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Charged impurities immersed in a Bose-Einstein condensate FLORIAN MEINERT, KATHRIN KLEINBACH, FELIX ENGEL, THOMAS DIETERLE, ROBERT LOEW, TILMAN PFAU, 5. Physikalisches Institut, University of Stuttgart — Giant Rydberg atoms immersed in a Bose-Einstein condensate provide an exquisite platform to study the interaction of charged impurities with neutral atoms at ultralow temperatures. Typically, the low-energy scattering of the Rydberg electron with neutral perturber atoms residing within the Rydberg orbit constitutes the dominant interaction process, which manifests in density-dependent spectral line shifts and broadening of the Rydberg excitation. Using a tightly focused optical tweezer we access a previously unexplored parameter regime for which the Rydberg electron orbit largely exceeds the spatial extent of the condensate. This reduces the contribution of electron-neutral interaction with increasing principal quantum number in the observed excitation spectrum. Consequently, the interaction of the condensate atoms with the Rydberg ionic core is expected to actively shape the spectral response. I will report on our endeavor to explore this appealing route to study atom-ion interaction in a Bose-Einstein condensate.

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