Surface and bulk electronic structure of the unconventional superconductor Sr_2RuO_4: unusual splitting of the β band

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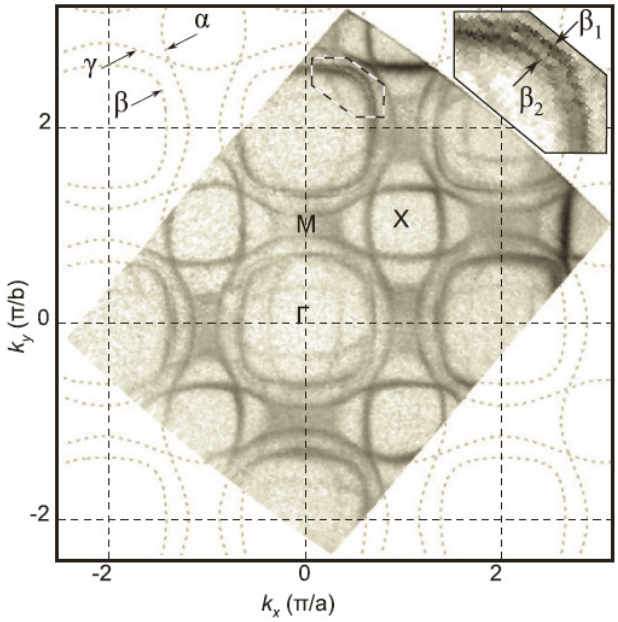
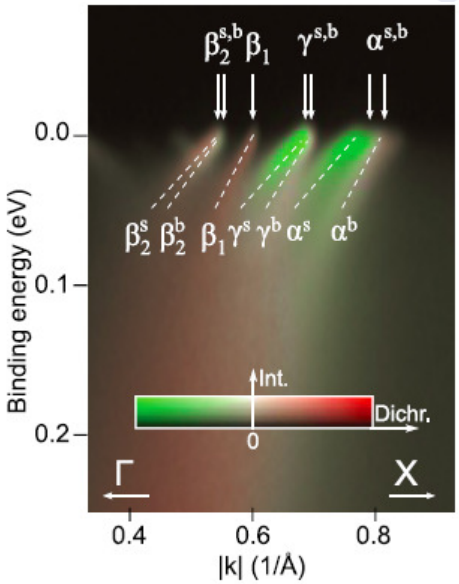
Angle-resolved photoemission spectroscopy performed at extremely low temperatures (T ~ 1 K) with improved momentum resolution enabled us to observe bulk α, β, γ bands and their surface counterparts along *with an additional new feature*, in ultra-pure Sr_2RuO_4 single crystals. Indeed, the Fermi Surface contour corresponding to the β band appears to be split (β_1 and β_2). The multitude of the features we observed in the spectra must result from a superposition of bulk and surface states. Circularly polarized light has been used to disentangle the signals from the bulk and surface layers and allowed us to discuss the origin of the splitting of the β band and the possible connection with the Rashba effect at the surface.



Overview of Sr_2RuO_4 Fermi Surface map. The inset shows the splitting of the β band.



Circular-dichroic signal to separate the surface and bulk bands in Sr_2RuO_4. In order to facilitate the comparison between the bands exhibiting circular dichroism and those with negligible dichroism, we plot them in this way: the brightness corresponds to the sum of intensities obtained with opposite polarizations (circular right + circular left) and the color, ranging from green through white to red, encodes the dichroism strength (circular right - circular left).