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Laser-cooling calcium ions in an ultracold neutral plasma[1] STEPHEN RUPPER, SCOTT BERGESON, Brigham Young University — The temperature in ultracold neutral plasmas is typically limited by nearest-neighbor interactions during the initial formation stage. The heating occurs because the ions are formed from resonantly-ionized laser-cooled atoms. These atoms have a completely flat pair correlation function before ionization occurs. After ionization, a deep hole in the pair correlation function develops at small radius. This increases the ion temperature by two orders of magnitude (10 mK to 3 K) in less than 1 μs. Overcoming this source of heating remains a major priority for this field. It would allow careful measurements of the transport and kinetic properties of the strongly coupled plasma over a wide range in the Coulomb coupling parameter, from 1 to about 30. We have built an experiment to laser-cool the ions in an ultracold neutral calcium plasma. The parameters in which the laser cooling is expected to occur are presented. Cooling is complicated because the Coulomb forces are typically orders of magnitude larger than the optical forces. Results from our initial work in laser cooling the plasma will be presented.

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