Study of the Spin Polarisation within the Valence Band of Au(111) Using SARPES

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Abstract. Au(111) crystals are well known for displaying strongly spin-polarised surface bands lying in the bulk band gap which are Rashba-split states as experimentally reveled by the Spin- and Angular-Resolved PhotoEmission Spectroscopy (SARPES) technique more than 2 decades ago [1]. Furthermore, as SARPES remains a very surface sensitive technique, measurements also report a spin-polarisation within the valence band. This result can look counter-intuitive given that the valence bands are perceived as bulk states, therefore not subject to spin splitting due to Au being centro-symmetric. We here show a thorough experimental study of the observed polarisation along specific directions in the Brillouin zone using Ultra-Violet light. The analysis is completed thanks to theoretical calculations performed with the SPR-KKR package [2], including the one-step model [3] which incorporates all effects arising from the experiment geometry, the light energy and final states.

[1] LaShell et al., Phys. Rev. Let. 77, 16 (1996).
[2] H. Ebert et al., Rep. Prog. Phys. 74 , 096501 (2011)
[3] Braun et al., Phys. Rep. 740 1–34 (2018)