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Laser induced alignment of molecules dissolved in Helium nanodroplets

HENRIK STAPELFELDT, Department of Chemistry, Aarhus University

Laser induced alignment, the method to confine the principal axes of molecules along axes fixed in the laboratory frame, is now used in a range of applications in physics and chemistry. With a few exceptions all studies have focused on isolated molecules in the gas phase. In this talk we present experimental studies of laser induced alignment of molecules embedded in the solvent of a superfluid helium nanodroplet [1]. Alignment is conducted in both the adiabatic and the nonadiabtic regime where the alignment pulse is much longer or shorter, respectively, than the rotational period of the molecules. In the nonadiabatic limit, induced by a few-hundred femtosecond long laser pulse, we show that methyliodide molecules reach an alignment maximum 20 ps after the alignment pulse and gradually loose the alignment completely in another 60 ps. This dynamics is completely different from that of isolated methyliodide molecules where alignment occurs in regularly spaced (by 33.3 ps), narrow time windows, termed revivals. Adiabatic alignment, induced by 10 ns laser pulses, resembles the gas phase behavior although the observed degree of alignment falls below that of isolated molecules.

Work done in collaboration with Dominik Pentkehner, Department of Chemistry, Aarhus University; Jens Hedegaard Nielsen, Department of Physics, Aarhus University; Alkwin Slenczka, Department of Chemistry, Regensburg University; and Klaus Mølmer, Department of Physics, Aarhus University.

[1] D. Pentlehner *et al.*, arXiv:1212.2862 (2012).