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The structure of relativistic jets and their magnetic fields

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Relativistic jets are ubiquitous on many different systems. From stellar-size objects such as X-ray binaries (XRBs) and gamma-ray bursts (GRBs) to billion times larger such as in active galactic nuclei (AGNs). Similarly, the inferred Lorentz factors of the jets range from mildly relativistic to ultra-relativistic with Gamma ~1000 in some GRBs. Despite decades of research, the structure, geometry and composition of jets is still highly debatable, with contradicting data.
Geoemtry-wise, it is now clear that jets are structured, which gives room to various phenomena, such as photon energy gain by repeated scattering. Contradicting data exists for the magnetic field and composition: in AGNs, the leading mechanism for jet production is Blandford-Znajek, which results in Pointing-dominated outflow. Magnetic field is measured using Faraday-rotation techniques. On the other hand, fitting GRB data indicates matter-dominated jets. I will discuss various possibilities of overcoming these discrepancies, including (i) neutrino contribution; (ii) matter injection via instabilities; and (iii) matter injection during the black hole formation.

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