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Rydberg atoms in the presence of a continuum of scatterers¹ JOVICA STANOJEVIC, ROBIN COTE, Department of Physics, University of Connecticut, Stors — We study Rydberg atoms in dense environments assuming that a very large number (in practice tens of thousands) of ground-state atoms (scatterers) are localized within the volume of a single Rydberg atom. A Green's function based approach is used to derive a nonperturbative inhomogeneous differential equation for the Rydberg electron wave function in the limit of a continuum scatterer density. In this description, the scatterers influence the Rydberg wave function through an inhomogeneous term in the Schrödinger equation. In turn, the Rydberg wave function affects the local scattering amplitudes of the many scatterers and the relationship between these amplitudes and the Rydberg wave function is found by solving the local scattering problem. Solutions of the inhomogeneous Schrödinger equation yield the energy shifts of the Rydberg levels. We also derive an effective potential that a single scatterer experiences inside a Rydberg atom.

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