

Temperature-Tunable Yoneda-Like Anomalous Soft X-Ray Reflection at the Al L₃ Edge

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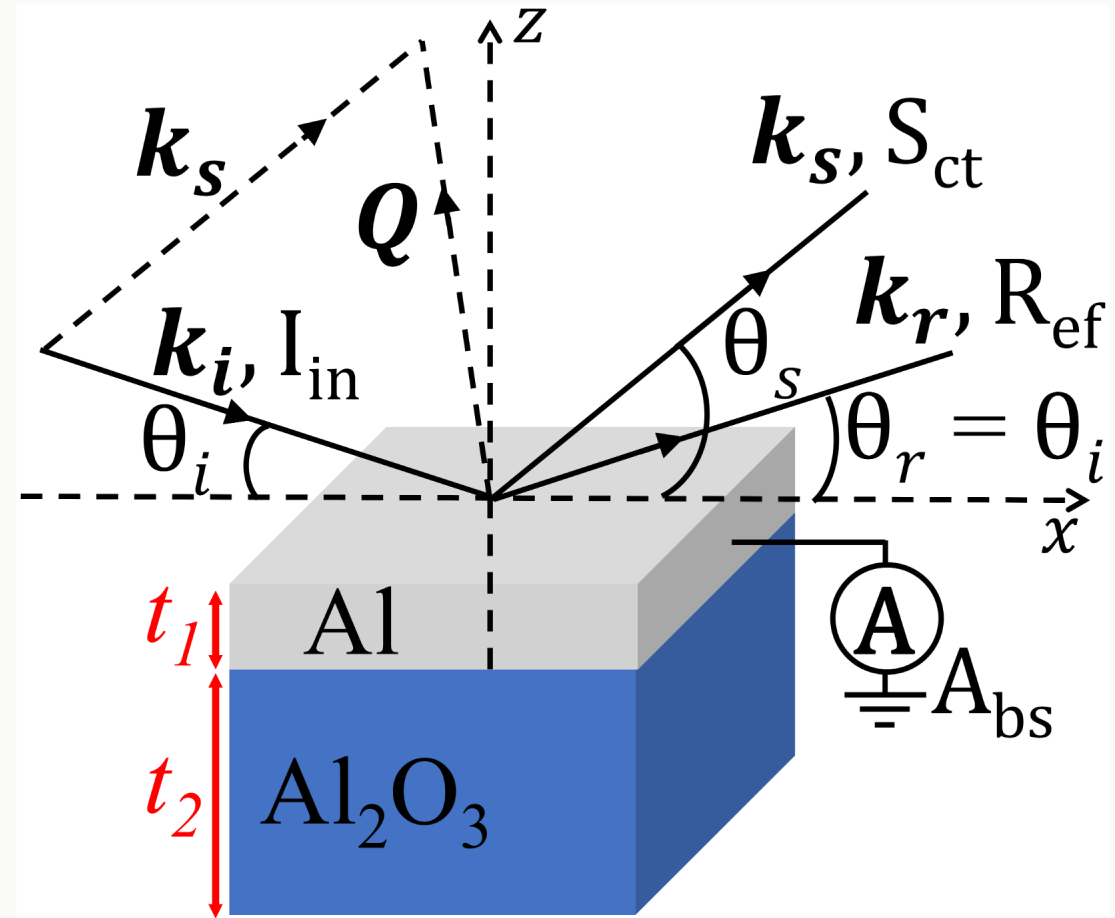
Why no Yoneda peak is expected

