Preliminary Laboratory Astrophysics Experiments on SPHINX and OEDIPE Pulsed Power Devices at CEA GRAMAT

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Simulating astrophysical phenomena in laboratory experiments has made considerable progress with the advent of high-power lasers and z-pinch pulsed power devices. In that field of research, scaled-down laboratory jets relevant to Herbig-Haro objects capability has been demonstrated. Recently, it has been shown on the Z-pinch MAGPIE (2MA, 250 ns) installation of Imperial College that unique experimental techniques to study both the jet formation, using radial arrays, and its propagation, using conical arrays, are now available [1].

CEA GRAMAT Z-pinch pulsed power facilities are among the biggest in Europe. SPHINX machine [2] is a 8MA, 1.2 µs driver and OEDIPE is a 800 kA, 1.4 µs driver. SPHINX was built and is used to produce k-shell radiation sources using wire arrays or Gas Puff z-pinch loads for radiation effects studies [3]. A unique characteristics of CEA GRAMAT devices, which makes them ideal for laboratory astrophysics experiments, is their relatively long current rise-time. It is expected to gain experimental access to jets of lengths of up to 10-20 cm (factor of ten or more compared to other pulsed-power facilities and 100 compared to laser produced jets), giving the opportunity to follow the dynamics, and development of instabilities, well into the non-linear regime.

We present preliminary experiments of radial and conical wire array loads on both SPHINX and OEDIPE. Pulsed-power devices are described as well as diagnostics setup. Results shown are very encouraging as the capability of having scaled-down, related laboratory system in such details opens up the exciting prospect to gain a deep understanding of these flows complementary to astronomical observations.

References

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