Abstract Submitted
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Resonant Alignment of Prolate Ellipsoids in Taylor-Couette Flow[1] MARTIN ASSEN, CHONG SHEN NG, JELLE WILL, RICHARD STEVENS, Univ of Twente, ROBERTO VERZICCO, Univ of Rome, DETLEF LOHSE, Univ of Twente — Neutrally buoyant spheres have been observed to preferentially concentrate in Taylor-Couette flow. This phenomenon can be attributed to Faxen forces (Henderson et al. 2007) or a balance between shear gradient and wall effects (Majji Morris 2018). But, the precise influence of particle shape on preferential clustering in Taylor-Couette flow is unknown. Using direct numerical simulations with the immersed boundary method, we show that prolate ellipsoids (Elongated spheroids, $\ell/d = 0.1$ with ℓ the particle major axis and d the gap-width between the cylinders) tend to get trapped at the Taylor vortex core for a specific range of Taylor numbers. Furthermore, trapped ellipsoids have their axis of revolution aligned with the tangent along the cylinder. This preferential clustering at the vortex core is a finite size effect and is therefore greatly enhanced when the ellipsoids are doubled in size. The clustering and alignment of the ellipsoids are shown to be linked to local flow regions where the axial vorticity of the Taylor vortex is lowest.

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Martin Assen
Univ of Twente

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