Abstract Submitted
for the DAMOP17 Meeting of
The American Physical Society

High precision spectroscopy of p-state Rubidium Rydberg molecules TANITA EICHERT, THOMAS NIEDERPRM, Department of Physics and research center OPTIMAS, University of Kaiserslautern, OLIVER THOMAS, Department of Physics and research center OPTIMAS, University of Kaiserslautern / Graduate School Materials Science in Mainz, CARSTEN LIPPE, HERWIG OTT, Department of Physics and research center OPTIMAS, University of Kaiserslautern
— In an ultracold gas the scattering interaction of a ground state atom and the highly excited electron of a Rydberg atom gives rise to an oscillatory potential that supports molecular bound states. We use high resolution time-of-flight spectroscopy over a range of several 10GHz to precisely determine the binding energies and lifetimes of molecular states in the vicinity of the 25P-state. For the so called butterfly molecules, that originate from a shape resonance in the p-wave electron-atom scattering and strongly mix high angular momentum states, we investigate their rotational structure in an external electric field allowing us to extract the precise bond length and huge dipole moments. By exciting ultralong-range Rydberg molecules we are able to observe a spin-flip of the ground state atom. This induced spin-flip is based on mixed singlet-triplet potentials containing contributions of both hyperfine states of the ground state atom. In additon, we resolve molecular states which feature strong entanglement between the orbital angular momentum of the Rydberg electron and the nuclear spin of the ground state atom due to nearly degenerate spin-orbit splitting of the Rydberg atom and hyperfine splitting in the ground state.

Tanita Eichert
University of Kaiserslautern

Date submitted: 06 Feb 2017 Electronic form version 1.4