

# Measuring electronic properties of free-standing nanocrystals for solar cell absorbers

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We will describe a novel experimental technique that combines surface XPS and gas-phase synchrotron radiation-based XPS/VUV PES, for the investigation of the electronic structure of different nanocrystals that could be low-cost and high-efficient solar cell absorbers [1]. Surface XPS is performed in Notre Dame University (US) using SPECS Surface Nano Analysis GmbH, with a PHOIBOS 150 hemispherical energy analyzer. The synchrotron based XPS/PES is performed at the SOLEIL synchrotron (France). For gas-phase PES, the nanoparticle beam is produced by an atomizer and focused by the aerodynamic lens into the interaction region. On DESIRS beamline, the angle-resolved photoemission spectra were measured by double imaging DELICIOUS3 spectrometer (VMI for electrons and VMI-TOF for ions). On PLEIADES, the  $\pm 30^\circ$  aperture wide-angle lens VG-Scienta R4000 electron analyzer was used to record the XPS. The nanoparticles are synthesized both at Vinca Institute of Nuclear Sciences (Serbia) and in Notre Dame. The experimental results are supported by DFT calculations performed at the Institute of Physics Belgrade (Serbia).

Recent results for lead halide perovskites [1] will be presented, as well as preliminary results for lead-free materials such as Ag-Bi-I ruderffite nanosystems. The procedure to synthesize nanoparticles of this material for aerosol generation has been most recently developed at Vinca Institute of Nuclear Sciences. We were able to obtain a complete band alignment to the vacuum of the nanocrystals and investigate their surface properties with high sensitivity.

## REFERENCES

[1] Milosavljević A. et al, J. Phys. Chem. Lett. 9, 3604 (2018).