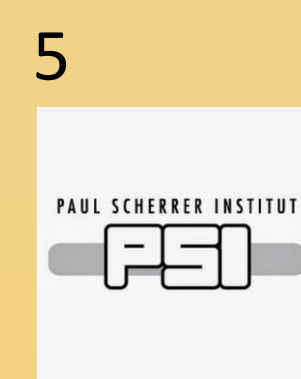


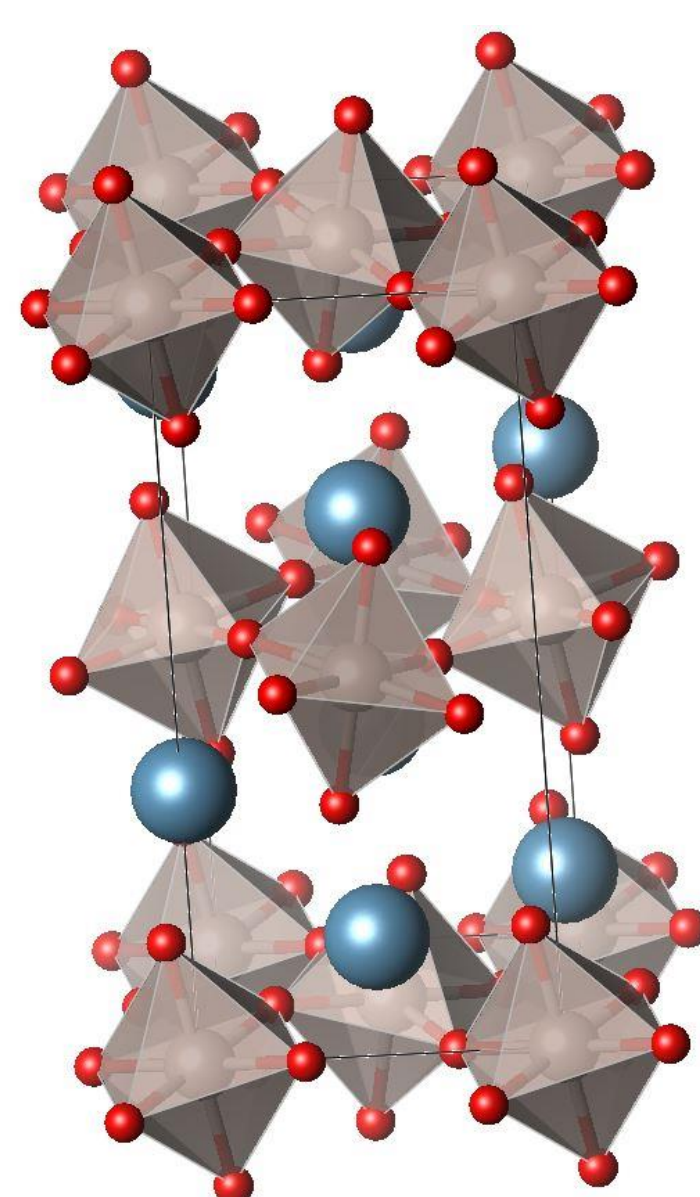
Spin Orbital in Ca_2RuO_4 : Resonant Inelastic X-ray Scattering study

L.Das¹, F.Forte^{2,3}, R.Fittipaldi^{2,3}, C.G.Fatuzzo⁴, V.Granata^{2,3}, O.Ivashko¹, M.Horio¹, F.Schindler¹, M.Dantz⁵, H.M.Ronnow⁴, W.Wan⁶, N.B.Christensen⁶, J.Pelliciani⁵, P.Olade-Velasco⁵, N.Kikugawa^{7,8}, T.Neupert¹, A.Vecchione^{2,3}, T.Schmitt⁵, M.Cuoco^{2,3}, and J.Chang¹



