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Rydberg atom formation in strongly correlated ultracold neutral plasmas GEORG BANNASCH, THOMAS POHL, MPI for the Physics of Complex Systems — In plasmas at very low temperatures the recombination into neutral atoms is dominated by three-body recombination (TBR), owing to the strong $\sim T^{-9/2}$ scaling of the recombination rate with the electron temperature. While this law is well established at high temperatures, the unphysical divergence as $T \to 0$ clearly suggest a breakdown in the low-temperature regime. Here, we use a combined molecular dynamics - Monte Carlo approach to investigate electron-ion recombination over a wide range of temperatures and densities. Through a careful analysis, we devise an approach that permits to distinguish recombined atoms from the surrounding plasma, i.e. to develop a chemical picture − even in the strongly coupled regime. Our method reproduces the known behavior of the recombination for high temperatures, but reveals significant deviations as T decreases. We discuss the fate of the kinetic bottleneck and resolve the discussed divergence-problem in the ultracold domain.

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