High-Energy Density Laboratory Astrophysics Studies of Accretion Shocks in Magnetic Cataclysmic Variables

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Résumé

Magnetic cataclysmic variables are binary systems containing an accreting magnetic white dwarf which accretes matter from a late type Roche-lobe filling secondary star. The presence of intense magnetic field, radiation and hydrodynamics implies a rich range of behaviours at different spatial and time scales. The radiation collected from these objects mainly comes from complex areas (the accretion column) near the white dwarf surface where the matter is heated by a stand-off shock to a temperature of around 10-50 keV, then cools by bremsstrahlung emission and other cooling processes that lead to the formation of a cooling layer. Unfortunately, the size scales associated with these radiative zones are on the order of the white dwarf radius or smaller, which complicates their direct observation. Thus, the possibility of reproducing these phenomena in the laboratory is a real opportunity to increase our understanding of the physics of accretion processes. We proved theoretically that by using an adapted scaling law we can reproduce, with powerful lasers, a laboratory accretion column at diagnosable spatial scales. Recently we have investigated this experimentally with the LULI2000 facility. The recent experimental, theoretical and numerical results and their connection with astronomical observations will be presented and discussed.

Mots-Clés: accretion, shock, laboratory, astrophysics

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