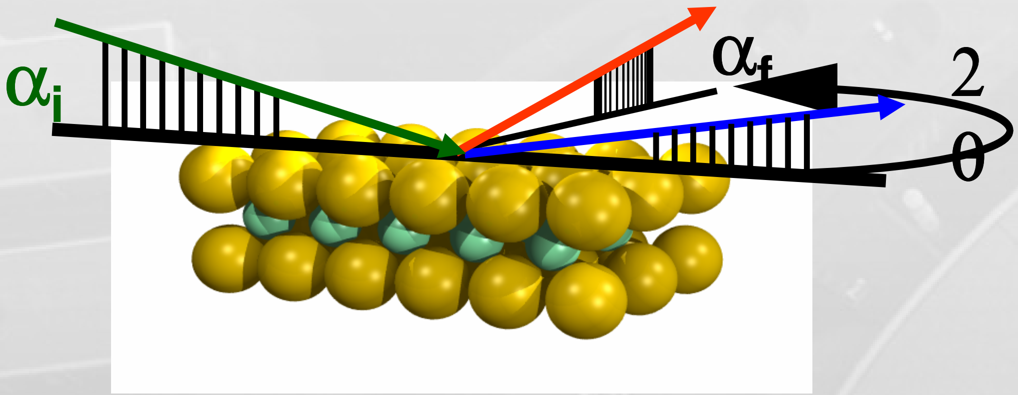
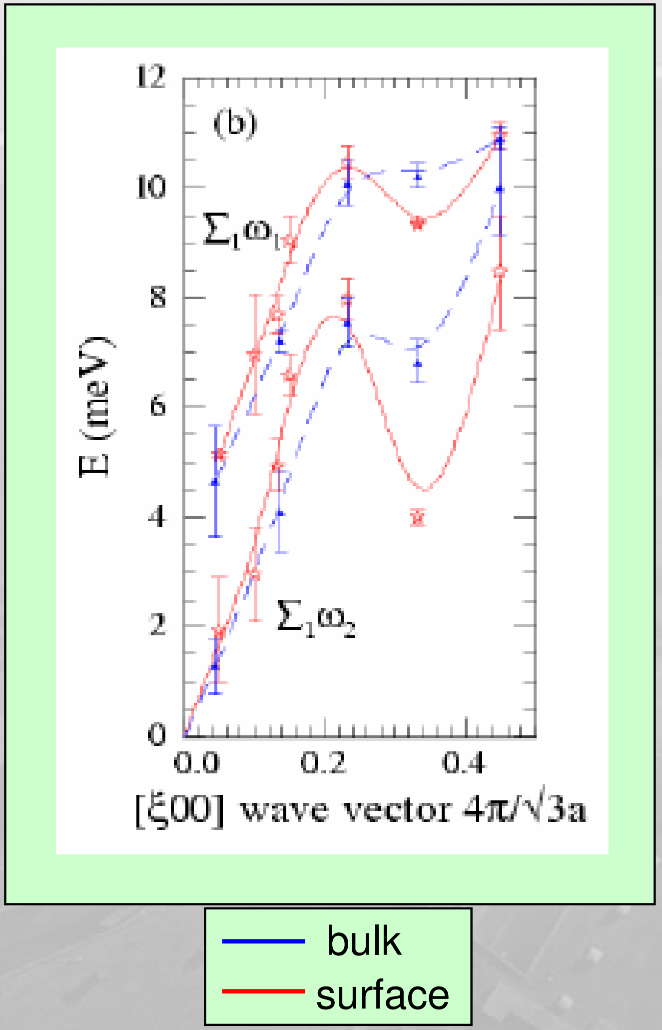
IXS in surface sensitive geometry



α_i **below critical angle** α_c **=>**
penetration depth: ~30 Å
Energy resolution: 3 meV

