Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Chaotic orbits tracked by a 3D asymmetric immersed solid at high Reynolds numbers using a novel Gerris-Immersed Solid (DNS) Solver PEI SHUI, Institute for Materials and Processes, School of Engineering, The University of Edinburgh, United Kindom, STÉPHANE POPINET, National Institute of Water and Atmospheric Research, P.O. Box 14-901, Kilbirnie, Wellington, New Zealand, PRASHANT VALLURI, Institute for Materials and Processes, School of Engineering, The University of Edinburgh, United Kindom, RAMA GOVINDARAJAN, TIFR-Hyderabad, Narsingi, Hyderabad 500075, India — The motion of a neutrally buoyant ellipsoidal solid with an initial momentum has been theoretically predicted to be chaotic in inviscid flow by Aref (1993). On the other hand, the particle could stop moving when the damping viscous force is strong enough. This work provides numerical evidence for 3D chaotic motion of a neutrally buoyant general ellipsoidal solid and suggests criteria for triggering this motion. The study also shows that the translational/rotational energy ratio plays the key role on the motion pattern, while the particle geometry and density aspect ratios also have some influence on the chaotic behaviour. We have developed a novel variant of the immersed solid solver under the framework of the Gerris flow package of Popinet et al. (2003). Our solid solver, the Gerris Immersed Solid Solver (GISS), is capable of handling 6 degree-of-freedom motion of particles with arbitrary geometry and number in three-dimensions and can precisely predict the hydrodynamic interactions and their effects on particle trajectories. The reliability and accuracy have been checked by a series of classical studies, testing both translational and rotational motions with a vast range of flow properties.

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Date submitted: 29 Jul 2014 Electronic form version 1.4