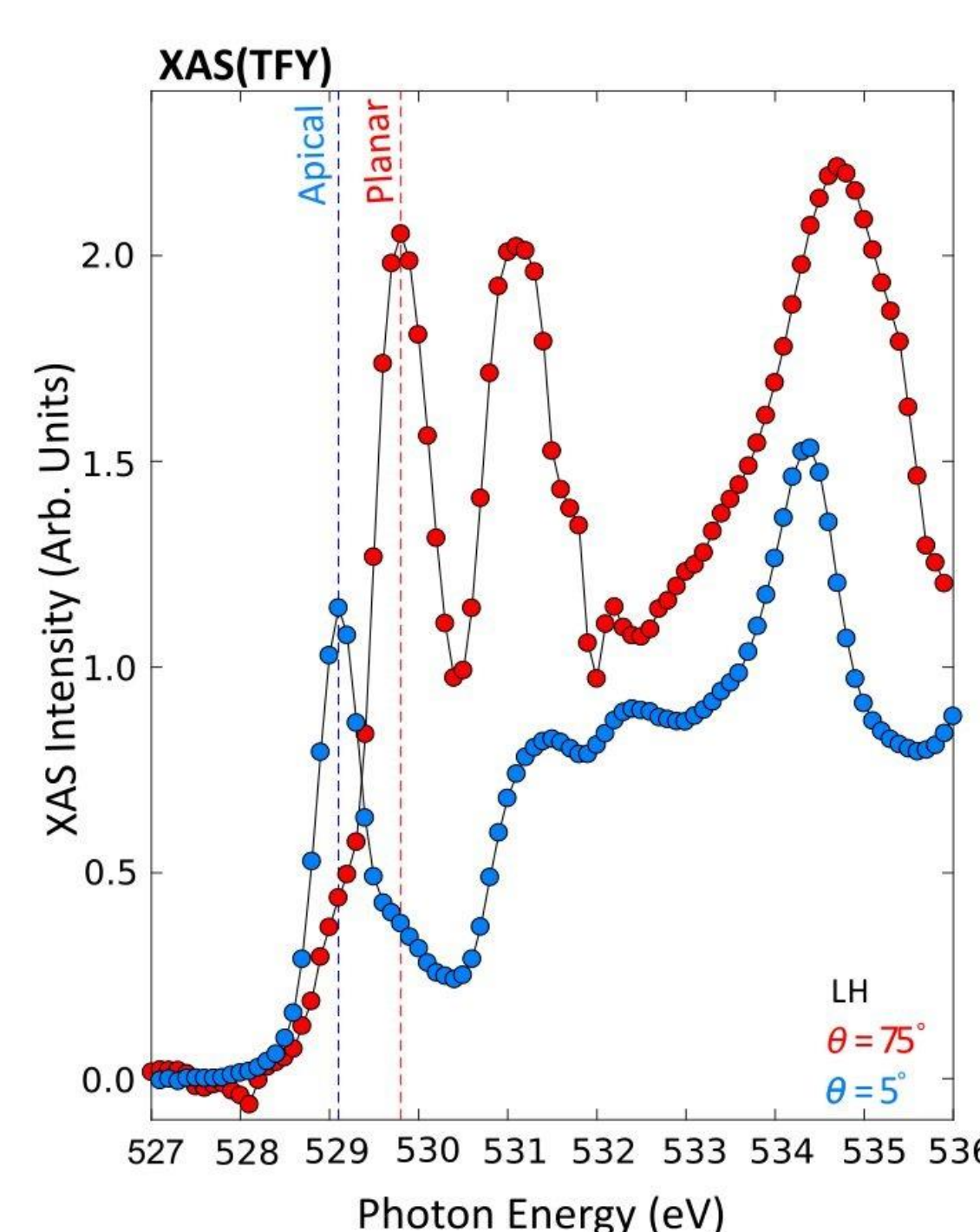
Summary

- Evidence of spin orbit coupled band- Mott scenario in AFM Mott state of Ca_2RuO_4
- Presence of weakly dispersive low energy excitations at 80 and 400 meV
- Composite spin orbital modes- excitations of entangled spins and orbitals
- Intricate interplay of Spin Orbit coupling and crystal field splitting

