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hedla@tecnico.ulisboa.pt

A laser-driven platform to study angular momentum transport in disk-jet transitions

Francisco Suzuki-Vidal[1,†], George Swadling[2], Mathieu Bailly-Grandvaux[3], Vicente Valenzuela-Villaseca[1], Christopher A. Walsh[2]

[1] *Blackett Laboratory, Imperial College London, UK*
[2] *Lawrence Livermore National Laboratory, USA*
[3] *Center for Energy Research, University of California at San Diego, La Jolla, California, USA*

[†] f.suzuki@imperial.ac.uk

We present first results on the formation of rotating plasma flows at the OMEGA laser to model physics relevant to accretion disks and jets in astrophysics. The experiments consist of a circular array of six V-shaped targets 3-D printed in CH and with a 5 degree offset respect to the axis of the array. The target package is illuminated with 12 beams, each with approx. 500 J and a 1 ns duration, leading to the formation of six radial jets propagating slightly off axis towards the centre of the array, driving a rotating plasma disk.

Time-resolved optical Thomson scattering spectra collected about the axis are Doppler shifted in opposite directions, as expected from a rotating flow. The measured rotation velocity is of the order of several hundreds of km/s. The data also indicates initial interpenetration of the colliding flows prior to the formation of the rotating disk.

The hydrodynamic regime in the experiments was studied with 3-D numerical simulations using the Gorgon code which, besides the formation of the radial flows and the rotating disk, predict the formation of an axial rotating jet in the center of the disk.

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