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On Helium Anions in Helium Droplets: Interpreting Recent Experiments[1] ANDREAS MAURACHER, STEFAN E. HUBER, Leopold-Franzens-Universitaet Innsbruck — Helium droplets provide an ideal environment to study elementary processes in atomic systems at very low temperatures. Here, we discuss properties of charged and neutral, atomic and molecular helium species formed in helium droplets upon electron impact. By studying their interaction with atomic ground state helium we find that He, He_2 and excited (metastable) He^{*-} are well bound within the helium droplet. In comparison, He^*, He_2^* and He_2^{*-} are found to be squeezed out due to energetic reasons. We also present the formation pathways of atomic and molecular helium anions in helium droplets. Transition barriers in the energetic lowest He^{*-} - He interaction potentials prevent molecule formation at the extremely low temperatures in helium droplets. In contrast, some excited states allow a barrier-free formation of molecular helium (anions). With these theoretical results at hand we can interpret recent experiments in which the resonant formation of atomic and molecular helium anions was observed. Furthermore, we give an outlook on the implications of the presence of these anionic species in doped helium droplets with regard to charge transfer reactions.

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