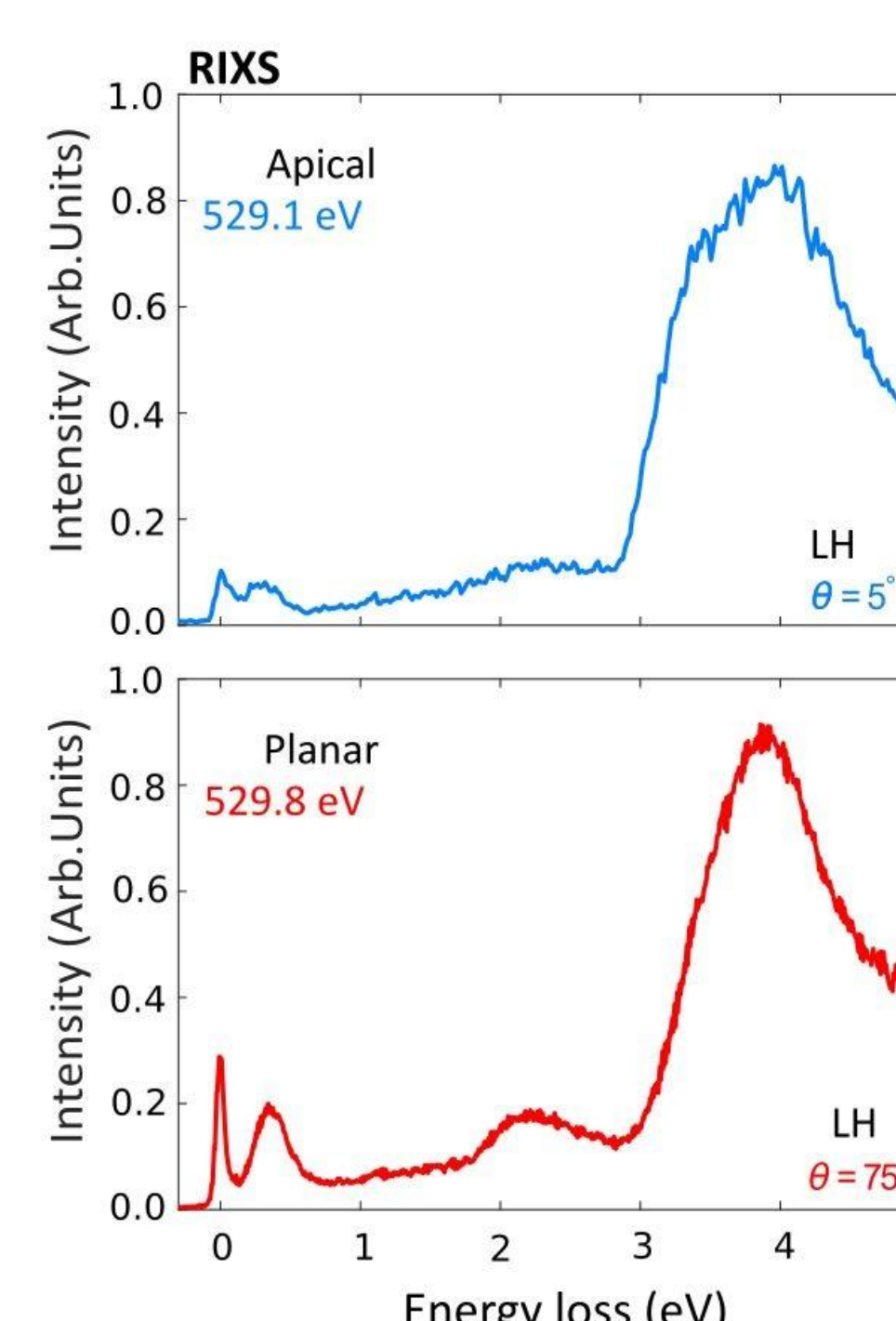


Ca_2RuO_4 crystal structure (I)

