Contribution ID: **273** Type: **Poster**

Search for millicharged particles using optically levitated microspheres

Millicharged particles, i.e. particles with charges much smaller than that of an electron, have been predicted by extensions to the Standard Model containing additional weakly-coupled gauge sectors, such as hidden sector dark matter models. If such particles were thermally produced in the early universe, they could have formed stable bound states with atoms and exist in measurable concentrations in terrestrial matter. Significant parameter space for millicharged particles remains unexplored at masses >1 GeV and charges <0.1 e, where previous accelerator- and levitometer-based searches become insensitive. We are developing a novel technique to search for millicharged particles in bulk matter using 5 um diameter quartz spheres that are optically levitated in high vacuum. We have demonstrated a force sensitivity of 4x10^-17 N Hz^-1/2 for 0.1 ng spheres, corresponding to a charge sensitivity of 3x10^-4 e Hz^-1/2 at an applied electric field of 1 kV/mm. We will describe the experimental apparatus and the expected sensitivity of a search for millicharged particles bound within the microspheres. The high force sensitivity of this technique can also be applied to searches for other short range forces, such as non-Newtonian gravitational interactions at micron distances.

Primary author: MOORE, David (Stanford University)

Co-authors: RIDER, Alexander (Stanford University); GRATTA, Giorgio (Stanford University); LU, Marie (Stanford University)

Presenter: MOORE, David (Stanford University)

Track Classification: 12) New concepts and techniques for accelerators and particle detectors