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The pursuit of more strongly coupled plasmas using the Rydberg blockade[1]

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Ultracold neutral plasmas (UNP), created by photoionizing laser-cooled atoms near (above or below) the ionization threshold, offer a superb system in which to study the properties of strongly coupled plasmas. In strongly coupled Coulomb systems, the Coulomb coupling parameter Γ is defined as the ratio of Coulomb interaction energy to kinetic energy and exceeds unity. When UNPs are created by exciting atoms just above the ionization threshold, the potential energy inherited from the spatial disorder of the atoms is rapidly redistributed between potential and kinetic degrees of freedom, limiting Γ to about 2 or less. One approach for reducing this disorder induced heating is to ionize a spatially ordered gas, such as a fully blockaded Rydberg gas which exhibits spatial correlations due to localized suppression of subsequent Rydberg excitations. Towards this effort we have recently demonstrated the use of a diffuse seed UNP's electrons to collisionally drive Rydberg atoms toward a plasma state. We will describe our efforts to apply this technique to a Rydberg-blockaded sample and present high resolution measurements of the resultant ion coupling parameter.

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