

Design of an experimental platform for jet-ambient interaction studies

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Abstract

The formation and evolution of shock structures and density non-uniformities along the jets from young stellar objects (YSOs) [1] provides insight into the basic fluid dynamics of collimated, radiatively-cooled supersonic flows. Pulsed power driven jets (conical/radial wire arrays; radial foils [2,3]) have appropriate dimensionless parameters (Mach number; Reynolds number; cooling parameter) to simulate aspects of this class of astrophysical jets under controlled conditions. In order to model YSO interaction dynamics we require a target plasma with density of the same order of magnitude as that of the jet. In our previous experiments gas cloud [4] and ablation of a plastic target [5] provided an ambient medium for jet interaction/deflection studies. In this paper we present a novel experimental configuration to propagate plasma jets into precursor plasma in a cylindrical wire array. Magnitude and distribution of density in the target plasma are selected by varying array diameter and wire number. It is found that this configuration enables user-friendly selection of interaction length and target density and preliminary results will be presented illustrating

the influence of target density and jet material on the flow dynamics of conical wire array jets.

- [1] Hartigan et al. 2011, ApJ, 736, 29
- [2] Lebedev et al. 2002, ApJ, 564, 113-119
- [3] Ciardi et al. 2009, ApJ, 691, L147-L150
- [4] Suzuki-Vidal et al. 2012, PoP, accepted
- [5] Lebedev et al. 2004, ApJ, 616, 988-997