Adiabatic-radiative shock systems in astrophysical jets: from the gamma-ray sky to the laboratory

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Abstract

Of all the processes in the Universe, the bipolar ejection of collimated plasma outflows from the inner regions of the accretion disc around a central object are among the most remarkable. Highly supersonic jets form high mass protostars and outflows in classical novae create a double shock structure where they terminate. The coexistence of an adiabatic and a radiative shock is expected in the jet termination region, being this scenario very promising for particle acceleration and high-energy emission [4]. By combining multi-wavelength observational data, numerical simulations, and plasma physics we study diffusive shock acceleration, magnetic field amplification and gamma-ray emission in jets in protostars and supersonic outflows in classical novae. We find that the magnetic field in the jet termination region can be amplified by the non-resonant hybrid (Bell) instability excited by the cosmic-ray streaming [2, 1]. Furthermore, the parameters for scaled laboratory experiments are very much in line with plasma conditions achievable in high-power laser facilities opening the door to new means for studying novae outflows never considered before [3].

References

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