5) is driving an outflow based on spectro-astrometry of forbidden [S II] emission lines at 6716 Å and 6731 Å observed in UVES/VLT spectra. ISO 143 is only one of a handful of brown dwarfs and very low-mass stars (M5-M8) for which an outflow has been detected and that show that the T Tauri phase continues at very low masses. We have found the outflow of ISO 143 to be intrinsically asymmetric and the accretion disk to not obscure the outflow, as solely the red outflow component is visible in the [S II] lines. ISO 143 is only the third T Tauri object showing a stronger red outflow component in spectro-astrometry, after RW Aur (G5) and ISO 217 (M6.25). We show here that including ISO 143 two out of seven outflows confirmed in the very low-mass regime (M5-M8) are intrinsically asymmetric. We measure a spatial extension of the outflow in [S II] of up to 200-300 mas (about 30-50 AU) and velocities of up to 50-70 km s^{-1}. We detect furthermore line emission of ISO 143 in Ca II (8498 Å), O I (8446 Å), He I (7065 Å), and weakly in [Fe II] (7155 Å). We demonstrate based on a line profile analysis and decomposition that the Ca II emission can be attributed to chromospheric activity, a variable wind, and the magnetospheric infall zone, the O I emission mainly to accretion-related processes but also a wind, and the He I emission to chromospheric or coronal activity. We estimate the mass outflow rate to be of the order of $10^{-10}\,M_\odot\,\mathrm{yr}^{-1}$ and the mass accretion rate to be of the order of 10^{-8} to $10^{-9}\,M_\odot\,\mathrm{yr}^{-1}$; these values are consistent with that of other brown dwarfs and very low-mass stars. The derived $\dot{M}_{out}/\dot{M}_{acc}$ ratio of 1-20 % is not supporting previous findings of this number to be very large (>40 %) for very low-mass objects.

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http://www.mpia.de/homes/joergens/refpublications.html

The simulation of molecular clouds formation in the Milky Way

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Using 3D hydrodynamic calculations we simulate formation of molecular clouds in the Galaxy. The simulations take into account molecular hydrogen chemical kinetics, cooling and heating processes. Comprehensive gravitational potential accounts for contributions from the stellar bulge, two and four armed spiral structure, stellar disk, dark halo and takes into account self-gravitation of the gaseous component. Gas clouds in our model form in the spiral arms due to shear and wiggle instabilities and turn into molecular clouds after $t \gtrsim 100$ Myr. At the times $t \sim 100 - 300$ Myr the clouds form hierarchical structures and agglomerations with the sizes of 100 pc and greater. We analyze physical properties of the simulated clouds and find that synthetic statistical distributions like mass spectrum, "mass-size" relation and velocity dispersion are close to those observed in the Galaxy. The synthetic $l - v$ (galactic longitude - radial velocity) diagram of the simulated molecular gas distribution resembles observed one and displays a structure with appearance similar to Molecular Ring of the Galaxy. Existence of this structure in our modelling can be explained by superposition of emission from the galactic bar and the spiral arms at ∼3-4 kpc.

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Protostellar Accretion Flows Destabilized by Magnetic Flux Redistribution

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Magnetic flux redistribution lies at the heart of the problem of star formation in dense cores of molecular clouds that are magnetized to a realistic level. If all of the magnetic flux of a typical core were to be dragged into the central star, the stellar field strength would be orders of magnitude higher than the observed values. This well-known "magnetic flux problem" can in principle be resolved through non-ideal MHD effects. Two dimensional (axisymmetric) calculations have shown that ambipolar diffusion, in particular, can transport magnetic flux outward relative to matter, allowing material to enter the central object without dragging the field lines along. We show through simulations that such axisymmetric protostellar accretion flows are unstable in three dimensions to magnetic interchange instability in the azimuthal direction. The instability is driven by the magnetic flux redistributed from the matter that enters the central object. It typically starts to develop during the transition from the prestellar phase of star formation to the protostellar mass accretion phase. In the latter phase, the magnetic flux is transported outward mainly through advection, by strongly magnetized low-density regions that expand against the collapsing inflow. The tussle between the gravity-driven infall and magnetically driven expansion leads to a highly filamentary inner accretion flow that is more disordered than previously envisioned. The efficient outward transport of magnetic flux by advection lowers the field strength at small radii, making the magnetic braking less efficient and the formation of rotationally supported disks easier in principle. However, we find no evidence for such disks in any of our rotating collapse simulations. We conclude that the inner protostellar accretion flow is shaped to a large extent by the flux redistribution-driven magnetic interchange instability. How disks form in such an environment is unclear.

