



Seminar/Talk

Revealing Electron-Ytterbium Interactions through Rydberg Molecular Spectroscopy

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Host: Julian Leonard

Abstract An ultralong-range Rydberg molecule (ULRM) forms optically through the interaction between a ground-state atom and the electron of a Rydberg atom. In this talk, I will present a first and comprehensive experimental and theoretical investigation of ULRMs of 174Yb in $6s_n 1S_0$ Rydberg states across nearly two decades in principal quantum number and three orders of magnitude in molecular binding energy. Using the Coulomb Green's function formalism, we compute Born-Oppenheimer molecular potentials describing a Rydberg atom perturbed by a ground-state atom and obtain quantitative agreement with high-resolution molecular spectra. This enables the extraction of low-energy electron-Yb scattering phase shifts, including the zero-energy s-wave scattering length and the positions of two spin-orbit split p-wave shape resonances. The latter provides strong evidence that the Yb^- anion exists only as a metastable resonance. We further demonstrate the sensitivity of ULRM spectra to the atomic quantum defects, enabling a precise determination of the quantum defect of the $6s23f 1F_3$ state. These findings establish Yb ULRMs as a powerful probe of low-energy electron-Yb interactions and an ideal platform for exploring Rydberg molecules and low-energy scattering physics.

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Office Bldg West / Ground floor / Heinzl Seminar Room (I21.EG.101)



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