General Physics Seminar
Rijnhuizen Seminar Room

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Electronic Structure and Dynamics of Atoms, Molecules and Nano-sized Objects from Helium Nanodroplet Isolation Spectroscopy

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Superfluid helium nanodroplets are used as a low temperature matrix to study atoms, molecules and larger complexes by spectroscopic means. At temperatures below 1 K helium provides in its superfluid state an isotropic, weakly perturbing environment to probe embedded species with high selectivity and spectral resolution. Laser-induced fluorescence is applied to study electronic properties of organic, semi-conducting nano-structures. Spectra of size-selected complexes of 3,4,9,10-perylene-tetracarboxylic dianhydride (PTCDA) are presented, where the helium environment enables us to separate charge transfer from molecular excitations. The results are discussed in comparison with spectra of PTCDA films and molecules probed in organic solvents.

When attaching alkali atoms to helium droplets we find a very peculiar selection of alkali clusters in huge spin states. We measured the abundance of cluster sizes by means of femtosecond multi-photon ionization. Since sodium and potassium readily form clusters, this process appears to be suppressed for the heavier alkalies. Apparently, these clusters are not stable in weakly bound, spin-polarized states.