Multiscale simulation of dust clusters in a strongly magnetized flowing plasma

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A key problem in the description of non-ideal, multi-component plasmas is the drastic difference in the characteristic length and time scales of the different particle species. This challenging multiscale problem inherent to studying streaming complex plasmas can efficiently be tackled by a statistical, linear-response ansatz for the light plasma constituents in combination with first-principle Langevin dynamics simulations of the heavy and strongly correlated dust component [1]. Of crucial importance in this scheme is the quality of the dynamically screened Coulomb potential [2]. For this purpose, we introduce Kielstream [3], a new high-performance computer code for the computation of three-dimensional plasma wakefields and the resulting electric fields.

Using the dielectric function for a partially ionized flowing magnetized plasma—introduced in the contribution by Kählert *et al.*—results are presented (i) for the wakefield around a single dust grain, (ii) multiscale simulations of a correlated ensemble of grains revealing fundamental structural changes when wake effects and an external magnetic field come into play, (iii) improved wakefields that take into account the non-Maxwellian character of the ion distribution.

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[2] P. Ludwig, W.J. Miloch, H. Kählert, and M. Bonitz, New J. Phys. **14**, 053016 (2012)

[3] P. Ludwig, C. Arran, and M. Bonitz, "*Introduction to Streaming Complex Plasmas B: Theoretical Description of Wake Effects*", Chapter in: "Complex Plasmas: Scientific Challenges and Technological Opportunities, M. Bonitz, K. Becker, J. Lopez and H. Thomsen [Eds.], Springer Series on Atomic, Optical and Plasma Physics, (2014)

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