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The dynamics of high energy density plasma jets magnetized by large dipole magnetic fields[1] PIERRE GOURDAIN, University of Rochester, TOM BYVANK, DAVE HAMMER, BRUCE KUSSE, CHARLIE SEYLER, Cornell University, SIMON BLAND, SERGEY LEBEDEV, GEORGE SWADLING, Imperial College — Astrophysical plasma jets expelled by proto-stars or galactic nuclei are often magnetized by the magnetic field that the star or galaxy generates. This field resembles the one of a dipole and, while strong near the celestial body, the field decays rapidly away from the source. Experimental observations of supersonic high energy density plasma jets generated in the laboratory by radial foils have shown that the field impacts strongly the dynamics of the jet. Such jets share some similarities with astrophysical jets in the magneto-hydrodynamics sense, e.g. large Reynolds, magnetic Reynolds and Peclet numbers. This work shows how a dipole field generated at the base of the supersonic jet affects the plasma dynamics. In regions where the plasma beta is low (near the base of the jet), the jet is conical. At higher altitudes, where the beta is high, the jet is strongly collimated. Numerical computations highlight the mechanisms responsible for such transitions.

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