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Role of magnetic field in star formation

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Abstract. Magnetic fields are a key component in star formation theories. Nevertheless, their exact role in the formation of stars is still a matter of debate. The process of angular momentum transportation by the disturbance caused during magnetic field reconnection still needs theoretical formulation in terms of the collapsing cloud's parameters. The purposes of this study are: to model the critical mass of a magnetized, gravitating and turbulent star forming molecular cloud (MC) and to formulate the momentum carried out by a magnetic field through magnetic field reconnection in terms of the MC's parameters. By applying theoretical modeling, we show how angular momentum transported via an Alfvén wave can be described in terms of mass, radius and dispersion velocity of a collapsing cloud core and a model equation of the critical mass for a gravitating, turbulent, and magnetized molecular cloud core. The outflow of angular momentum by magnetic fields facilitates the inflow of mass. On the other side, magnetic pressure prevents collapse. Therefore, magnetic fields have a dual purpose in the process of star formation. This momentum outflow triggers the inflow of mass to conserve angular momentum. The results show that Alfvén waves are like a machine that extracts angular momentum from a magnetized collapsing cloud core. Thus the total angular momentum transported by magnetic field at a distance R from the core's center depends on the size, mass and turbulent velocity dispersion of the collapsing cloud core.

Keywords. Star formation, molecular cloud, magnetic pressure, turbulence, angular momentum