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Cold Highly Charged Ions in a Cryogenic Paul Trap

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Narrow optical transitions in highly charged ions (HCIs) are of particular interest for metrology and fundamental physics. Atomic clocks could exploit the low susceptibility of HCIs to external electric fields. The highest sensitivity for a changing fine structure constant ever predicted for a stable atomic system is found in Ir^{17+}. However, spectroscopy of HCIs is hindered by the large ($\sim 10^6$ K) temperatures at which they are produced and trapped. An unprecedented improvement in such laser spectroscopy can be obtained when HCIs are cooled down to the mK range in a linear Paul trap. We have developed a cryogenic linear Paul trap in which HCIs will be sympathetically cooled by Be^+ ions. Optimized optical access for laser light is provided while maintaining excellent UHV conditions. The Paul trap will be connected to an electron beam ion trap (EBIT) which is able to produce a wide range of HCIs. This EBIT will also provide the first experimental input needed for the determination of the transition energies.

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