Abstract Submitted
for the DAMOP16 Meeting of
The American Physical Society

Ultracold Long-Range Rydberg Molecules with Complex Multichannel Spectra[1] MATTHEW EILES, CHRIS GREENE, Purdue University Department of Physics and Astronomy — A generalized class of exotic long-range Rydberg molecules consisting of a multichannel Rydberg atom bound to a distant ground state atom by the Rydberg electron is predicted. These molecules are characterized by the rich physics provided by the strongly perturbed multichannel Rydberg spectra of divalent atoms, in contrast to the regular Rydberg series of the alkali atoms used to form Rydberg molecules to date. These multichannel Rydberg molecules exhibit favorable properties for laser excitation, because states exist where the quantum defect varies strongly with the principal quantum number n. In particular, the nd Rydberg state of calcium becomes nearly degenerate with states of high orbital angular momentum over the range $17 < n < 22$, promoting its admixture into the high l deeply bound trilobite molecule states and thereby circumventing the usual difficulty posed by electric dipole selection rules. Further novel molecular states are predicted to occur in the low-J states of silicon, which are strongly perturbed due to channel interactions between Rydberg series leading to the spin-orbit split ionization thresholds. These interactions manifest themselves in potential curves exhibiting two distinct length scales, providing novel opportunities for quantum manipulation.

[1]Supported in part by the National Science Foundation under Grant No. PHY-1306905

Matthew Eiles
Purdue University Department of Physics and Astronomy

Date submitted: 29 Jan 2016 Electronic form version 1.4