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**Rotation-triggered path instabilities of rising spheres and cylinder** VARGHESE MATHAI, XIAOJUE ZHU, Physics of Fluids Group, University of Twente, The Netherlands, CHAO SUN, Center for Combustion Energy Department of Thermal Engineering, Tsinghua University, DETLEF LOHSE, Physics of Fluids Group, University of Twente, The Netherlands — Path-instabilities are a common observation in the dynamics of buoyant particles in flows. However, the factors leading to the onset of oscillatory motion have remained difficult to predict even for simple bodies such as bubbles, spheres and cylinders. In literature, two quantities are considered to control the buoyancy-driven dynamics for isotropic bodies (spheres and cylinders); they are the particle's density relative to the fluid ($\Gamma \equiv \rho_\mathrm{p}/\rho_\mathrm{f}$) and its Galileo number (Ga). In contrast to this picture, we show that buoyant spheres (as well as cylinders) can exhibit dramatically different modes of vibration and wake-shedding patterns under seemingly identical conditions ($\Gamma$ and Ga fixed). These effects stem from the simplest of changes in the mass distribution of the particle (hollow to solid sphere), which changes its rotational inertia. We show that rotation can couple with the particle's translational motion and trigger distinctly different wake-induced oscillatory motions. The present findings also provide an explanation for the wide variation that is witnessed in the dynamics of buoyant isotropic bodies.

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