MAGNETIC BRAKING IN ROTATING BROWN DWARFS: AN OBSERVATION BASED STUDY

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ABSTRACT

Usually the brown dwarfs possess a very high rotation rate realized in the surface with different rotation rates at different latitudes. This differential rotation in brown dwarfs yields a dynamo process in their convective zone and eventually it generates magnetic field. It has been found that the relation between angular velocity and generated magnetic field strength at high rotation rates follow a power law distribution. But in low mass convective stellar and substellar bodies like the brown dwarfs the principal role of this magnetic field is the redistribution of angular velocity and so the angular momentum. As a consequence, the generated magnetic field later puts a brake in the existing rotation rate obeying again a power law. Thus the amount of braking in rotation rate possesses a direct explicit relation with the existing rotation rate. An effort is made in this work to identify the relationship between the differential rotation at different latitudes in the surface, the magnetic field generated as a consequence, braking in rotation rate due to the magnetic field strength and finally the effective rotation rate at different latitudes in the observed brown dwarfs. Here five different observed brown dwarfs are considered which are found to possess some magnetic fields due to the strong rotation. We have demonstrated the changing profiles of magnetic field strength and braking in rotation rate due to the magnetic field strength and the final effective rotation rate at different latitudes on the surface for each of the brown dwarfs separately.

Keywords: Brown dwarf, angular velocity, magnetic field strength, magnetic braking, effective rotation rate.

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