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Ambipolar Diffusion Heating in Turbulent Systems

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The temperature of the gas in molecular clouds is a key determinant of the characteristic mass of star formation. Ambipolar diffusion (AD) is considered one of the most important heating mechanisms in weakly ionized molecular clouds. In this work, we study the AD heating rate using 2-fluid turbulence simulations and compare it with the overall heating rate due to turbulent dissipation. We find that for observed molecular clouds, which typically have Alfven Mach numbers of ~ 1 (Crutcher 1999) and AD Reynolds numbers of ~ 20 (McKee et al. 2010), about 70% of the total turbulent dissipation is in the form of AD heating. AD has an important effect on the length scale where energy is dissipated: when AD heating is strong, most of the energy in the cascade is removed by ion-neutral drift, with a comparatively small amount of energy making it down to small scales. We derive a relation for the AD heating rate that describes the results of our simulations to within a factor of two. Turbulent dissipation, including AD heating, is generally less important that cosmic-ray heating in molecular clouds, although there is substantial scatter in both.

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Strong irradiation of protostellar cores in Corona Australis

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Context. The importance of the physical environment in the evolution of newly formed low-mass stars remains an open question. In particular, radiation from nearby more massive stars may affect both the physical and chemical structure of these kinds of young stars.
Aims. To constrain the physical characteristics of a group of embedded low-mass protostars in Corona Australis in the vicinity of the young luminous Herbig Be star R CrA.
Methods. Millimetre wavelength maps of molecular line and continuum emission towards the low-mass star forming region IRS7 near R CrA from the Submillimeter Array (SMA) and Atacama Pathfinder Experiment (APEX) are presented. The maps show the distribution of 18 lines from 7 species (H_2CO, CH_3OH, HC_3N, *c*-C_3H_2, HCN, CN and SiO) on scales from $3''$ to $60''$ (400–8 000 AU). Using a set of H_2CO lines, we estimate the temperatures and column densities in the region using both LTE and non-LTE methods. The results are compared with 1-D radiative transfer modelling of the protostellar cores. These models constrain which properties of the central source, protostellar envelope, and surrounding radiation field can give rise to the observed line and continuum emission.
Results. Most of the H_2CO emission from the regions emerges from two elongated ($\sim$ 6 000 AU long) narrow ($<$ 1 500 AU) ridges dominating the emission picked up in both interferometric and single-dish measurements. The temperatures inferred from the H_2CO lines are no less than ~ 30 K and more likely 50–60 K, and the line emission peaks are offset by $\sim$ 2 500 AU from the location of the embedded protostars. These temperatures can not be explained by the heating from the young stellar objects (YSOs) themselves. Irradiation by the nearby Herbig Be star R CrA could, however, explain these high temperatures. The elevated temperatures can in turn impact the physical and chemical characteristics of protostars, in particular, lead to enhanced abundances of typical tracers of photon dominated regions (PDRs) such as seen in single-dish line surveys of embedded protostars in the region.

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DoAr 33: A good candidate for revealing dust growth and settling in protoplanetary disks

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We aim to evaluate the evolutionary stage of the circumstellar disk around DoAr 33, a T Tauri star in the Ophiuchus molecular cloud and a promising target for follow-up observations to find signs of dust evolution in protoplanetary disks. The currently available data on DoAr 33 comprises its spectral energy distribution from the optical to the millimeter regimes. This data set allows us to characterize the structure of a circumstellar disk using self-consistent radiative transfer models. We employed two different types of models, a well-mixed model and a settled disk model in which dust growth and settling are taken into account. Simulated annealing was used to search for an optimum parameter set. Our results suggest that the assumption of a well-mixed dust and gas phase leads to overestimation of the mid-infrared flux, whereas the (sub)millimeter emission can be predicted quite well. Observational and theoretical arguments imply that an overall decrease in mid-infrared flux can be explained by dust growth and settling towards the midplane of the disk. As expected, the settled disk model is able to satisfactorily reproduce the data points at all wavelengths. DoAr 33 is therefore a good candidate for studying dust growth and settling in protoplanetary disks, so it deserves to be investigated with future observations.

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Interpreting the simultaneous variability of near-IR continuum and line emission in young stellar objects

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We present new near-infrared (IR) spectra (0.80-1.35 um) of the pre-Main Sequence source PV Cep taken during a monitoring program of eruptive variables we are conducting since some years. Simultaneous photometric and spectroscopic observations are systematically carried out during outburst and quiescence periods. By correlating extinction-free parameters, such as HI recombination lines and underlying continuum, it is possible to infer on the mechanism(s) responsible for their origin. Accretion and mass loss processes have a dominant role in determining the PV Cep irregular variability of both continuum and line emission. The potentialities of the observational modality are also discussed.

