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Controlled charge exchange between alkaline earth metals and their ions[1] MARKO GACESA, ROBIN CÔTÉ, University of Connecticut - Storrs
— We theoretically investigate the prospects of realizing controlled charge exchange via magnetic Feshbach resonances in cold and ultracold collisions of atoms and ions. In particular, we focus on near-resonant charge exchange in heteroisotopic combinations of alkaline earth metals, such as $^{9}\mathrm{Be}^{+} + ^{10}\mathrm{Be} \leftrightarrow ^{9}\mathrm{Be} + ^{10}\mathrm{Be}^{+}$, which exhibit favorable electronic and hyperfine structure. The quantum scattering calculations are performed for a range of initial states and experimentally attainable magnetic fields in standard coupled-channel Feshbach projection formalism, where higher-order corrections such as the mass-polarization term are explicitely included. In addition, we predict a number of magnetic Feshbach resonances for different heteronuclear isotopic combinations of the listed and related alkaline earth elements. Our results imply that near-resonant charge-exchange could be used to realize atom-ion quantum gates, as well as controlled charge transfer in optically trapped cold quantum gases.

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