Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

The scaling laws of an exploding liquid cylinder irradiated by an ultrashort X-ray pulse[1] ALFONSO GANAN-CALVO, Universidad de Sevilla, ETSI, 41092 Sevilla, Spain — A general formulation of the partial destruction of a liquid object in vacuum after the sudden deposition of a very large amount of energy is proposed. That energy instantaneously raises the pressure of a portion of the liquid to extreme values and changes its state, which causes its explosive expansion into vacuum and against the rest of the liquid object. When the deformable object is a liquid capillary cylinder or column, the model reduces to a universal equation for the evolution of the expanding gap between the two sides of the exploding liquid column. The theoretical analysis contemplates two asymptotic stages for small and large times from the initiation of the blast, whose asymptotic solutions are fitted to available experimental data. An universal approximate analytical solution is obtained. A complete dimensional analysis of the problem and an optimal collapse of experimental data reveal that the proposed solution is in remarkable agreement with experiments of a jet exploding after being irradiated by an ultrashort and intense X-ray pulse from a X-ray free electron laser (XFEL).

[1]Supported by the Ministerio de Economia y Competitividad (Spain), Plan Estatal Retos, project DPI2016-78887-C3-1-R

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Date submitted: 29 Jul 2019 Electronic form version 1.4