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Probing Dynamical Processes in the Planet-forming Region with Dust Mineralogy

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We present Herschel Space Observatory PACS spectra of GQ Lup, a protoplanetary disk in the Lupus star-forming region. Through spectral energy distribution fitting from 0.3 μm to 1.3 mm, we construct a self-consistent model of this system's temperature and density structures, finding that although it is 3 Myr old, its dust has not settled to the midplane substantially. The disk has a radial gradient in both the silicate dust composition and grain size, with large amorphous grains in the upper layers of the inner disk and an enhancement of submicron, crystalline grains in the outer disk. We detect an excess of emission in the Herschel PACS B2A band near 63 μm and model it with a combination of 15-70 μm crystalline water ice grains with a size distribution consistent with ice recondensation-enhanced grain growth and a mass fraction half of that of our solar system. The combination of crystalline water ice and silicates in the outer disk is suggestive of disk-wide heating events or planetesimal collisions. If confirmed, this would be the first detection of water ice by Herschel.

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On the convergence of the critical cooling timescale for the fragmentation of self-gravitating discs

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We carry out simulations of gravitationally unstable discs using a Smoothed Particle Hydrodynamics (SPH) code and a grid-based hydrodynamics code, FARGO, to understand the previous non-convergent results reported by Meru & Bate (2011a). We obtain evidence that convergence with increasing resolution occurs with both SPH and FARGO and in both cases we find that the critical cooling timescale is larger than previously thought. We show that SPH has a first-order convergence rate while FARGO converges with a second-order rate. We show that the convergence of the critical cooling timescale for fragmentation depends largely on the numerical viscosity employed in both SPH and FARGO. With SPH, particle velocity dispersion may also play a role. We show that reducing the dissipation from the numerical viscosity leads to larger values of the critical cooling time at a given resolution. For SPH, we find that the effect of the dissipation due to the numerical viscosity is somewhat larger than had previously been appreciated. In particular, we show that using a quadratic term in the SPH artificial viscosity ($\beta_{\rm SPH}$) that is too low appears to lead to excess dissipation in gravitationally unstable discs, which may affect any results that sensitively depend on the thermodynamics, such as disc fragmentation. We show that the two codes converge to values of the critical cooling timescale, $\beta_{\rm crit} > 20$ (for a ratio of specific heats of $\gamma = 5/3$), and perhaps even as large as $\beta_{\rm crit} \approx 30$. These are approximately $3-5$ times larger than has been found by most previous studies. This is equivalent to a maximum gravitational stress that a disc can withstand without fragmenting of $\alpha_{\rm GI,crit} \approx 0.013 - 0.02$, which is much smaller than the values typically used in the literature. It is therefore easier for self-gravitating discs to fragment than has been concluded from most past studies.

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Estimating column density from ammonia (1,1) emission in star-forming regions

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We present a new, approximate method of calculating the column density of ammonia in mapping observations of the 23 GHz inversion lines. The temperature regime typically found in star forming regions allows for the assumption of a slowly varying partition function for ammonia. It is therefore possible to determine the column density using only the (J=1,K=1) inversion transition rather than the typical combination of the (1,1) and (2,2) transitions, with additional

uncertainties comparable to or less than typical observational error. The proposed method allows column density and mass estimates to be extended into areas of lower signal to noise ratio. We show examples of column density maps around a number of cores in the W3 and Perseus star-forming regions made using this approximation, along with a comparison to the corresponding results obtained using the full two-transition approach. We suggest that this method is a useful tool in studying the distribution of mass around YSOs, particularly in the outskirts of the protostellar envelope where the (2,2) ammonia line is often undetectable on the short timescales necessary for large area mapping.

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Why circumstellar disks are so faint in scattered light: The case of HD 100546

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Scattered light images of circumstellar disks play an important role in characterizing the planet forming environments around young stars. The characteristic size of the scattering dust grains can be estimated from the observed brightness asymmetry between the front and back side of the disk, for example using standard Mie theory. However such models often overpredict their brightness by one or two orders of magnitude, and have difficulty explaining very red disk colors. We aim to develop a dust model that explains simultaneously the observed disk surface brightness, colors and asymmetry in scattered light, focussing on constraining grain sizes. We use the 2D radiative transfer code MCMax with anisotropic scattering to explore the effects of grain size on synthetic scattered light images of circumstellar disks. We compare the results with surface brightness profiles of the protoplanetary disk HD 100546 in scattered light at wavelengths from 0.4 to 2.2 micron. We find that extreme forward scattering by micron sized particles lowers the *effective* dust albedo and creates a faint and red disk that *appears* only slightly forward scattering. For the outer ($\gtrsim$100 AU) disk of HD 100546 we derive a minimum grain size of 2.5 micron, likely present in the form of aggregates. Intermediate sized grains are too bright, whereas smaller grains are faint and scatter more isotropically, but also produce disk colors that are too blue. Observed surface brightness asymmetries alone are not sufficient to constrain the grain size in circumstellar disks. Additional information, such as the brightness and colors of the disk are needed to provide additional constraints.