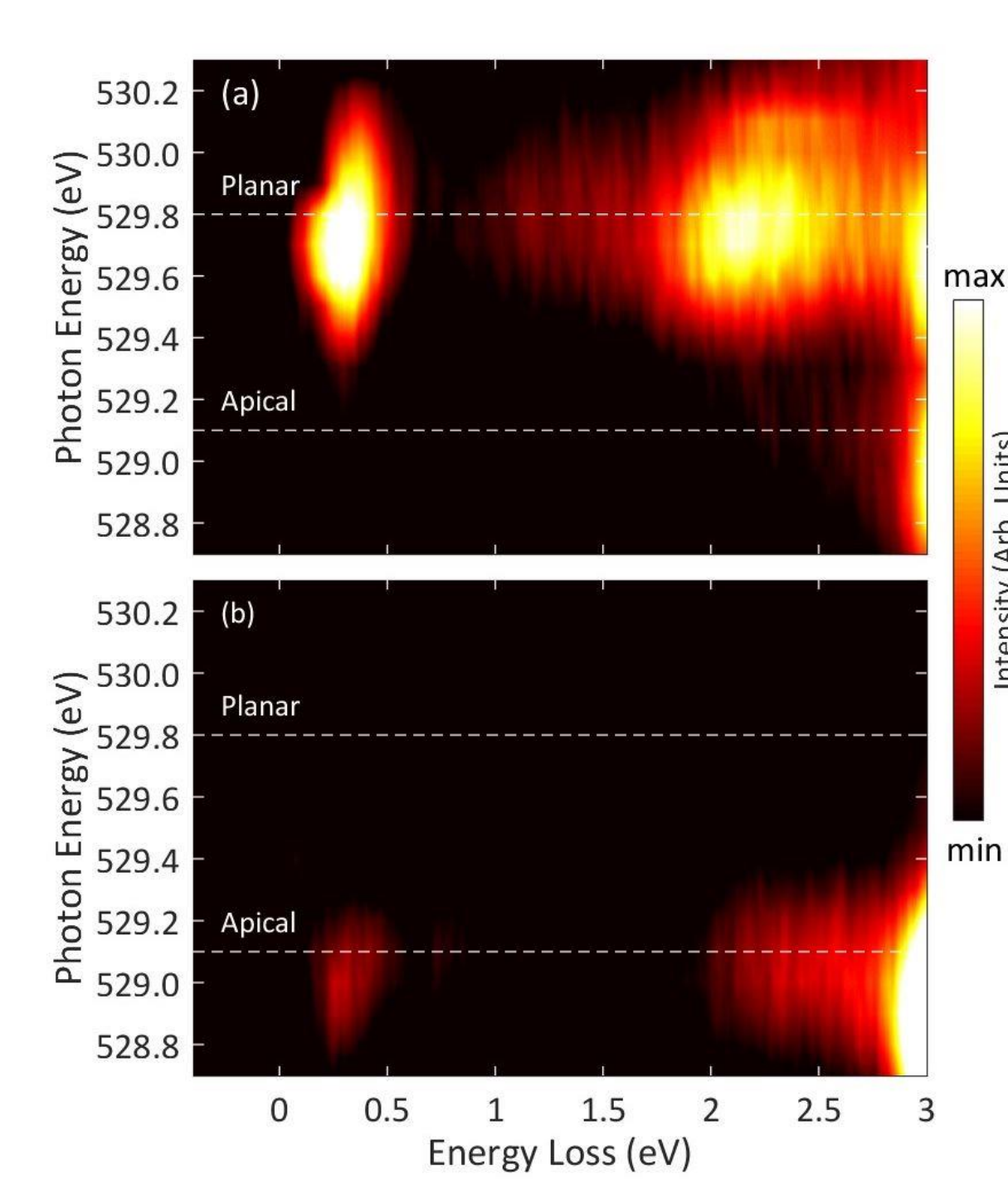
Results



Background subtracted X-ray Absorption spectroscopy spectra



