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Magnetic Field Configurations Associated With Angular Momentum Transport in Astrophysics and the Accretion Theory of Spontaneous Rotation in the Laboratory* B. COPPI, MIT — Differentially rotating structures in the prevalent field of a central object have been shown to develop a "crystal" magnetic structure resulting from toroidal internal currents and leading to the formation of density ring sequences[1] rather than disks. Poloidal current densities with appropriate symmetries are found to be connected with angular momentum transport processes represented by an effective viscosity. Jets are suggested to consist of a series of stable "smoke- rings" ejected vertically in opposite directions from the central region of the considered ring sequence. A small inward flow velocity is shown to induce a spiral pattern in the magnetic field lines on a selected family of magnetic surfaces. The accretion theory[2] of the spontaneous rotation phenomenon in toroidal laboratory plasmas relies on the ejection of angular momentum toward the surrounding material wall, by collisional ballooning modes excited at the edge, whose phase velocity depends on collisionality. The resulting recoil gives rise to the rotation of the main body of the plasma column as other plasma modes (called VTG) provide the needed inward transport of angular momentum. *Sponsored in part by the US D.O.E.

[1]B. Coppi and F. Rousseau, *Ap. J.* **641**, 458 (2006)
[2]B. Coppi, *Nuc. Fus.* **42**, 1 (2002)

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