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Outflow Structure and Velocity Field of Orion Source I: ALMA Imaging of SiO Isotopologue Maser and Thermal Emission

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Using Science Verification data from the Atacama Large Millimeter/Submillimeter Array (ALMA), we have identified and imaged five rotational transitions (J=5-4 and J=6-5) of the three silicon monoxide isotopologues ^{28}SiO v=0, 1, 2 and ^{29}SiO v=0 and ^{28}Si^{18}O v=0 in the frequency range from 214 to 246 GHz towards the Orion BN/KL region. The emission of the ground-state ^{28}SiO, ^{29}SiO and ^{28}Si^{18}O shows an extended bipolar shape in the northeast-southwest direction at the position of Radio Source I, indicating that these isotopologues trace an outflow ($\sim$18 km s^{-1}, P.A. $\sim$50^{o}, $\sim$5000 AU in diameter) that is driven by this embedded high-mass young stellar object (YSO). Whereas on small scales (10-1000 AU) the outflow from Source I has a well-ordered spatial and velocity structure, as probed by Very Long Baseline Interferometry (VLBI) imaging of SiO masers, the large scales (500-5000 AU) probed by thermal SiO with ALMA reveal a complex structure and velocity field, most likely related to the effects of the environment of

the BN/KL region on the outflow emanating from Source I.

The emission of the vibrationally-excited species peaks at the position of Source I. This emission is compact and not resolved at an angular resolution of ∼1.5” (∼600 AU at a distance of 420 pc). 2-D Gaussian fitting to individual velocity channels locates emission peaks within radii of 100 AU, i.e. they trace the innermost part of the outflow. A narrow spectral profile and spatial distribution of the v=1 J=5-4 line similar to the masing v=1 J=1-0 transition, provide evidence for the most highly rotationally excited (frequency > 200 GHz) SiO maser emission associated with Source I known to date. The maser emission will enable studies of the Source I disk-outflow interface with future ALMA longest baselines.

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The impact of thermodynamics on gravitational collapse: filament formation and magnetic field amplification

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Stars form by the gravitational collapse of interstellar gas. The thermodynamic response of the gas can be characterized by an effective equation of state. It determines how gas heats up or cools as it gets compressed, and hence plays a key role in regulating the process of stellar birth on virtually all scales, ranging from individual star clusters up to the galaxy as a whole. We present a systematic study of the impact of thermodynamics on gravitational collapse in the context of high-redshift star formation, but argue that our findings are also relevant for present-day star formation in molecular clouds.

We consider a polytropic equation of state, $P = k\rho^{\Gamma}$, with both sub-isothermal exponents $\Gamma < 1$ and super-isothermal exponents $\Gamma > 1$. We find significant differences between these two cases. For $\Gamma > 1$, pressure gradients slow down the contraction and lead to the formation of a virialized, turbulent core. Weak magnetic fields are strongly tangled and efficiently amplified via the small-scale turbulent dynamo on timescales corresponding to the eddy-turnover time at the viscous scale. For $\Gamma < 1$, on the other hand, pressure support is not sufficient for the formation of such a core. Gravitational contraction proceeds much more rapidly and the flow develops very strong shocks, creating a network of intersecting sheets and extended filaments. The resulting magnetic field lines are very coherent and exhibit a considerable degree of order. Nevertheless, even under these conditions we still find exponential growth of the magnetic energy density in the kinematic regime.

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Are molecular outflows around high-mass stars driven by ionization feedback?

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The formation of massive stars exceeding 10 $M_\odot$ usually results in large-scale molecular outflows. Numerical simulations, including ionization, of the formation of such stars show evidence for ionization-driven molecular outflows. We here examine whether the outflows seen in these models reproduce the observations. We compute synthetic ALMA and CARMA maps of CO emission lines of the outflows, and compare their signatures to existing single-dish and interferometric data. We find that the ionization-driven models can only reproduce weak outflows around high-mass star-forming regions. We argue that expanding H II regions probably do not represent the dominant mechanism for driving observed outflows. We suggest instead that observed outflows are driven by the collective action of the outflows from the many lower-mass stars that inevitably form around young massive stars in a cluster.