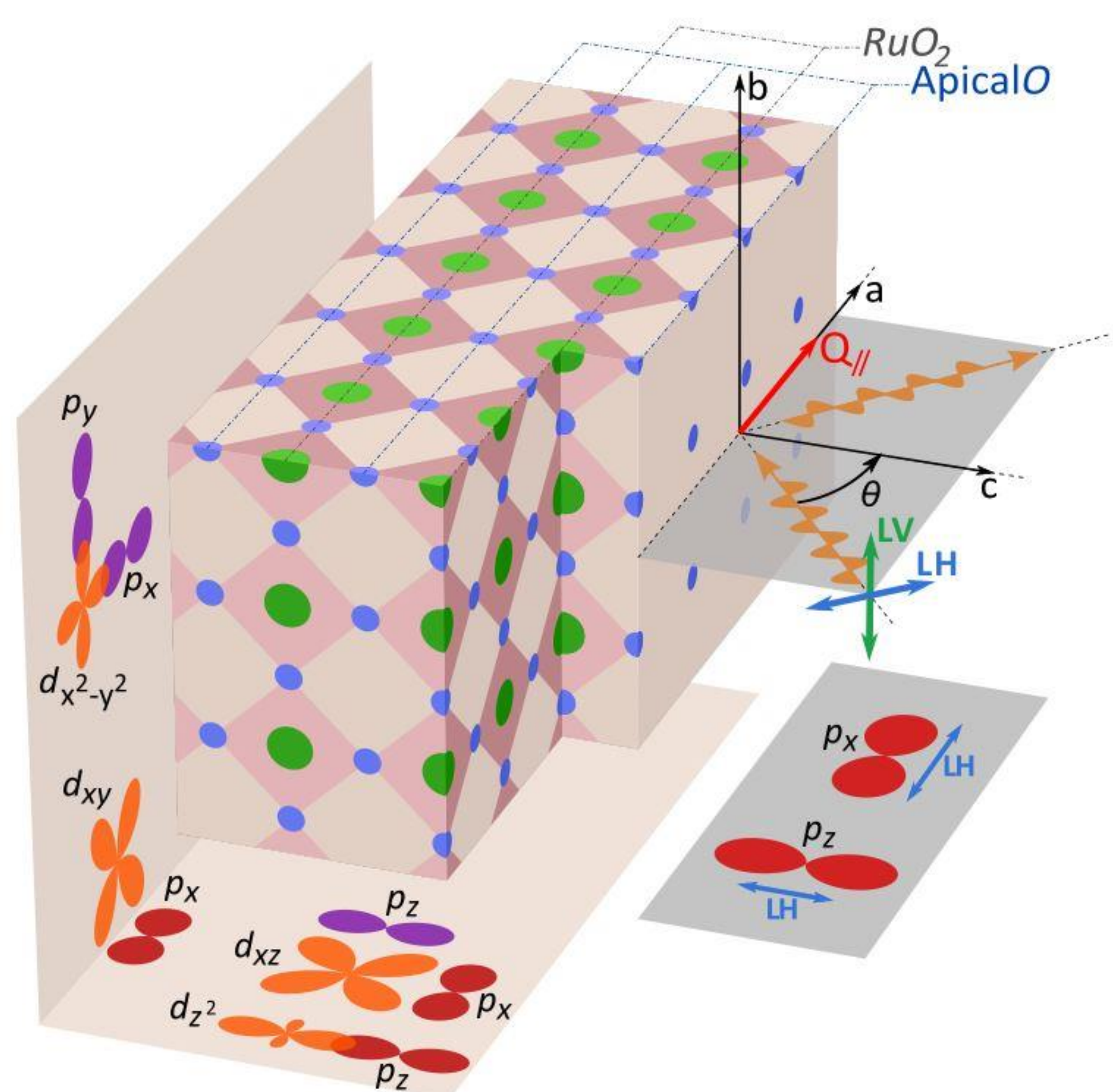
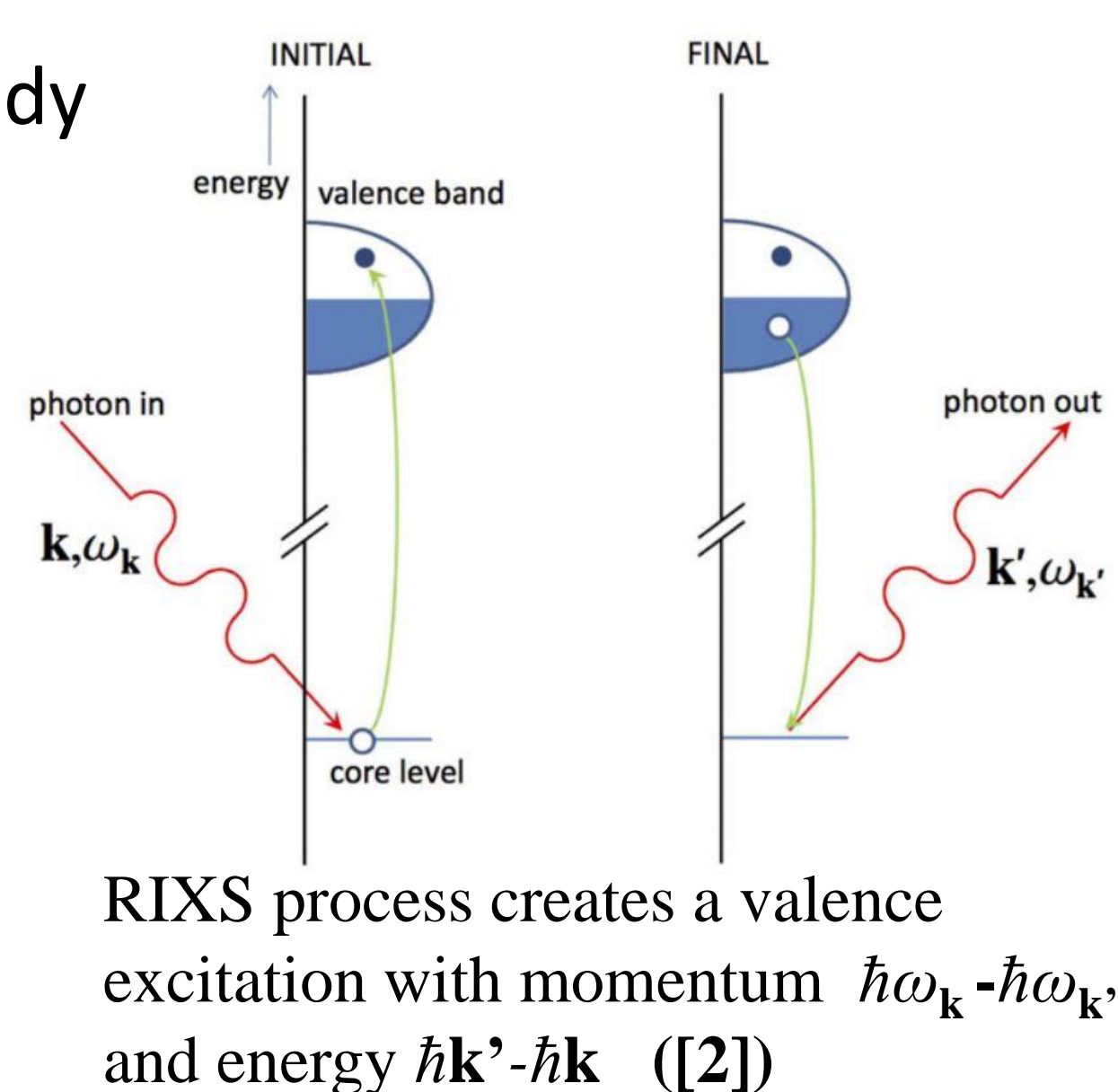
RIXS spectra at apical and planar resonances



