Magnetic fields in the ISM of the Milky Way and Nearby Galaxies

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In this lecture, I will discuss the physics of the magnetised interstellar medium (ISM), briefly outlining how Maxwell's equations lead to the presence of magnetic pressure and tension in the ISM. I will discuss the insights which we are gaining into the energy balance, dynamics and evolution of the magnetized ISM from recent observations and simulations, on size scales ranging from nearby star-forming regions to the discs and winds of nearby galaxies. I will particularly discuss how we can infer the dynamic importance of magnetic fields from measurements of magnetic field strength and geometry in the interstellar medium, and the emerging evidence for how the interaction between magnetic fields, outflows and feedback may influence star formation efficiency on both small and large scales. Finally, I will briefly discuss how future instrumentation will allow us to further investigate magnetic fields over the full range of size and density scales in the ISM.

Bibliography

- "The Physics of Fluids and Plasmas: An Introduction for Astrophysicists", Arnab Rai Choudhuri, Cambridge University Press, 2014: Chapter 6, "Basic Magnetohydrodynamics"
- "Magnetic fields in star formation: from clouds to cores", Pattle et al. 2023, Protostars and Planets VII, ASP Conference Series, Vol. 534, p.193