Seminar/Talk

Revealing Electron-Ytterbium Interactions through Rydberg Molecular Spectroscopy

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Host: Julian Leonard

AbstractAn 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 6sns 1S0 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 1F3 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.

Wednesday, May 27, 2026 10:00am - 11:00am
Office Bldg West / Ground floor / Heinzel Seminar Room (I21.EG.101)

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