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Flow past an obstacle immersed in a Yukawa liquid: An atomistic study HARISH CHARAN, RAJARAMAN GANESH, Inst for Plasm Res — Understanding vortex dynamics in the flow past an obstacle in conventional fluids is a fundamental problem which exhibits a Universal relation between dimensionless vortex generation frequency described by Strouhal number (St) and dimensionless viscosity represented by Reynolds number (Ry). Considering Yukawa liquid as a prototype for strongly coupled fluids, characterized by coupling strength (Γ, ratio of average potential to kinetic energy per particle) and screening parameter (κ, ratio of mean inter-particle distance to shielding length), we address the fundamental problem of flow past an obstacle immersed in a Yukawa liquid using first principles based classical molecular dynamics simulations. The flow past an obstacle is seen to indeed develop patterns at the wake and vortices which are seen to dynamically shed the obstacle. We investigate the phenomena for the range of values of subsonic flow speeds, Ry (2-35), Γ (10-100) and κ (0.25-1.5). We demonstrate the existence of a new Universal St-Ry relation for Yukawa liquids and growth rate dependency on Ry. Universality of the St-Ry relationship is shown to be valid at very low Ry numbers considered ($2 < Ry < 35$). Explicit growth rate analysis has been done for the first time at the atomic scale.

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