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Numerical simulations of Z-Pinch experiments to create supersonic differentially-rotating plasma flows MATTEO BOCHI, SEBASTIAAN UMMELS, JEREMY CHITTENDEN, SERGEY LEBEDEV, Imperial College —
Recently, it was proposed that a small number of plasma jets produced by lasers could be used to generate a plasma configuration relevant to some features of astrophysical accretion disc physics. We propose complementary experimental configurations which employ converging flows generated in a cylindrical wire array Z-pinch modified to produce a rotating plasma. In this paper we present 3D MHD simulations using the code GORGON which show how this approach can be implemented at the MAGPIE facility at Imperial College, London. We will present the general scenario and the results of a parametric study relating the parameters of the array with the features of the resulting plasma. In particular, we will show how a rotating plasma cylinder or ring, with typical rotation velocity 30 Km/s and Mach number 8 is formed, and how, after about 1-2 revolutions, the material of the plasma ring is ejected in a pair of thermally driven, conical outflows propagating along the rotation axis. We will discuss to what aspects of the physics of accretion discs, the results of such experiments could be relevant. We will also consider the effects of different magnetic configurations, which further expand the possibility to relate the experiments with the astrophysical discs. Experimental implementation of some of these setups is currently in progress on MAGPIE.

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