RIXS response as function of incident photon energy and energy loss

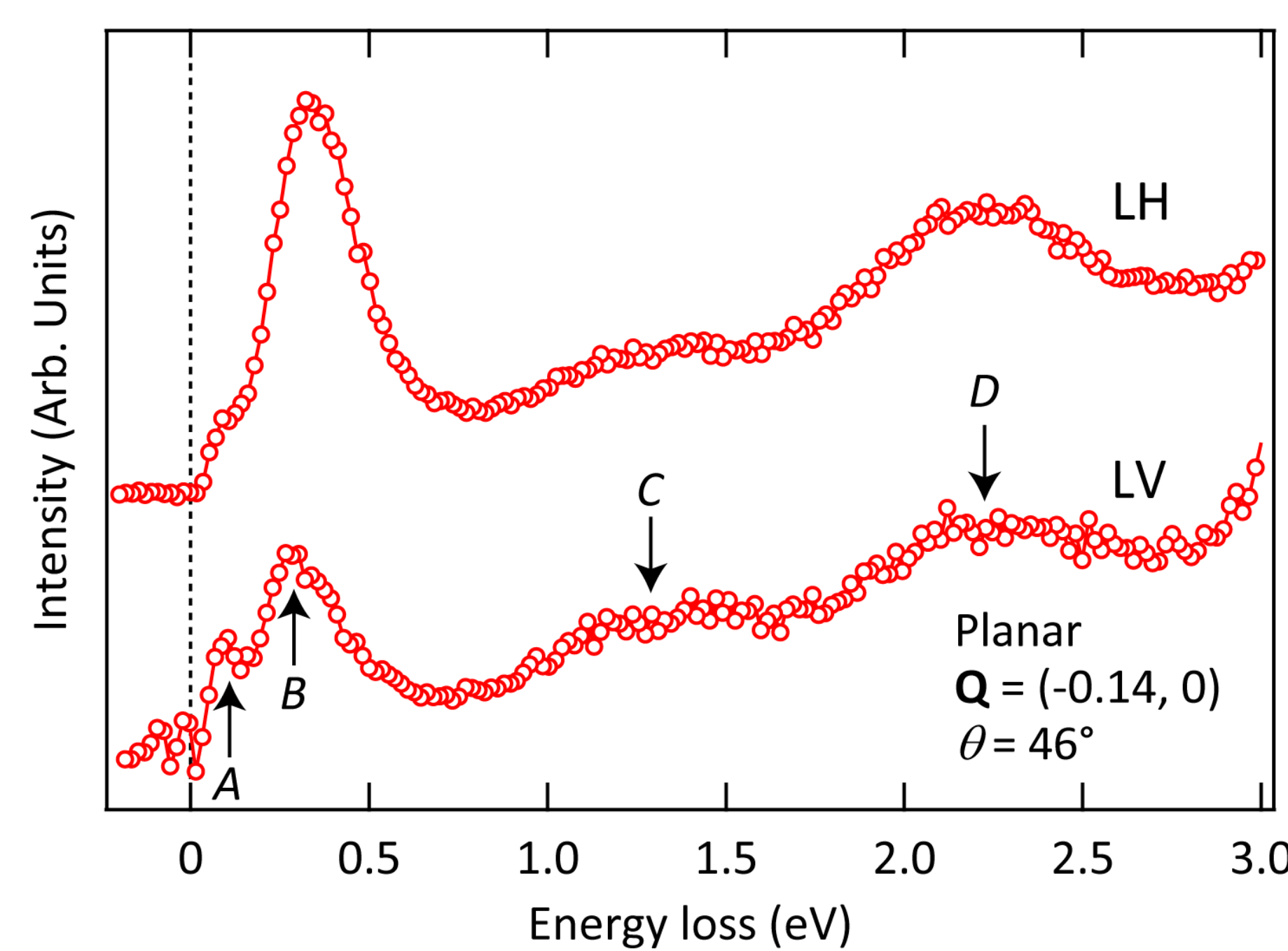
Methods

- Oxygen K-edge RIXS study
- Photon in - Photon out process
- Electron excited from core level to empty valence.
- Empty core state filled by an electron from the occupied states

