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Inward radial transport in differentially rotated plasma discs formed in z-pinch experiments SERGEY LEBEDEV, M. BENNETT, G.F. SWADLING, L. SUTTLE, Imperial College, E. BLACKMAN, University of Rochester , G. BURDIAK, J.P. CHITTENDEN, Imperial College, A. CIARDI, Paris Observatory, R.P. DRAKE, University of Michigan, A. FRANK, University of Rochester, G.N. HALL, J. HARE, S. PATANKAR, R.A. SMITH, F. SUZUKI-VIDAL, Imperial College — We will present experimental results showing the development of instabilities and an inward transport of matter in a differentially rotating supersonic plasma disc with dimensionless parameters relevant to modeling physics of astrophysical discs. The converging off-axis plasma flow forming the disc is produced by ablation of wires in a cylindrical wire array z-pinch (1.4MA, 250ns) combined with a cusp magnetic field, and the rotating disc is supported in equilibrium by the ram pressure of the flow. The radial profile of rotation velocity in the disc is measured using Doppler shifts of the ion feature of Thomson scattering spectra, while the broadening of the spectra yields the plasma temperature. The evolution of the disc structure is observed with multi-frame XUV and optical cameras, and the plasma density is measured using end-on laser interferometry. The Reynolds number in the disc is sufficiently large ($>10^5$) to allow development of turbulence on the time-scale of the experiment, and the observed inward transport of matter with the growth of small scale structures suggests that turbulence is responsible for the transport.

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