Probing quantum materials interfaces with HAXPES at the GALAXIES beamline, SOLEIL Synchrotron

J.-P. Rueff[1]

[1] Synchrotron SOLEIL, L'Orme des Merisiers, BP 48 St Aubin, 91192 Gif sur Yvette, France
Email: jean-pascal.rueff@synchrotron-soleil.fr

We will review recent HAXPES results obtained at the GALAXIES beamline, SOLEIL Synchrotron [1] regarding interfacial properties of metal oxides specially when combined to standing waves. This approach started at GALAXIES in collaboration with C.S. Fadley in CCMO [2] and continues today in different systems including CMO / YCO superlattices [3]. The functionality of novel quantum materials derives from the competition between the internal degrees of freedom (electrons, spin, orbital, topology, spin-orbit coupling) most notably observed at interfaces. An intense research activity has been set off for fabricating and manipulating interfacial properties of quantum materials leading to a frenzy of scientific discoveries including 2DEG, interfacial superconductivity, etc. HAXPES appears as a major probe of electronic interfacial behavior due to its superior probing depth and sensitivity to the local atomic properties. Extension of this work to investigating materials properties in operando conditions or characterizing ultrafast charge dynamics as recently obtained in GeSe [4] will be discussed. These results will be put in the context of the 4th generation (DLSR) synchrotron sources with much reduced H source size which offer new possibilities for in-depth interfacial characterization.

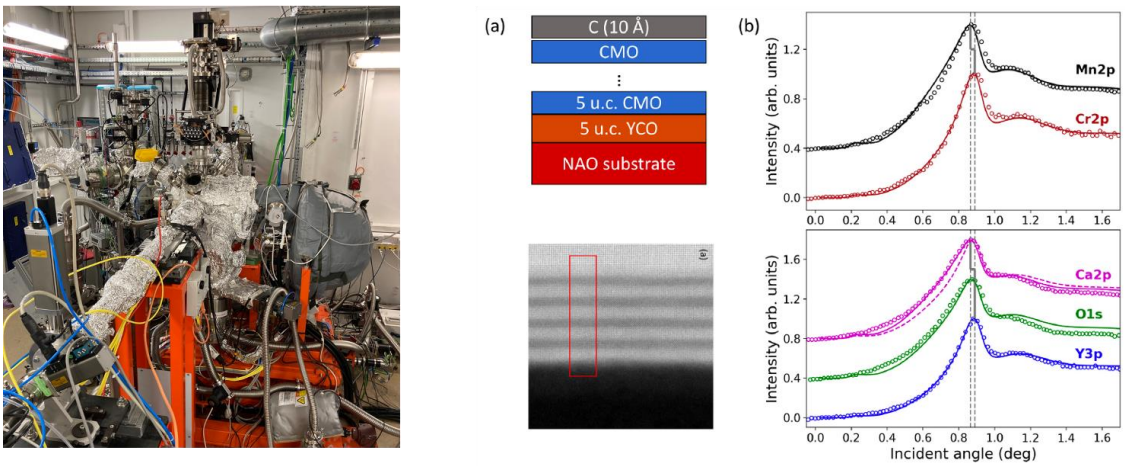

Fig. 1: *(left) HAXPES endstation at the GALAXIES beamline; (right) depth profiling of CMO / YCO superlattice by SW-HAXPES (from Ref. [2])*

References

[1] J.-P. Rueff *et al*., *J. Synchrotron Rad.* **22**, 175 (2015)
[2] M. Marinova *et al.*, Nano Letters **15**, 253 (2015)
[3] L. Cambou *et al.*, *J. of Vacuum Science & Technology A* **39**, no. 5, 053204 (2021)
[4] Z. Chen *et al.*, *Nature Communications Physics* **4**, no. 1, 138 (2021).