

## Experimental studies of magnetically driven plasma jets

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We will present experimental results on the formation of supersonic, radiatively cooled jets driven by the pressure of the toroidal magnetic field generated by the 1.5 MA, 250 ns current from the MAGPIE generator. The morphology of the jet produced in the experiments is relevant to the “magnetic tower” scenario in astrophysical jets, in which the jet on the axis of a magnetic cavity expanding into the ambient medium is collimated by the toroidal magnetic field. The jets in the experiments have similar Mach number, plasma beta and cooling parameter to those in protostellar jets and additionally the Reynolds, magnetic Reynolds and Peclet numbers are much larger than unity, allowing the experiments to be scaled to astrophysical flows [1]. The experimental configuration allows for the generation of episodic magnetic cavities [2,3], suggesting that periodic formation of jets in the astrophysical situations could be responsible for some of the variability observed in astrophysical jets. Preliminary measurements of magnetic, kinetic and Poynting energy of the jets in the experiments, together with estimates of their temperature and trapped toroidal magnetic field will be presented and discussed.

### References

- [1] S. V. Lebedev et al., Mon. Not. R. Astron. Soc., 361, 97-108, 2005.
- [2] A. Ciardi et al., The Astrophysical Journal, 691, L147-L150, 2009.
- [3] F. Suzuki-Vidal et al., Astrophysics and Space Science, 322, 19-23, 2009.