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Episodic accretion, protostellar radiative feedback, and their role in low-mass star formation

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Protostars grow in mass by accreting material through their discs, and this accretion is initially their main source of luminosity. The resulting radiative feedback heats the environments of young protostars, and may thereby suppress further fragmentation and star formation. There is growing evidence that the accretion of material onto protostars is episodic rather than continuous; most of it happens in short bursts that last up to a few hundred years, whereas the intervals between these outbursts of accretion could be thousands of years. We have developed a model to include the effects of episodic accretion in simulations of star formation. Episodic accretion results in episodic radiative feedback, which heats and temporarily stabilises the disc, suppressing the growth of gravitational instabilities. However, once an outburst has been terminated, the luminosity of the protostar is low, and the disc cools rapidly. Provided that there is enough time between successive outbursts, the disc may become gravitationally unstable and fragment. The model suggests that episodic accretion may allow disc fragmentation if (i) the time between successive outbursts is longer than the dynamical timescale for the growth of gravitational instabilities (a few kyr), and (ii) the quiescent accretion rate onto the protostar is sufficiently low (at most a few times $10^{-7}\,\mathrm{M}_\odot\,\mathrm{yr}^{-1}$). We also find that after a few protostars form in the disc, their own episodic accretion events shorten the intervals between successive outbursts, and suppress further fragmentation, thus limiting the number of objects forming in the disc. We conclude that episodic accretion moderates the effect of radiative feedback from young protostars on their environments, and, under certain conditions, allows the formation of low-mass stars, brown dwarfs, and planetary-mass objects by fragmentation of protostellar discs.

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Sputtering in oblique C-type shocks

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We present the first results for the sputtering of grain mantles and cores obtained with self-consistent multifluid hydromagnetic models of C-type shocks propagating through dusty media. The threshold shock speed for mantle sputtering is about 10 km s^{-1} and is independent of density. The mantles are completely vapourised in shocks with speeds of 20-25 km s^{-1}. At such shock speeds core sputtering commences and gas-phase SiO forms. Core destruction is not total in any C-type shock because grains are not completely destroyed in shocks with speeds near the minimum speeds at which J-type shocks appear. Due to the density-dependence of the critical shock speed for this transition, higher gas-phase SiO fractional abundances are produced behind shocks propagating in lower density gas. For shock speeds near the threshold speeds for both core and mantle sputtering, sputtering is much greater for shock velocities at smaller angles relative to the upstream magnetic field. At higher shock speeds, the angular variation is still present but less pronounced.

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Imprints of Molecular Clouds in Radio Continuum Images

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We show radio continuum images of several molecular complexes in the inner Galaxy and report the presence of dark features that coincide with dense molecular clouds. Unlike infrared dark clouds, these features which we call “radio dark clouds” are produced by a deficiency in radio continuum emission from molecular clouds that are embedded in a bath of UV radiation field or synchrotron emitting cosmic ray particles. The contribution of the continuum emission along different pathlengths results in dark features that trace embedded molecular clouds. The new technique of identifying cold clouds can place constraints on the depth and the magnetic field of molecular clouds when compared to those of the surrounding hot plasma radiating at radio wavelengths. The study of five molecular complexes in the inner Galaxy, Sgr A, Sgr B2, radio Arc, the snake filament and G359.75-0.13 demonstrate an anti–correlation between the distributions of radio continuum and molecular line and dust emission. Radio dark clouds are identified in GBT maps and VLA images taken with uniform sampling of *uv* coverage. The level at which the continuum flux is suppressed in these sources suggests that the depth of the molecular cloud is similar to the size of the continuum emission within a factor of two. These examples suggest that high resolution, high dynamic range continuum images can be powerful probes of interacting molecular clouds with massive stars and supernova remnants in regions where the kinematic distance estimates are ambiguous as well as in the nuclei of active galaxies.

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Moving ... ??

If you move or your e-mail address changes, please send the editor your new address. If the Newsletter bounces back from an address for three consecutive months, the address is deleted from the mailing list.

Postdoctoral fellowships and PhD positions in Star- and Planet formation, Astrochemistry, Early Solar System

Two 2-4 year postdoctoral fellowships and two 4-year PhD positions are available within the Molecular Astrophysics group at the Leiden Observatory for observational and modeling studies of star- and planet formation and their astrochemistry. The postdocs and PhD students will be part of an international team studying the physical and chemical evolution from collapsing cores to protoplanetary disks centered around ALMA data. A wide range of complementary data from Herschel (in the context of the WISH and DIGIT key programs) as well as ground-based infrared and submillimeter spectroscopy is available. One postdoc position will be focussed on developing models to link the chemical composition of disks with that of icy solar system objects such as comets.

The postdoc candidates are expected to co-supervise PhD students and are encouraged to also pursue a personal research program. The postdoc appointments are initially for two years, with the possibility of renewal of 1-2 years. They can start anytime up to Fall 2013.

