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Doubly excited states of atomic negative ions MATTHEW EILES, CHRIS GREENE, Purdue University Department of Physics and Astronomy — Doubly excited states of negative ions reveal the intricate details of electron correlations and depend sensitively on the structure of the excited atomic state. In hydrogen, the degenerate states of the excited atom form a permanent dipole, leading to the dipole series of doubly excited resonances [1]. In other species, the non-degenerate excited states instead form induced dipole potentials, but for higher partial waves their increasingly small energy splittings can lead to both polarization terms in the asymptotic potentials. We theoretically investigate the high partial wave cross sections measured recently [2] using the eigenchannel R-Matrix method to understand the role of these potentials in the observed photodetachment cross sections. We also explore the interactions between a doubly excited hydrogen negative ion and a neutral atom, using analogies to Rydberg molecules. Just as a Rydberg electron can bind to an atom within its large ($R \sim n^2$) orbit, the outer electron of a doubly excited H- ion can also bind to an atom in its exponential orbit, $R \sim \exp(n)$. We use the Fermi pseudopotential to investigate the possibility of forming exotic molecules.

[1]M. Gailitis and R. Damburg, Proc. Phys. Soc. 82, 192 (1963)
[2]Lindahl et al. PRL 108, 033004 (2012)

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