At 72.8 eV: $\text{Re } n = 1.0249 > 1$

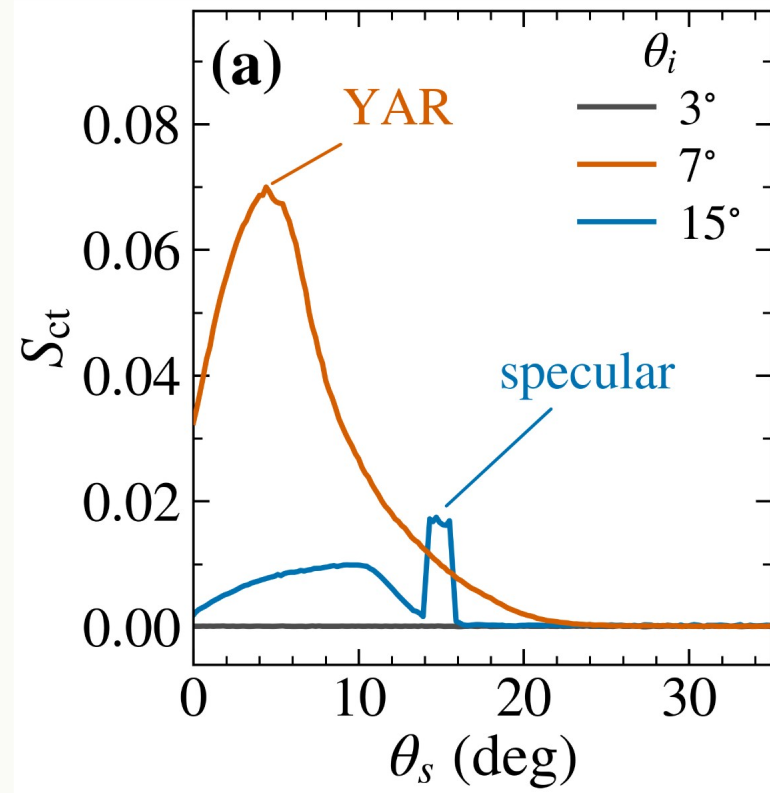
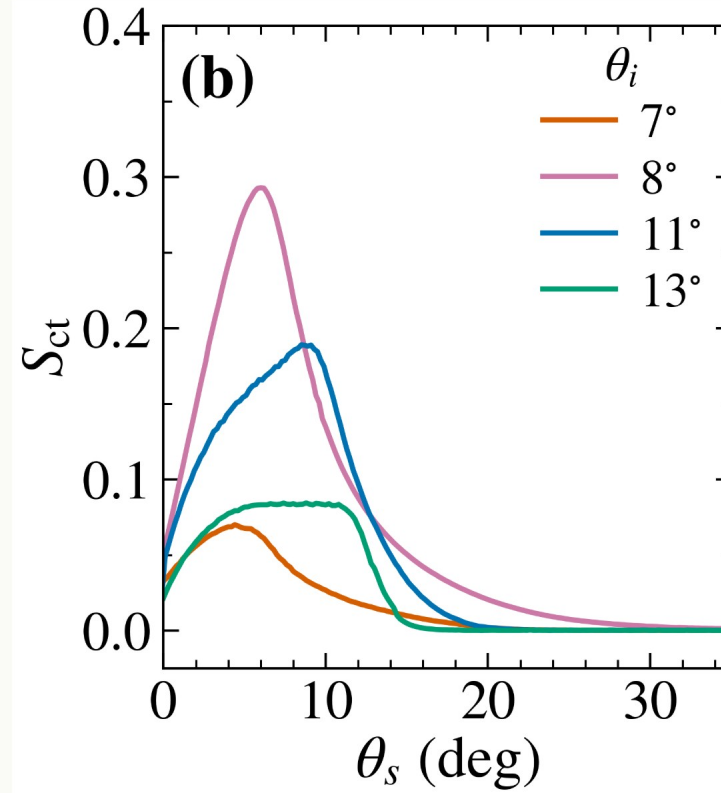
Aluminum is denser than vacuum: no critical angle.

The Yoneda enhancement goes into the film, not to the detector.

Theory: no Yoneda peak in reflection.



