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Magnetic drift in protoplanetary and circumplanetary discs

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Flux-freezing breaks down under the low levels of ionisation in molecular cloud cores and protoplanetary discs. The dominant processes are ambipolar diffusion and hall drift, which enable slippage of magnetic flux through the predominantly neutral gas. The nature of the field line drift through the bulk neutral component of the gas is as important as its magnitude. Under ambipolar diffusion, magnetic field lines in the direction of the local magnetic stress; the drift is accompanied by dissipation associated with collisions between charged and neutral species. The Hall effect introduces a drift perpendicular to the local magnetic stresses that is unaccompanied by dissipation. Hall drift dominates ambipolar diffusion over a wide range of radii in protoplanetary disks and likely plays a significant role during gravitational collapse of cloud cores.

I shall outline the physics underlying magnetic drift in a partially ionised medium and then discuss applications to gravitational collapse, magnetorotational instability and jet acceleration in protoplanetary and circumplanetary discs.

Author: Prof. WARDLE, Mark (Macquarie University)

Presenter: Prof. WARDLE, Mark (Macquarie University)

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