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Liquid explosions induced by X-ray laser pulses CLAUDIU STAN, HARTAWAN LAKSMONO, RAYMOND SIERRA, TREVOR MCQUEEN, DESPINA MILATHIANAKI, JASON KOGLIN, THOMAS LANE, MARC MESSERSCHMIDT, GARTH WILLIAMS, MATT HAYES, SERGE GUILLET, SLAC National Accelerator Laboratory, SABINE BOTHA, KAROL NASS, ILME SCHLICHTING, ROBERT SHOEMAN, Max-Planck Institute for Medical Research, HOWARD STONE, Princeton University, SBASTIEN BOUTET, SLAC National Accelerator Laboratory — Sudden generation and release of enough energy to vaporize matter are encountered in systems that range from supernovae explosions and asteroid impacts to applications in fusion energy generation, materials processing, and laser surgery. Understanding these strong explosions is important to both fundamental science and technical applications. We studied a new type of microexplosion, induced by absorption of X-ray pulses from a free-electron laser in micron-sized drops and jets of water. These explosions are related to, but different from, those observed in experiments performed with optical lasers. Unlike explosions caused by optical lasers, X-ray laser explosions produce symmetric expansion patterns that are simpler to rationalize. The release of energy initially concentrated in a small region inside drops and jets leads to ballistic vapor flow and inertial liquid flow. The kinematics of these flows indicates that the conversion of the energy deposited by X-rays into flow has a scaling that is similar to the one encountered in shock waves.

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