

Self-sustained rotational dynamics of a dust particle pair in a plasma flow

Kolotinskii D.A.^{1,2,@}, Lisin E.A.^{1,2}, Syrovatka R.A.^{1,2},
Timofeev A.V.^{1,2,3}, Voronov I.V.^{1,2}, Vasiliev M.M.^{1,2} and
Petrov O.F.^{1,2}

¹ Moscow Institute of Physics and Technology, Institutskiy Pereulok 9,
Dolgoprudny, 141701, Russia

² Joint Institute for High Temperatures of the Russian Academy of Sciences,
Izhorskaya 13 Bldg 2, Moscow, 125412, Russia

³ National Research University Higher School of Economics, Myasnitskaya 20,
Moscow, 101000, Russia

@ kolotinsky.daniil@yandex.ru

We report experimental and numerical studies of self-sustained rotation in a minimal plasma–dust system of two vertically aligned particles levitating in an RF discharge plasma. The rotation arises spontaneously without magnetic fields or surface activity, representing the simplest configuration exhibiting coherent non-Hamiltonian dynamics. Simulations with the self-consistent OPENDUST code [1] reproduce this behavior and show that it results from asymmetry of interparticle interaction due to the ion wake potential and charge difference caused by ion shadowing. Linear stability analysis confirms that symmetry breaking leads to a Hopf-type bifurcation and sustained rotation. These findings provide the first combined experimental and theoretical evidence of synchronized rotation in a two-particle plasma system, complementing earlier observations of torsional dynamics in plasma monolayers [2–5].

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