ON THE ASSOCIATION OF YOUNG STAR CLUSTERS AND THEIR PARENTAL CLOUDS: A STATISTICAL FRACTAL ANALYSIS

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We present a study of 21 young star clusters aiming to characterize their association to dense clouds. The structure of the clouds was evaluated by means of the Q statistical fractal analysis, designed to compare their geometric structure with the spatial distribution of the cluster members. The sample was selected from the study by Santos-Silva and Gregorio-Hetem (2012, A&A, 547, A107) that evaluated the radial density profile of the stellar superficial distribution of the young clusters. The fractal dimension and other statistical parameters of most of the sample indicate that there is a good cloud-cluster correlation, when compared to other works based on an artificial distribution of points (Lomax et al. 2011, MNRAS, 412, 627). As presented in a previous work (Fernandes et al. 2012, A&A, 541, A95), the cluster NGC 6530 is the only object of our sample that presents anomalous statistical behaviour. The fractal analysis shows that this cluster has a centrally concentrated distribution of stars that differs from the substructures found in the density distribution of the cloud projected in the A_V map, suggesting that the original cloud geometry was changed by the cluster formation.

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INCREASE OF IONIZATION FRACTION OF DUSTY PROTO-STELLAR ACCRETION DISKS BY DAMPING OF ALFVÉN WAVES

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The ambient of the cloud that gives rise to the process of star formationconsisted of: turbulence, magnetic field and dust. In general, in the process of star formation there is the formation of an accretion disk whose material must lose their angular momentum in order to be accreted into the central object. The magneto-rotational instability (MRI) is probably the mechanism responsible for a magnetohydrodynamic (MHD) turbulence that leads to disk accretion. However, this mechanism only exists if the gas in the disk is sufficiently ionized to be coupled to the magnetic field. Besides the viscous heating mechanism often included in the models by means of the alpha-prescription, in this work we study the damping of Alfvén waves as an additional heating source. The waves suffer a damping near the dust-cyclotron frequency, since charged grains in a magnetized disk are highly coupled to the waves due to cyclotron resonances. We study the transfer of energy from the damping of the waves to the disk and we show that this mechanism can increase the ionization fraction, making possible the presence of the MRI in a large part of the disk.

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THE ROLE OF RECONNECTION DIFFUSION IN THE GRAVITATIONAL COLLAPSE OF TURBULENT CLOUD CORES

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For a molecular cloud clump to form stars some transport of magnetic flux is required from the denser, inner regions to the outer regions of the cloud, otherwise this can prevent the collapse. Fast magnetic reconnection which takes place in the presence of turbulence can induce a process of reconnection diffusion (RD). Extending earlier numerical studies of reconnection diffusion in cylindrical clouds, we consider more realistic clouds with spherical gravitational potentials and also account for the effects of the gas self-gravity. We demonstrate that within our setup RD is efficient. We have also identified the conditions under which RD becomes strong enough to make an initially subcritical cloud clump supercritical and induce its collapse. Our results indicate that the formation of a supercritical core is regulated by a complex interplay between gravity, self-gravity, the magnetic field strength and nearly transonic and trans-Alfvénic turbulence, confirming that RD is able to remove magnetic flux from collapsing clumps, but only a few of them become nearly critical or supercritical, sub-Alfvénic cores, which is consistent with the observations. Besides, we have found that the supercritical cores built up in our simulations develop a predominantly helical magnetic field geometry which is also consistent with observations. Finally, we have evaluated the effective values of the turbulent reconnection diffusion coefficient

and found that they are much larger than the numerical diffusion, especially for initially trans-Alfvénic clouds, ensuring that the detected magnetic flux removal is due to to the action of the RD rather than to numerical diffusivity.

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MODELING THE CIRCUMSTELLAR ENVIRONMENT OF AB AUR USING THE Hα LINE

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AB Aurigae is the brightest Ae Herbig star in the northern hemisphere and it shows evidence of accretion and ejection processes in its circumstellar region. Moreover the Hα line shows a P-Cygni type profile which is a common indication of wind. Its Hα line is very variable, and most of this variation occurs in its blue-shifted side. One of the processes that can be used to explain this variation is a disk wind similar to those of the classical T Tauri stars. AB Aurigae has been observed using spectral interferometry in the optical region, by the VEGA spectrometer in the CHARA-array, which can resolve details of milliseconds of arc in size: in the case of AB Aur represent sizes smaller than 1 AU. With this resolution, it's possible to observe the region where the wind is being ejected. Using a radiative transfer code that already had been used to model the Hα line profiles in classical T Tauri stars, and adapting it to model the Hα line in AB Aur, we calculate an intensity map showing the region where this line is being formed, and then we compare it with data from the interferometric observations. This work will give us a better understanding of the ejection and accretion mechanism that are responsible for the formation of the Hα line around AB Aur and in some of the Herbig Ae/Be stars, and whether a disk wind mechanism can explain or not this line in these objects.

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STEADY-STATE ACCRETION DISK MODELS WITH VARIABLE α

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We present solutions for the radial and vertical structure of standard accretion disks (Shakura & Sunyaev). In these disks, the accretion and distribution of the angular momentum are controlled by the viscosity parameter, α. Self-similarity solutions for accretion disks predict that α must be constant on the disk, if the viscosity can be described by a power law $\nu \propto R^\gamma$ with $\gamma = 1$. Recently, Isella et al. (2009) showed that for a sample of 14 young stellar objects, $-0.8 \leq \gamma \leq 0.8$, indicating that $\alpha = \alpha(R)$. Based on these evidences, we have computed the structure for 11 of these objects, using $\alpha(R)$ as prescribed by Isella et al. (2009). We compare our results with the solutions of the same disks for $\alpha = 10^{-3}$ to 10^{-1}, constant. Our results show that the disks (as expected) are lighter, cooler and thinner in its inner regions, when compared with the disks with α constant. We make a qualitative analysis of the solutions obtained with the JED + SAD models (Jet Emitting Disk + Standard Accretion Disk), which also predict the same behavior for the central part of the accretion disks. We show that the height scale maps the age of the objects: the disks become thinner overall to the extent as the objects become older. As the stars studied have different masses and accretion rates, the results appear to be independent of the specific characteristics of the disk+star system.

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THE SONYC SURVEY: TOWARDS A COMPLETE CENSUS OF BROWN DWARFS IN STAR FORMING REGIONS

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Deep surveys of star forming regions are the backbone of observational studies on the origin of stars and planets: On one side, they provide large and homogeneous object samples required to study disks,