Candidates with an observational and/or modeling background in astrochemistry, low-mass star formation, circumstellar disks, submillimeter spectroscopy, planet formation and planet population synthesis models are encouraged to apply.

Leiden Observatory carries out observational, interpretative and theoretical research in the fields of the star and planet formation, laboratory astrophysics, galactic structure, the formation and dynamics of (high-redshift) galaxies and their nuclei, and cosmology. Leiden is a charming university town, within easy reach of the major European centers.

Applications should include a curriculum vitae, publication list, and a brief statement of research experience and interests, and arrange for at least three letters of reference to be uploaded on the relevant website. Deadline for PhD positions is December 15 2012. Review of applications for the postdoc positions will start on November 15 2012.

E-mail inquiries: ewine@strw.leidenuniv.nl

Websites for submission:

Postdocs: http://jobs.strw.leidenuniv.nl/2013/dishoeckPD/

PhD: http://www.strw.leidenuniv.nl/phd/apply.php

Senior Lecturer in Astrophysics at Stockholm University

The department of Astronomy at Stockholm University announces an Associate Professor position in Astrophysics, with the subject area including **theoretical or observational studies for the formation of stars and planetary systems, as well as exoplanets**. Deadline for application: Nov 20, 2012.

Approximately 50 people are actively working at the Department of Astronomy, Stockholm University. The activities include research, education and outreach. The research span over a wide range of subjects, from the sun, exoplanets, the formation and death of stars, and galaxies to the distant and early universe. Through the Swedish memberships in ESO and ESA there is access to world class observational facilities.

Fluency in the Swedish language is not a requirement. However, some undergraduate teaching at the department is in Swedish. If the candidate who is hired is not fluent in Swedish, he or she will be given opportunity to learn the language during the first few years.

For more information, see http://www.astro.su.se/english/about-us/vacancies or contact the department's director Göran Östlin at ostlin@astro.su.se. Please note that all applications have to be submitted through the Stockholm University web-based application form.

Post-doctoral Position in Star and Planet Formation (position 1) ETH Zurich

The Institute for Astronomy of the ETH Zurich, Star and Planet Formation Research Group (led by Professor Michael Meyer) invites applications for a new post-doctoral fellowship related to the STARFORM Project. STARFORM is a Swiss collaboration (the University of Geneva, the University of Zurich, and the ETH Zurich) aimed at understanding the star formation process from observational, theoretical, and computational points of view. We seek to explore star formation within nearby molecular clouds and in distant galaxies, from small to large scales, using in particular infrared and millimeter observations and state-of-the-art simulations. More information can be found at http://obswww.unige.ch/wordpress/starform.

As part of this project, the ETH Zurich will work closely with colleagues at the University of Zurich to create mock observations of hydrodynamic models of molecular clouds and compare them quantitatively to observations. We are part of an on-going survey of the Orion B molecular cloud and will collaborate with experts in analysis of cloud structure and comparison of models to data. We will also work with colleagues at the University of Geneva on related projects. Salaries and duration of appointments will be commensurate with experience. Starting salaries begin at CHF 84700, with initial appointments of 2+1 years, up to a maximum of six.

Switzerland is a member of ESO and ESA, and successful applicants will have full access to their facilities, as well as data from ongoing programs utilizing the Hubble Space Telescope, the Herschel Space Telescope and a range of millimeter wave survey telescopes. The Institute for Astronomy maintains a network of workstations, as well as a range of high performance computing options, including stand-alone machines, large clusters, and the resources of the Swiss National Supercomputing Center (CSCS).

Applications are invited from all nationalities and should consist of a CV and brief descriptions of past/proposed research (combined length not to exceed 10 pages). A separate publication list should be attached. Materials should be sent electronically in a single pdf file. This file, as well as three letters of reference (sent directly by the referees) should be sent to eth-astro-star-planet@phys.ethz.ch. Review of applications will begin December 1, 2012 and will continue until positions are filled.

The ETH Zurich will provide benefits for maternity leave, retirement, accident insurance, and relocation costs. Weblink: http://www.pa.ethz.ch/

Post-doctoral Position in Star and Planet Formation (position 2) ETH Zurich

The Institute of Astronomy of the ETH Zurich, Star and Planet Formation Research Group (led by Professor Michael Meyer) invites applications for a new post-doctoral fellowship related to the formation of stars and planets. Our group is involved in several research topics including the detection and characterization of extra-solar planets, the structure and evolution of circumstellar disks, and the formation and evolution of young star clusters. More information can be found at http://www.astro.ethz.ch/meyer/index

Salaries and duration of appointments will be commensurate with experience. Starting salaries begin at CHF 84700, with initial appointments of 2+1 years, up to a maximum of six. Successful applicants will have the opportunity to work with students at all levels and become involved in one or more of several large programs in which our research group participates.

