Masters project

Rotational dynamics of trapped dipolar molecular ions

Ion traps are devices that use electric fields, sometimes in combination with magnetic fields, to constrain the movements of atomic or molecular ions. They are used in many different contexts, such as high-precision spectroscopy, atomic clocks, and quantum computing. At low temperatures, an ensemble of trapped ions will form a Coulomb crystal, where the position of each ion is fixed as in a solid crystal. While these systems have been intensely studied for atomic ions, not much theoretical work has been done for molecular ions. In particular, the effect on the rotations of the molecular ions due to dipole.dipole interactions has not been investigated.

The goal of this project is to study a Coulomb crystal of dipolar molecular ions. This will require the development of a classical model for the trapped ions and their interaction, as well as running simulations of the Coulomb crystal. The possibility of phase transitions in the system will be investigated.

This project requires good computational skills. An understanding of Monte Carlo methods and molecular physics are a plus. Knowledge of a programming language (Fortran 90, C, C++) is required.

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