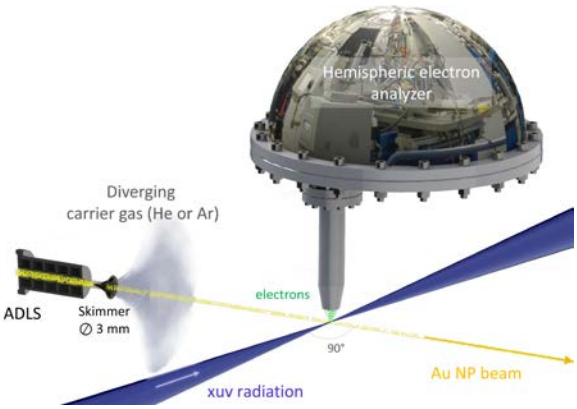
Surface chemistry of colloidal gold nanoparticles generated by laser ablation and their electronic properties

A promising nanoparticle (NPs) synthesis technique is based on laser irradiation of a solid target in a liquid environment. The Pulsed Laser Ablation in Liquids (PLAL) method results in the formation of ligand-free NPs which can be produced in organic or non-organic solvents. These systems are well-suited for the development of different technological applications[1] usually requiring subsequent surface functionalization. In addition, their surface chemical composition is expected to take part in the colloidal stability of the PLAL product. The resulting surface charge could be responsible of the electrostatic repulsion impeding their aggregation. However, no consensus[2-6] has been drawn so far on these questions and a precise knowledge of their surface properties and composition is mandatory. An experimental investigation of the surface chemistry occurring at the PLAL NP surface will be presented based on experiments conducted at SOLEIL synchrotron facility on the PLEIADES beamline. X-ray photoelectron spectroscopy measurements performed on free-standing[7,8] gold NPs will be reported addressing the question of (i) their surface oxidation state[9] and (ii) the chemical composition of their first's surface atomic layers. Signatures of halide-ions and possible gold oxidized atoms on the NPs surface have been evidenced, demonstrating that this technique provides a promising new way to study bare gold surfaces and a complementary insight to their colloidal stability. Furthermore, this study opens promising perspectives to tune the electronic properties of nanoparticles, and, in particular their work function. This question will be addressed in the frame of the future development of the project.



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