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I2.006 Magnetized laser plasmas for laboratory astrophysics

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Coupling high-power lasers and high-strength magnetic fields helps gaining unique insight and understanding of a variety of phenomena of crucial importance for astrophysics. We have shown that such platform could be used to mimic the expansion of a young star isotropic disk wind threaded by a co-axial poloidal magnetic field [1, 2, 3]. The same system can also be used to study (i) the issue of accretion dynamics in young star [4], in particular to shed light on the deficiency of x-ray emissivity in these systems, or (ii) the issue particle energization in astrophysical plasmas [5]. These examples will be reviewed and discussed, as well as examples in investigating the fundamental issue of magnetic reconnection in plasmas. We will also discuss perspectives offered by the upcoming new generation of lasers that will offer unprecedented levels of power (up to 10 PW), which will allow to generate very dense bunches of particles at high energy. This could also have a positive impact on laboratory astrophysical studies, e.g. in the field of nucleosynthesis studies where extreme fluxes of neutrons are required in order to investigate double neutron capture, which is out of reach of existing, accelerator-based facilities, but which lasers might allow to tackle.

[1] D. P. Higginson, et al., "Enhancement of quasi-stationary shocks and heating via temporalstaging in a magnetized, laser-plasma jet", Phys. Rev. Lett. 119, 255002 (2017)
[2] D. P. Higginson, et al., "Detailed Characterization of Laser-Produced AstrophysicallyRelevant Jets Formed via a Poloidal Magnetic Nozzle", High Energy Dens. Physics 23, 48-59 (2017)
[3] B. Albertazzi et al., "Laboratory formation of a scaled protostellar jet by co-aligned poloidal magnetic field", Science 346, 325 (2014)
[4] G. Revet, et al., "Laboratory unravelling of matter accretion in young stars", Science Advances 3, no. 11, e1700982 (2017)
[5] D. P. Higginson, et al., "A Novel Platform to Study Magnetized High-Velocity Collisionless Shocks", High Energy Dens. Physics 17, 190-197 (2015)

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