Rayleigh-Taylor instabilities relevant to Supernovae Remnants

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Hydrodynamics instabilities, such as the Rayleigh-Taylor (RT) or Richtmyer-Meshkov (RM), play a major role in astrophysical fluid dynamics. In particular, they might be responsible of the lack of spherical symmetry in Supernova Remnants, and might affect the dissipation of the energy. Those instabilities also have a huge impact on ICF as they are potentially involved in mixing, which prevents to achieve ignition. In general, models are often not accurate enough, especially to describe late-time evolution of RTI. Experimental data are therefore needed in non-linear or turbulent phases to benchmark both models and simulations.

In this context we performed an experiment on the LULI2000 facility, in order to observe on highly non-linear stage of RTI. To this end, the target was made of modulated brominated plastic pusher with a low density foam (20 to 500 mg/cc) acting as decelerating medium. A short pulse X-ray back-lighter have been used (ref Brambrink HPLSE) in a bottom-up geometry, giving a 25 µm spatial resolution. This setup allowed us to acquire a complete and detailed time sequence of the RTI evolution, until its highly non-linear stage varying the Atwood number from 0.44 to 0.97. Finally, a direct comparison to FLASH simulations shows good agreement in all cases.