ALKALI-METAL ATOMS AS SPIN LABELS ON HELIUM NANODROPLETS

MARKUS KOCH, MARTIN RATSCHEK, CARLO CALLEGARI[a], and WOLFGANG E. ERNST, *Institute of Experimental Physics, TU Graz, Petersgasse 16, 8010 Graz, Austria.*

We have recently achieved electron spin resonance (ESR) of single alkali-metal atoms isolated on helium (He) nanodroplets[b,c,d]. A two-laser pump/probe setup for optically detected magnetic resonance is applied, which is based on magnetic circular dichroism to selectively address spin states. The influence of the helium droplet on the alkali-metal valence-electron wave function is directly noticeable as a shift of the ESR transitions with respect to that of free atoms. This perturbation depends on the size of the droplets and can be modeled with an increase of the hyperfine constant, that is an increase of the Fermi contact interaction.
After careful characterization of the Rb–He-droplet system the method is being developed into a more universal diagnostic tool to study spin dynamics. ESR silent species located inside the droplet can be investigated by utilizing the surface Rb atom as spin label, and the droplet size is a convenient handle to control the distance between the two. In case of species with a nuclear spin (e.g., ^{129}Xe) spin exchange between the optically pumped Rb atom and the nuclear spin can be studied.
We are also extending our method to study magnetically active materials of technological importance, such as Cr, Cu, and small clusters thereof, and we strive to present the first results at the meeting.

[a] present address: Sincrotrone Trieste, Strada Statale 14 - km 163.5, 34149 Basovizza, Trieste, Italy

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