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Circulation' dynamo in complex plasma

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In ground based experiments (performed in Ar using a rf discharge), we observe the interaction of individual agglomerated particles with a monodisperse (bulk) complex plasma cloud containing (melamine formaldehyde) microparticles of 7.17 μm $\pm$3% diameter. The particles are levitated by thermophoresis. For this purpose, a gas temperature gradient 2000 K/m is applied. The particle cloud has a complicated 'sandwich-like' vertical structure of two dense slabs (filled by particles), separated by a void, a central particle free region. The void is impenetrable for the small of the bulk particles, but not for heavier and/or accelerated agglomerates, which may slide through the entire void and therefore can be used as natural test particles for determination of the acting force inside the void. The bulk particle remains in quasi equilibrium for a long time and is dynamically active, e.g. intense edge rotations (vortices) and nonlinear vertical waves. We traced particle motions in detail and studied the correlation of particle vibrations inside the clouds and the motion of agglomerates and/or accelerated particles penetrating through the void. In this report we focus our attention on the physical mechanism of particle rotations, which we have termed "a circulation' dynamo". It has been observed and investigated for the first time at the kinetic level in laboratory experiments in a dusty plasma, where gravity was compensated by an opposite temperature gradient. A possible physical explanation of the cloud's activity is based on the assumption, that the phenomenon can be considered as a consequence of the non-Hamiltonian character of complex plasmas.