But we see one at 300 K

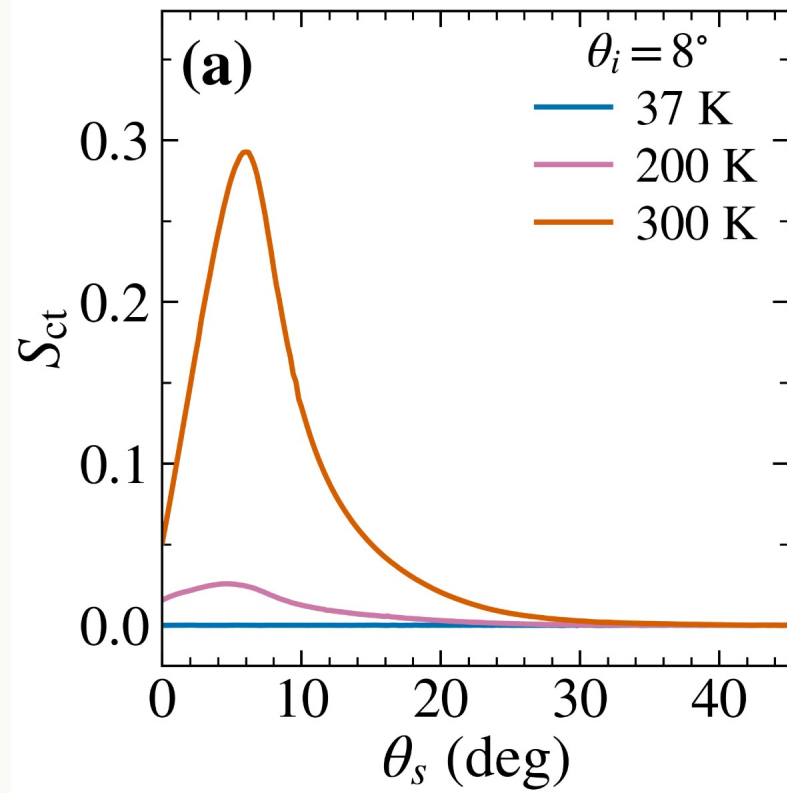
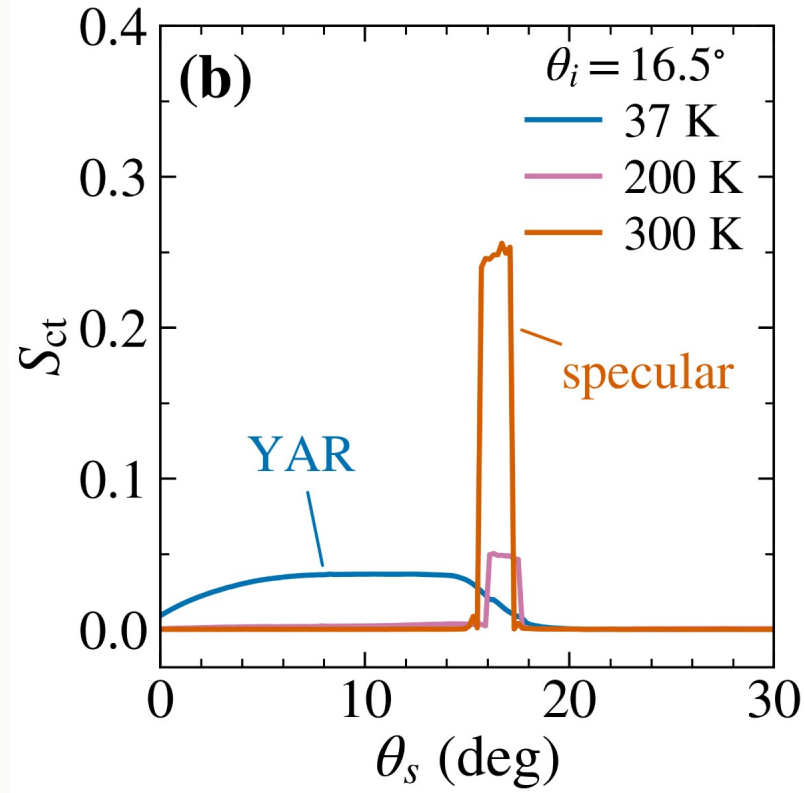


3°: flat. Below 6° , nothing is reflected.

