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Metastable states of rigid bodies in a flow. ASHWIN VAIDYA, DORALIA CASTILLO, MATT CRISTALDI, Montclair State University, BONGJAE CHUNG, George Mason University, KARINA SORIANO, HAIYAN SU, Montclair State University — Symmetric bodies such as cylinders and spheroids, in their terminal stable states, are long known to have their long axis align themselves perpendicular to the direction of flow. This property has been confirmed in sedimentation and horizontal flow setup and the transition to a terminal stable state is believed to coincide with the onset of significant inertial effects in the flow. However, the threshold at which this transition occurs is yet unknown. In this presentation we report a recent experimental study to examine the nature of the transition of prolate spheroids and cylinders of various aspect ratios, from initial to their terminal stable equilibrium. Our experiments reveal that the body reconfigures itself from its initial orientation, continuously to an angle perpendicular to the flow direction, revealing possible steady intermediate angles. Are these "metastable states" real or an artifact of our experiments? Experiments performed on a variety of bodies and using different suspension mechanism show this state to be persistent. A three dimensional numerical simulations performed by us provide strong support for these observations and reveals interesting new findings about the nature of the torque imposed on the body due to the flow at changing Reynolds numbers.

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