Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Optical coupling to atomic states in superconductors[1] MATTHIAS LE DALL, IGOR DINIZ, ROGÉRIO DE SOUSA, Department of Physics and Astronomy, University of Victoria, British Columbia, Canada — Superconducting devices can act as sensitive detectors of optical excitations in many different quantum systems and are now being considered as a method to probe and manipulate neutral atoms in atomic clouds, as well as impurities and nanostructures with complex energy spectra. Here we present a theory for the optical excitations of hydrogenic atomic states hybridized with a superconductor, including the full orbital degeneracy. We derive a low energy effective Hamiltonian for the atom and show that the proximity effect leads to a rich spectrum of Yu-Shiba-Rusinov (YSR) bound states within the superconducting energy gap. The presence of superconducting correlations greatly affects the atomic electric dipole transitions, and the mixing with the superconducting vacuum opens up additional optical resonances. Furthermore, the strengths of the transitions are quantified through a modified optical sum rule. Our results demonstrate that the overlap between atomic states and the superconductor activates new optical transitions, and creates novel opportunities for detection and manipulation of YSR states.

[1]This research is supported by NSERC Discovery and NSERC CRD/478366-2015.

Matthias Le Dall
Department of Physics and Astronomy, University of Victoria

Date submitted: 20 Nov 2016 Electronic form version 1.4