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Radiative Reverse Shock Laser Experiments Relevant to Accretion Processes in Cataclysmic Variables[1]

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We present results from experiments that explore radiative reverse shock waves and their contribution to the evolving dynamics of the cataclysmic variable (CV) system in which they reside. CVs are close binary star systems containing a white dwarf (WD) that accretes matter from its late-type main sequence companion star. In the process of accretion, a reverse shock forms when the supersonic infalling plasma is impeded. It provides the main source of radiation in the binary systems. In the case of a non-magnetic CV, the impact on an accretion disk produces this "hot spot," where the flow obliquely strikes the rotating accretion disk. This collision region has many ambiguities as a radiation hydrodynamic system, but shock development in the infalling flow can be modeled [1]. We discuss the production of radiative reverse shocks in experiments at the Omega-60 laser facility. The ability of this high-intensity laser to create large energy densities in targets having millimeter-scale volumes makes it feasible to create supersonic plasma flows. Obtaining a radiative reverse shock in the laboratory requires a sufficiently fast flow (> 60 km/s) within a material whose opacity is large enough to produce energetically significant emission from experimentally achievable layers. We will show the radiographic and emission data from three campaigns on Omega-60 with accompanying CRASH [2] simulations, and will discuss the implications in the context of the CV system.

[1] Armitage, P. J. and Livio, M., ApJ, 493, 898 (1998).
[2] van der Holst, B., Toth, G., Sokolov, I.V., et al., ApJS, 194, 23 (2011).

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