Laser Streaming: Turning a Laser Beam into a Liquid Jet Flow

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Transforming a laser beam into a mass jet flow has been a challenge both scientifically and technologically. I will present our recent demonstration of the generation of a liquid jet by simply focusing a pulsed laser into water through a glass window. The jet originates from the laser focusing spot on the glass and moves in the same direction as the refracted beam. Microscopically, this transformation is made possible by an underlying plasmonic nanoparticle-decorated cavity which is self-fabricated on the glass by nanoparticle-assisted laser etching and exhibits size and shape uniquely tailored to the incident beam profile. Hydrophone signals indicate that the jet is driven via acoustic streaming by a long-lasting ultrasound that is resonantly generated by laser and the cavity through the photoacoustic effect. Creating new research in optofluidics and opening up enormous light-controlled device applications. The principle of this light-driven flow via ultrasound, i.e. photoacoustic streaming by coupling photoacoustics to acoustic streaming, is general and can be applied to any liquids. This generality is verified by our latest generation of jet flow by a pre-fabricated gold implanted glass window.