

Investigation of space-charge phenomena in gas-filled Penning traps

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The centering of ions in Penning traps by quadrupolar excitation in the presence of a buffer gas has been studied for the case of high charge-densities. The cooling resonance is found to deviate significantly from the single-particle situation. In particular, the efficiency of the cooling process is affected as well as the resolving power that can be obtained. The behavior has been studied experimentally at the preparation trap REXTRAP and the high-precision Penning trap setup ISOLTRAP both located at the mass separator ISOLDE at CERN. In addition, the phenomenon has been investigated numerically by a custom-designed simulation tool and, furthermore, a consistent analytical description has been found. The presentation will include the methods and results of all three aspects, experimental findings, analytical model and numerical simulations.