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Cooling Electrons through Resonant Mode-Mode Coupling[1]
HUWS LANDSBERGER, JOEL FAJANS, JONATHAN WURTELE, University of California, Berkeley — Low temperature plasma physics is of importance to antimatter research, where cyclotron cooling of positrons brings energetic antimatter to antiatom-creation temperatures. Resonant cavity cooling, or cooling of a nonneutral plasma by coupling the radiation field with the electromagnetic modes inside a trap cavity, is a useful technique to cool plasmas to wall temperatures (˜10K) but may be difficult to perform due to plasma location or trap geometry. Thus, understanding the effectiveness of mode-mode coupling in plasmas is essential—by coupling an easily cooled plasma to a mode, and the mode to another mode or plasma, a previously warm plasma may be cooled. We intend to determine if this methodology is possible using the Berkeley electron trap's high-resonance cavities. Based off the results, using cavities or resonating circuits across electrodes may be used in conjunction with or in lieu of collisional cooling to obtain very cold plasmas. This may help to increase the production rate of testable antihydrogen in collaborations such as ALPHA at CERN, and lead to extreme precision on fundamental symmetry tests.

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