Switzerland is a member of ESO and ESA, and successful applicants will have full access to their facilities, as well as data from ongoing programs utilizing the Hubble Space Telescope, the Herschel Space Telescope and a range ofother facilities. The Institute for Astronomy maintains a network of workstations, as well as a range of high performance computing options, including stand-alone machines, large clusters, and the resources of the Swiss National Supercomputing Center (CSCS). Members of the Institute also play a leading role in the interdisciplinary PLANET-Z initiative linking research groups at the ETH Zurich in astronomy, earth science, and computational astrophysics at the University of Zurich to study planet formation. Interested applicants will also be welcome to explore research opportunities in the Astronomical Instrumentation Laboratory.

Applications are invited from all nationalities and should consist of a CV and brief descriptions of past/proposed research (combined length not to exceed 10 pages). A separate publication list should be attached. Materials should be sent electronically in a single pdf file. This file, as well as three letters of reference (sent directly by the referees) should be sent to eth-astro-star-planet@phys.ethz.ch. Review of applications will begin December 1, 2012 and will continue until positions are filled.

The ETH Zurich will provide benefits for maternity leave, retirement, accident insurance, and relocation costs. Weblink: http://www.pa.ethz.ch/

PhD Student Position in Star and Planet Formation, ETH Zurich

The Institute for Astronomy of ETH Zurich, Star and Planet Formation Research Group (led by Professor Michael Meyer) invites applications for new PhD positions related to: i) the direct detection and characterization of extra-solar planets; ii) tests of planet formation theory from an astronomical, cosmochemical, and geophysical perspective; and iii) formation and evolution of young star clusters within molecular clouds.

Salaries for PhD students start at CHF 51750. Students will have the opportunity to study experimental and theoretical aspects of astronomy through formal coursework, conducting research with local experts in star and planet formation as well as our international network of collaborators, and utilize state-of-the-art facilities.

Switzerland is a member of ESO and ESA, and successful applicants will have full access to their facilities, as well as data from ongoing programs utilizing the Hubble Space Telescope, and the Herschel Space Telescope. The Institute for Astronomy maintains a network of workstations, as well as a range of high performance computing options, including stand-alone machines, large clusters, and the resources of the Swiss National Supercomputing Center (CSCS). Members of the Institute also play a leading role in the interdisciplinary PLANET-Z initiative linking research groups at the ETH Zurich in astronomy, earth science, and computational astrophysics at the University of Zurich. Qualified applicants will be able to explore research opportunities in the Astronomical Instrumentation Laboratory.

Applications are invited from all nationalities and should consist of a CV, description of relevant research experience, academic transcripts, scores from relevant standardized tests (e.g. TOEFL, Physics GRE) a personal statement of interests and goals, and the names of three references that can be contacted if necessary. Materials should be sent electronically in a single pdf file to eth-astro-star-planet@phys.ethz.ch. Review of applications will begin December 1, 2012.

The ETH Zurich will provide benefits for maternity leave, retirement, accident insurance, and relocation costs. Weblink: http://www.pa.ethz.ch/

Faculty Position in Observational Astronomy with Focus on Origins Rice University

The Department of Physics and Astronomy at Rice University invites applications for a tenure-track faculty position in observational astronomy with an emphasis on Origins science, which includes the formation of galaxies, stars, and planets. This search seeks an outstanding individual whose research will complement and extend existing activities in star and planet formation at Rice University (see http://physics.rice.edu/). While preference will be given to observational astronomers, outstanding candidates with a theoretical or computational focus will also be considered. In addition to developing an independent and vigorous research program, the successful applicant will normally be expected to teach one undergraduate or graduate course each semester. The department expects to make an appointment at the assistant professor level. A PhD in astronomy/astrophysics or related field is required. Applicants should send a curriculum vitae, statements of research and teaching interests, a list of publications, and two or three selected reprints, in a single PDF file, to umbe@rice.edu with subject line “Astronomer Search” or to Prof. Hatigan, Chair, Astronomy Search Committee, Dept. of Physics and Astronomy - MS 61, Rice University, 6100 Main Street, Houston, TX 77005. Applicants should also arrange for at least three letters of recommendation to be sent by email or post. Applications will be accepted until the position is filled, but only those received by January 15, 2013 will be assured full consideration. The appointment is expected to start in July 2013. Rice University is an affirmative action/equal opportunity employer; women and underrepresented minorities are strongly encouraged to apply.

Workshop on ”Ice and Planet Formation”
15 - 17 May 2013, Lund Observatory, Sweden

This workshop in Lund focuses on ice(s) and planet formation. Astrophysical ice has become an increasingly popular topic in the past years, inspired and driven by new observations of ices in molecular clouds and protoplanetary discs, models of dust coagulation and planet formation where ice plays an important role and current and upcoming laboratory experiments on ice collisions and ice deposition.