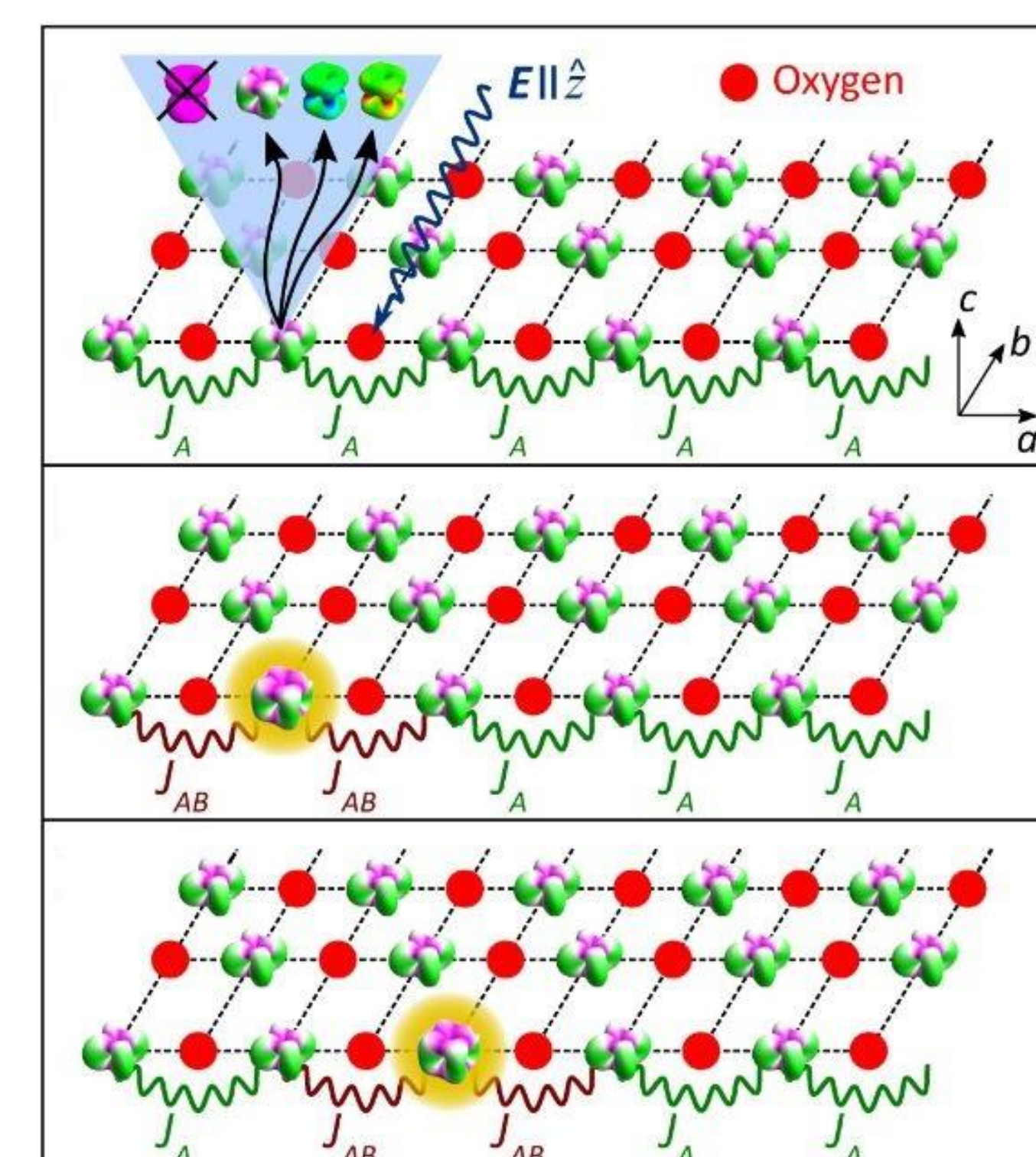
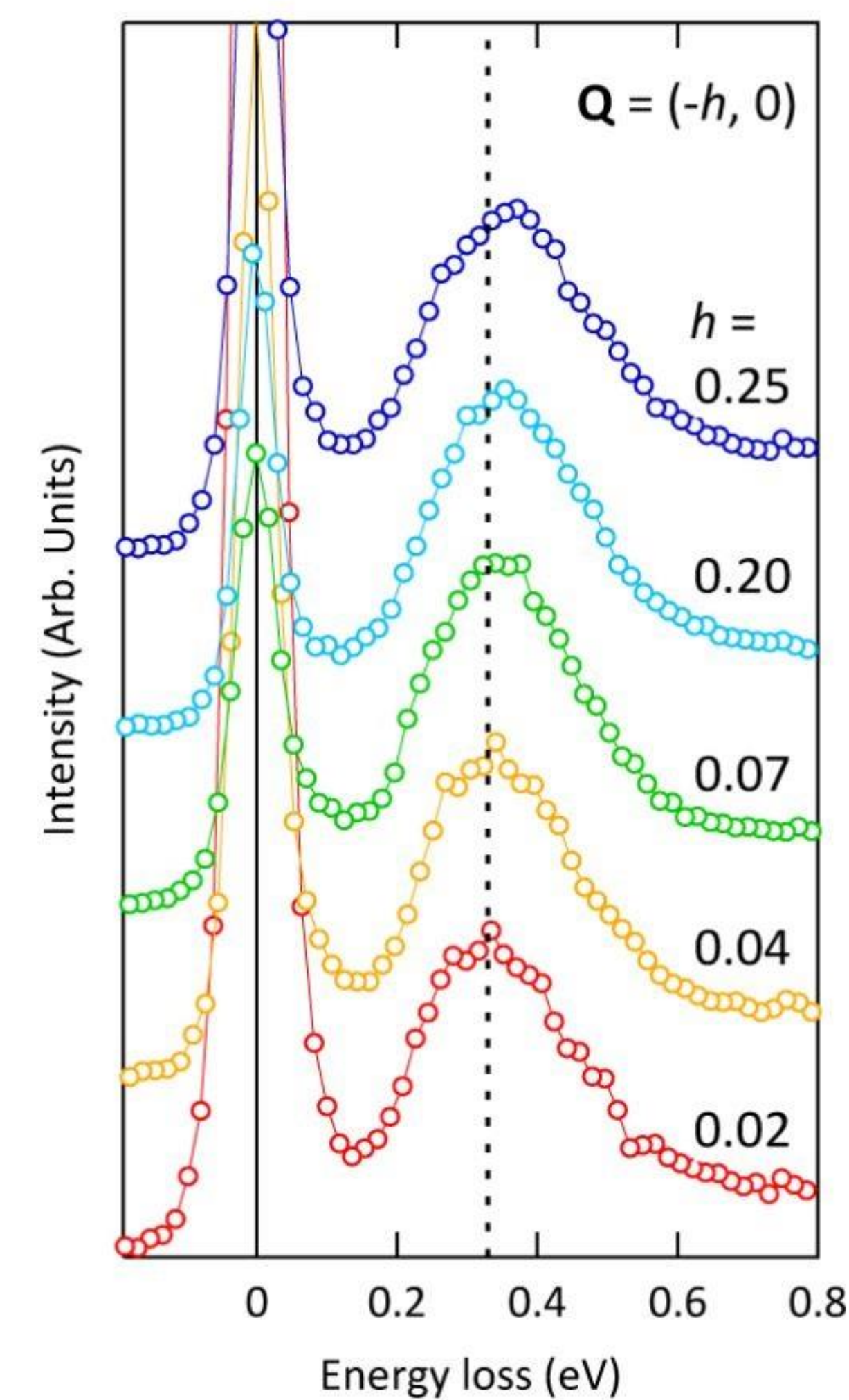
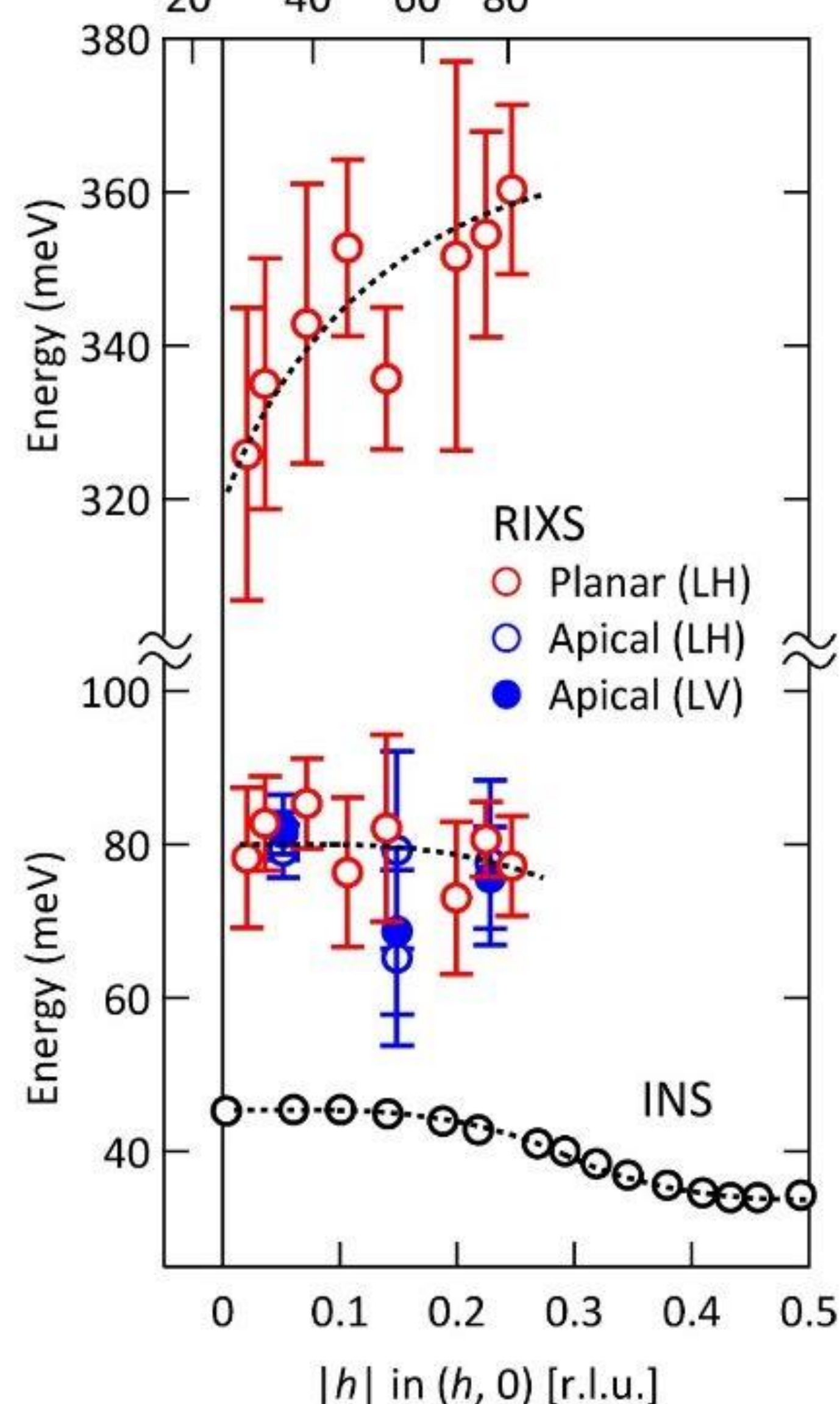


Schematic representation of the experimental geometry

Analysis



Incident angle θ (degree)



Schematic illustration of propagation of the excited spin-orbital

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- Braden, M., et al. "Crystal and magnetic structure of Ca_2RuO_4 : Magnetoelastic coupling and the metal-insulator transition." *Physical Review B* 58.2 (1998): 847.
- Ament, Luuk JP, et al. "Resonant inelastic x-ray scattering studies of elementary excitations." *Reviews of Modern Physics* 83.2 (2011): 705.
- Jain, A., et al. "Higgs mode and its decay in a two-dimensional antiferromagnet." *Nature Physics* (2017).

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Experiments performed at ADDRESS beam line SLS, PSI