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Sympathetic cooling of highly charged ions in a Penning trap using a self-cooled electron plasma

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The amazing evolution of precision in recent Penning-trap experiments is driving the need for ever-improving cooling techniques. In this talk, the prospect of a new sympathetic cooling technique using an electron-plasma coupled to a single highly charged ion is presented. Utilizing the synchrotron-radiation of electrons in a strong magnetic field enables cooling to very low motional quantum numbers, almost to their ground state. Using a common-resonator, the motion of this self-cooled electron plasma can be coupled to a single ion stored in a spatially separated Penning trap, allowing sympathetic cooling of all modes of the ion. The extremely low expected temperatures in the milllikelvin range open up an exciting new frontier of measurements in Penning traps.

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