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Uniting the family of jets of single cavitation bubbles[1] OUTI SUPPONEN, Ecole polytechnique fédérale de Lausanne, DANAIL OBRESCHKOW, University of Western Australia, MARC TINGUELY, PHILIPPE KOBEL, NICOLAS DORSAZ, MOHAMED FARHAT, Ecole polytechnique fédérale de Lausanne
— Micro-jets are high-speed liquid jets that are produced when a cavitation bubble experiences a non-spherical collapse. Such jets may be driven by any anisotropy in the liquid, such as those induced by near surfaces, gravity, pressure gradients in flows or shock waves. Here we unify this diverse family of micro-jets by describing their dynamics with a single anisotropy parameter $\zeta \geq 0$ that represents a dimensionless version of the liquid momentum at the collapse point. We observe, experimentally and numerically, that the dimensionless jet parameters describing the jet speed, jet impact time, bubble displacement, bubble volume at jet impact and vapor-jet volume, all reduce to functions of ζ. Consequently, a measurement of a single parameter, such as the bubble displacement, may be used to estimate any other parameter, such as the jet speed. The jets are phenomenologically categorized into three visually distinct regimes: weak jets that hardly pierce the bubble, intermediate jets that pierce the bubble late during the collapse, and strong jets that pierce the bubble at an early stage of the collapse. In the weak and intermediate jet regimes, that is, when $\zeta < 0.1$, the dimensionless jet parameters scale as simple power laws of ζ independently of the jet driver.

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