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Imaging the Photodynamics of Doped Helium Droplets

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During the last decade helium nanodroplets have been established as an ideal spectroscopic matrix. Helium droplets are also thought to be ideal low temperature nanoreactors because of their ability to stabilize weakly bound species. As the focus is nowadays shifting to the study of chemical reactions in liquid helium droplets, question related to the energy relaxation and solvation dynamics become more and more prominent. To address these questions experiments have been performed in with species with a well defined kinetic energy distribution have been created via the photodissociation molecules residing inside helium droplets. The velocity distributions of the photofragments that have escaped from the droplets have been determined using ion imaging techniques. The analysis of speed distributions as function of droplet size and precursor has enabled to obtain a consistent picture of the mechanisms underlying the translational motion of these non-thermal species through this quantum liquid. Additional information on the solvation dynamics could be obtained by using non-resonant ionization techniques in these experiments. More recently the translational dynamics of quasi-free electrons in helium droplets has been investigated by means of photoelectron spectroscopy. The results on these experiments indicate that the relaxation of the electrons is governed by the same mechanism responsible for the kinetic energy relaxation of non-thermal neutral molecules.