7° to 13°: shape changes, window range stays roughly the same.

15°: the specular peak returns.

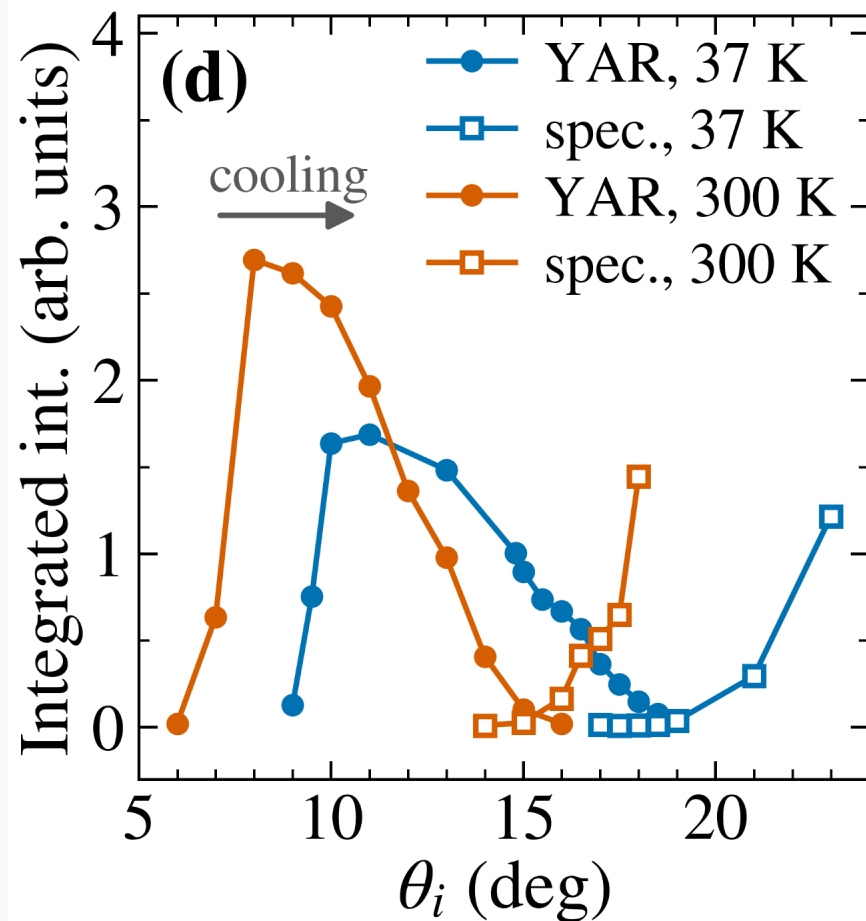
Cooling: opposite effects at 8° and 16.5°



8° : YAR drops by more than 10^3 .

16.5° : YAR grows, specular peak vanishes.

One shift of the profile explains both



Cooling stretches the profile to larger incidence angles by $k = 1.30 \pm 0.07$.

Refraction sets the scale: a limiting angle $\arccos(1/n) = 12.7^\circ$, comparable to the 16.3° window edge.

So $|\text{Re } n - 1|$ grows by about 70% ($k^2 = 1.7 \pm 0.2$).

Not the lattice: Debye-Waller change $< 0.01\%$.

Take-home message

A temperature-tunable Yoneda-like reflection, where theory forbids one.

It is controlled by the resonant electronic response, not the lattice.

Poster PO.172 · Thursday 4.00 PM · Multi-Purpose Hall

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