The goal of the workshop is to bring together observers, experimentalists and theorists to discuss the present state-of-the-art of the field as well as future directions. The workshop will consist of contributed talks and posters, with ample time for discussion during extended breaks and poster sessions.

The Ice and Planet Formation workshop will be held 15–17 May 2013 at Lund Observatory in Lund in Sweden. The workshop will start after lunch on Wednesday 15 May and end after lunch on Friday 17 May.

Registration closes 15 February 2013.

Scientific organising committee:

Jürgen Blum (University of Braunschweig), Ewine van Dishoeck (Leiden University), Carsten Dominik (Amsterdam University), Cornelis Dullemond (Heidelberg University), Thomas Henning (Max Planck Institute for Astronomy), Michiel Hogerheijde (Leiden University), Anders Johansen (Lund University), Klaus Pontoppidan (Space Telescope Science Institute)

Local organising committee:

Anders Johansen (Lund University), Katrin Ros (Lund University), Michiel Lambrechts (Lund University)

Website: http://www.astro.lu.se/~anders/IPF2013

Contact: Anders Johansen (anders@astro.lu.se)

Physics at the Magnetospheric Boundary
Geneva, Switzerland, 25 - 28 June 2013

The ”Physics at the Magnetospheric Boundary” conference is aimed at bringing together specialists working theoretically, numerically and observationally on processes occurring at the limit of the magnetically dominated region around accreting objects such as neutron stars, white dwarfs, and T Tauri stars, where the surrounding hot plasma is finally captured.

Different manifestations of similar physical processes occur in this wide variety of celestial sources and have been investigated since the 1960s by different scientific communities. The conference represents a precious opportunity of exchange between research groups working on the topic of accretion, across different wavelengths and source types. It poses the basis for the next steps forward in our understanding of the physics at the magnetospheric boundary.

Planned sessions for this conference include:

- Theory of accretion onto magnetized stars
- Numerical modelling of plasma-field interaction: accretion and jets production
- Observational clues to the physics at the magnetosphere
- Future perspectives in theory and observations

More details are available on the conference website:

http://www.isdc.unige.ch/magbound/

Subscribe to the conference mailing list to receive further news:

http://www.isdc.unige.ch/magbound/index.php/newsletter-subscription

StarBench: A workshop for the benchmarking of star formation codes
8 - 11 April 2013 at the University of Exeter, UK

Hydrodynamical simulations are a powerful tool for understanding the dynamical evolution of the interstellar medium leading to star formation. Adaptive Mesh Refinement and Smoothed Particle Hydrodynamics are the most common techniques used in the implementation of the numerical hydrodynamic codes. New algorithms are constantly being developed by many groups worldwide, offering new tools for examining star formation.

This meeting will be dedicated to the technical comparison of these codes and to round-table discussions for the pros and cons of each method. In this frame of work, participants will be asked to perform a priori specific simulations using their codes, the results of which will be used for the discussion during the meeting.

Topics will include:
1) Expansion of HII regions,
2) Hydrodynamical Instabilities,
3) Evolution of circumstellar disks,
4) Fluid mixture (two-phase media),
5) Shock tube tests,
6) Synthetic observations.

The workshop will be hosted from 8th-11th April 2013 in Reed Hall at the University of Exeter.

Please visit our webpage for more information:
http://www.astro.ex.ac.uk/people/haworth/workshop_bench/index.html

Please do not hesitate to contact us:
Thomas Haworth (haworth@astro.ex.ac.uk) and Thomas Bisbas (tb@star.ucl.ac.uk)

The Star Formation Newsletter is a vehicle for fast distribution of information of interest for astronomers working on star formation and molecular clouds. You can submit material for the following sections: *Abstracts of recently accepted papers* (only for papers sent to refereed journals), *Abstracts of recently accepted major reviews* (not standard conference contributions), *Dissertation Abstracts* (presenting abstracts of new Ph.D dissertations), *Meetings* (announcing meetings broadly of interest to the star and planet formation and early solar system community), *New Jobs* (advertising jobs specifically aimed towards persons within the areas of the Newsletter), and *Short Announcements* (where you can inform or request information from the community).

Latex macros for submitting abstracts and dissertation abstracts (by e-mail to reipurth@ifa.hawaii.edu) are appended to each issue of the newsletter. You can also submit via the Newsletter web interface at http://www2.ifa.hawaii.edu/star-formation/index.cfm

The Star Formation Newsletter is available on the World Wide Web at http://www.ifa.hawaii.edu/users/reipurth/newsletter.htm.