Experimental evidence of the Landau-Darrieus instability in HED conditions

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The unprecedented laser capabilities of NIF make it possible to consider laboratory scale experiments in which large laser focal spots is sustained over large amount of time [1]. We present here a set of direct drive experiments on NIF sustaining a 2 mm flat ablation front inside a thick foam foil ~~during~~ for 30 ns. The purpose of this proposal is to ~~evidence~~ observe for the first time the Landau-Darrieus Instability (LDI) in the context of laser driven ablation fronts. In ~~the same way than~~a similar way to a flame, a laser driven ablation front is a deflagration wave, transforming cold dense matter into hot light matter. The LDI is a generic instability of deflagration waves. Consequently, the LDI ~~is supposed to be also observed~~should be observable in direct-drive laser experiments. ~~However,~~Although this ubiquitous instability ~~in the~~is well known in combustion and astrophysical communities, it had not been observed until then in the context of laser experiments ~~context~~.

The success of these experiments constitute a major breakthrough in the field, essentially because the LDI has been speculated for years but thought to be not observable in the laser-plasma context. Reaching the laser experimental conditions of the development of this instability open the field of nuclear flames analogy study in laboratory and comfort our current understanding of the ablation front instabilities.

Reference:

[1] A. Casner *et al.*, Phys. Plasmas **22**, 056302 (2015).

Mis en forme : Anglais (États-Unis)