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TEAMS « SALLE CONVIVIALE » OU FB200

Electrosatric ion beam trap and its applications

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An electrostatic ion beam trap (EIBT) with extraction has been designed and simulated to study the formation, reactivity, and fragmentation of clusters arising from ion-cluster collisions [1]. Such studies are very important to understand the molecular formation in the space [2]. The schematic of the setup is shown in Figure1. This setup has three main parts: extraction region, an Einzel lens, and the electrostatic ion beam trap. Ions are formed in interaction zone by ion collisions with molecular clusters, then the collision products are extracted by a weak electrostatic field, and focused by the Einzel lens to the entrance mirror of the EIBT. In order to get extracted ions from the interaction zone to the center of trap, we lower down the voltages of the few electrodes of the entrance mirror, once the ions are in the field free region of the EIBT, the voltages of the electrodes raised to the standard trapping voltages. This allows the trapping of ions in the EIBT. The voltages on the extraction region, the Einzel lens, and the EIBT have been optimized to obtain best trapping efficiency using Simion software. The EIBT works as high resolution mass spectrometer. Other spectroscopies can also be done in the field free region. In addition, a particle in a cell technique is used to simulate space charge effect in the EIBT, understating the processes like self-bunching, enhanced diffusion, and application of the EIBT as a high mass resolution spectrometer [3].

A combination of two EIBTs can trap both positive and negative ions in the same filed free regions to study the merge beam cold collisions, which sheds light on the formation of molecules in the early universe. We recently designed, simulated, and fabricated such a setup, which is called hybrid electrostatic ion beam trap (HEBIT). Simulation supports as low as ~4 meV resolution of the collision energy. Neutral products and laser induced cations can be readily imaged behind the HEIBT mirrors [4].

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References

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