Structure of High Velocity Radiative Shocks from optically Thin to Thick

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In astrophysics, many phenomena involving strong radiative shocks (RS) disturb and inject energy into the interstellar medium, affecting the rate of star formation in galaxies. For instance, the compression and disturbance of the interstellar gas caused by shocks from supernova explosions can trigger the collapse of nearby molecular clouds, initiating the formation of new stars. Therefore, the interaction of strong radiative shock waves with other structures is a central problem in astrophysics. Moreover, magnetic fields play an important role additionally to radiation for example in protogalaxies giving rise to globular clusters. It also can stabilize thermal instability with a transverse magnetic field. Recent results of radiative shock (and their interaction with an obstacle) experiments on laser facilities are shown where we have measured many of the variables involved such as shock velocity, radiative precursor length and temperature, ablation of an obstacle by the radiation, shock generated in the obstacle after shock impact. We studied the transition between an optically thin medium (low xenon gas pressure) to optically thick (high xenon gas pressure) and observed a huge difference in the shock and radiative precursor length. In the meanwhile, we performed 2d numerical investigations using FLASH code when an external B field is present as it intervenes in the astropohysical situation. In the case of radiative magnetised shock, we do observe the generation of a magnetosonic wave ahead of the RS for a B field perpendicular to the shock propagation. Discussion on the impact in astrophysics will be presented.

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