General Physics Seminar
Rijnhuizen Seminar Room

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Infrared spectroscopy of molecules and metastable structures in superfluid helium droplets

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Infrared excitation of guest molecules inside liquid helium nanodroplets is only weakly influenced by the surrounding liquid. This allows us to study solvent effects without the broadening typically present in spectroscopy in the liquid phase. The infrared spectra show that molecules are free to rotate in the superfluid, but their rotational constant is often significantly reduced. Both vibrational and rotational relaxation have been observed. The latter only occurs if the rotational energy is high enough to directly excite the helium excitations. In addition, a variety of effects, related to the finite size of the droplets, results in inhomogeneous broadening of the spectra.

Helium droplets can be used to grow new and interesting weakly bound complexes. The low temperature inside the droplets (0.37 K), stabilizes isomers that correspond to local minima on the associated potential energy surfaces and are not found in the gas phase. Infrared (vibrational) spectroscopy is used to characterize these structures.