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Non-conservative charged particle swarms in ac electric and magnetic fields[1] SASA DUJKO, RONALD WHITE, School of Engineering and Physical Sciences, James Cook University, ZORAN PETROVIC, Institute of Physics, University of Belgrade — A time-dependent multi term solution of the Boltzmann equation has been developed and used to calculate the transport properties of charged particle swarms under the influence of time-dependent electric and magnetic fields crossed at arbitrary angle. The hierarchy resulting from a spherical harmonic decomposition of the Boltzmann equation in the hydrodynamic regime is solved numerically by representing the speed dependence of the phase-space distribution function in terms of an expansion in Sonine polynomials about a Maxwellian distribution at internaly determined temperature. The investigation is carried out over a wide range of electric and magnetic field amplitudes, field frequencies, field orientations and phases between the fields corresponding to various conditions operative in ICP. Values of mean energy, drift velocity, diffusion tensor and power density absorbed by the electron swarm for certain model and real gases are reported here. A multitude of new kinetic phenomena induced by temporal non-locality of electron kinetics were observed and explained using a physical arguments. Of special note are the phenomena associated with the synergism of magnetic field and non-conservatibve collisions. We believe that modelling of ICP and magnetically enhanced/assisted plasma reactors can greatly benefit from this study.

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