Modeling in the laboratory the interaction of Supernovae Remnants with various Astrophysical objects

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The physics of supernova remnants (SNRs) interacting with the ambient medium and astrophysical objects (another SNR, molecular clouds, stars, jet winds, …) is fundamental in the structure and the dynamics of the interstellar medium (ISM) and also in high-energy astrophysics. During the last two decades, astronomical observations highlighted mysterious objects which could be related to SNR-SNR interaction (DEM L316 [1], 3C400.2 [2] or in the Cygnus Loop [3]). This conclusion is only based on multi-dimensional numerical simulations because the multiwavelength studies of emitted radiation coming from these astrophysical objects are not sufficient to constrain the origin of these specific structure. Moreover, it is difficult to know if the double shell structure observed is due to the optical projection of the SNRs or due to a real impact. In addition, these regions could be favorable to star formation by interacting with small clump in molecular clouds. In this talk, a different approach has been established to try to improve our knowledge of these objects. We present a series of experiment made at LULI2000 modelling in the laboratory (i) the interaction of two BWs [4] and (ii) the interaction of BWs with a spherical object mimicking a clump. To this end, one or two beams of LULI2000 are used and focused on 300 µm diameter carbon rods, located a part from the central axis of the chamber, producing the BW that will propagate in differents gases (N2, Ar) and interact on the axis. Various optical diagnostics have been implemented to access to the relevant parameters (velocity, density, temperature, …) and therefore, fully characterize the interaction zone formed by the collision of two blast waves in their Taylor-Sedov phase. In addition, x-ray radiography have been also used to observe the compression of a sphere produced during its interaction with BWs. By changing the backlighter beam delay from shot to shot we have been able to follow the dynamic of the compression wave propagating inside the sphere.

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