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Atomization and deviation of cylindrical water jets in a transverse acoustic field

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This work deals with a particular breakup mode experienced by cylindrical liquid jets when submitted to an intense transverse acoustic wave. Experiments on low speed water jets (< 1 m/s) of diameters 3 mm and 6 mm show that sound waves with a frequency ranging from 500 Hz to 1800 Hz can produce bulges along the jet. When the sound level is high enough, these bulges can trigger an effective atomization mechanism where the jet flattens as a liquid sheet before disintegrating. Sound field can also induce steady deviation of the jet. Both phenomena are theoretically studied. A first model, which treats bulges as outward marks of one particular mode of vibration of the liquid column, is proposed. This model leads to a criterion for the onset of atomization that satisfactorily agrees with experimental observations of the present work. A second analysis identifies deviations as radiation pressure effects. It predicts the direction of experimental deviations with success.