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