

# Status and outlook: DESIREE and He<sup>-</sup> lifetimes measured at cryogenic temperatures in an electrostatic ion-beam trap

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The DESIREE (Double ElectroStatic Ion Ring ExpERiment) facility at Stockholm University consists of two cryogenically cooled electrostatic ion storage rings with a common section for merged ion-beams experiments, two ion injectors for which several types of sources for positive and negative ions are available, and a stand-alone beam line in its own laboratory for single pass experiments and ion source developments. The ion beams merging section and the long-time storage option allow for unique experiments on charge- and energy transfer processes, and on cold chemical reactions, in collisions between positive and negative ions from meV to keV center-of-mass energies. During storage the ions reach thermal equilibrium with the rings and their vacuum vessel at regulated temperatures of 10-300 K, which also means that fragile ions like metastable He<sup>-</sup> or molecular dianions may be studied without depletion by black-body radiation [1,2]. The latter was recently demonstrated with a small electrostatic ion trap, ConeTrap, operated at 10 K, to measure the intrinsic lifetimes of the 1s2s2p <sup>4</sup>P<sup>o</sup> levels in He<sup>-</sup> directly [3]. An electrospray source for biomolecular and, e.g., PAH ions is mounted on the stand alone beam line together with an rf ion funnel, a warm accumulation trap, ion guides, a mass filter, and a cryogenic cooling trap [4]. This system is operational while ion optics in DESIREE is now being mounted (Fig 1).



**Figure 1.** Left: ConeTrap mounted for the He<sup>-</sup> lifetime measurement at 10 K. Middle: An artist's view of ions circulating in the storage rings of DESIREE. Right: Mounting and alignment of DESIREE ion optics.

## References

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- [3] P. Reinhed *et al*, *Physical Review Letters* **103**, 213002 (2009)
- [4] N. Haag, *PhD thesis Stockholm University* (2011), <http://www.avhandlingar.se/avhandling/b333b1c370>

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