2H-NbSe$_2$

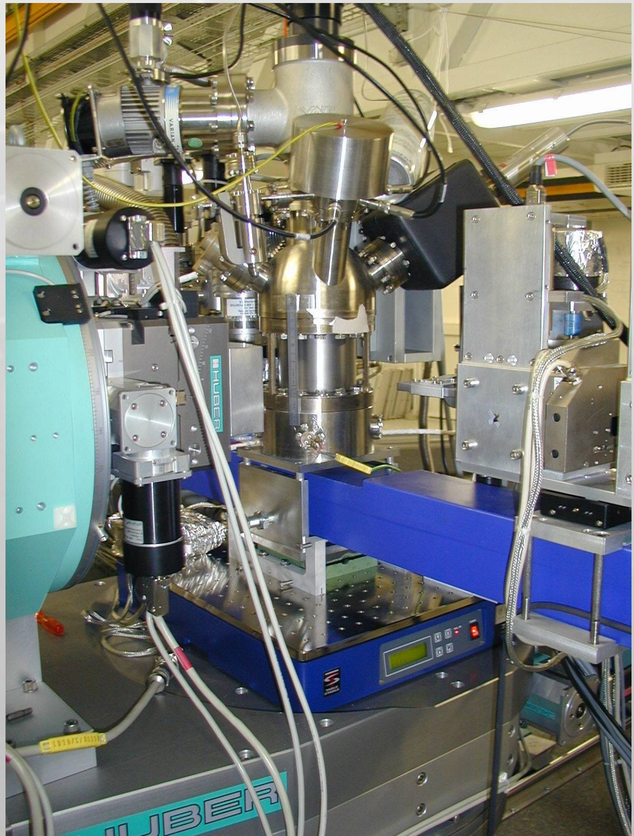


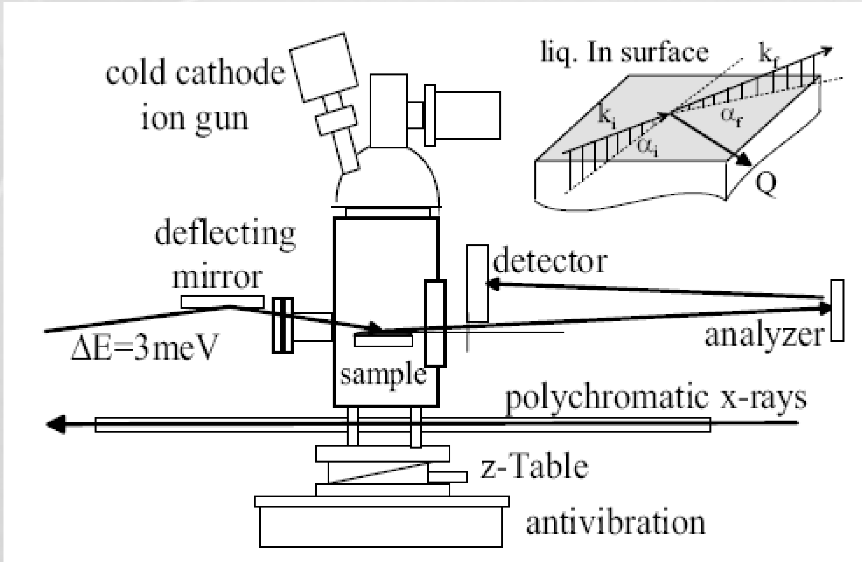
- More pronounced Kohn anomaly in surface sensitive geometry.
  - increased electron-phonon coupling.
  - changes in the Fermi surface.

B. Murphy et al.; Phys. Rev. Lett. 95, 256104 (2005)

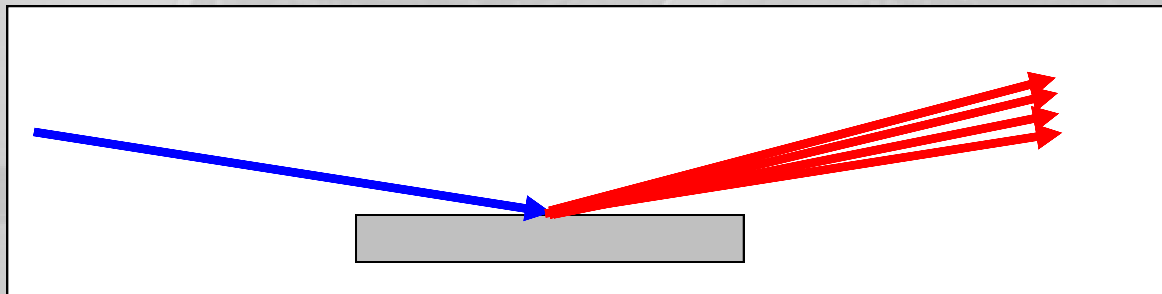
THz liquid surface dynamics

- Modification of the THz dynamics at the surface?



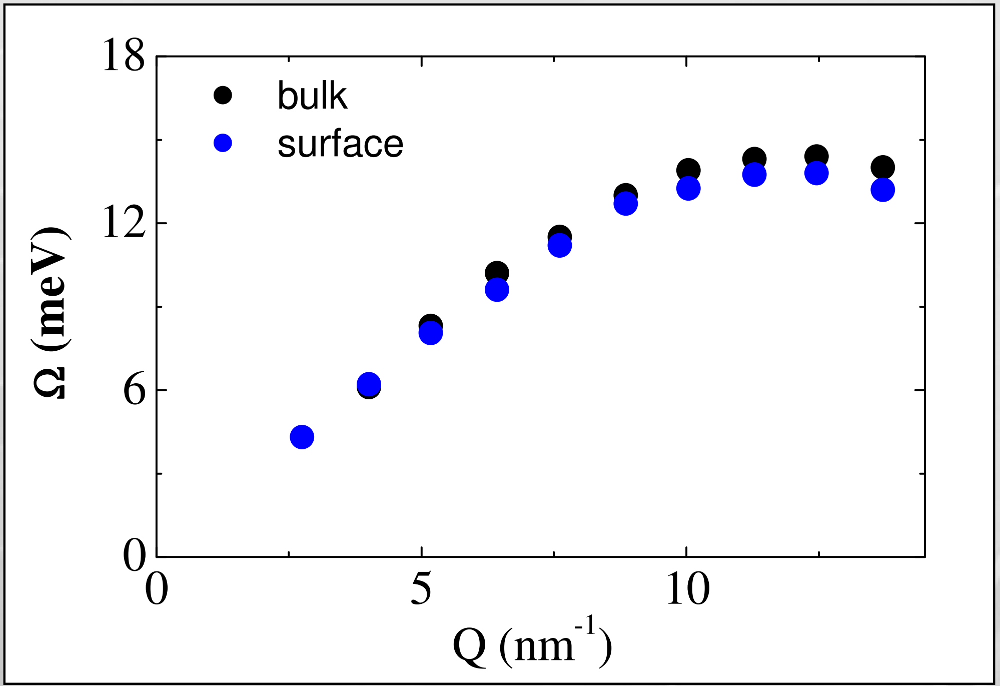


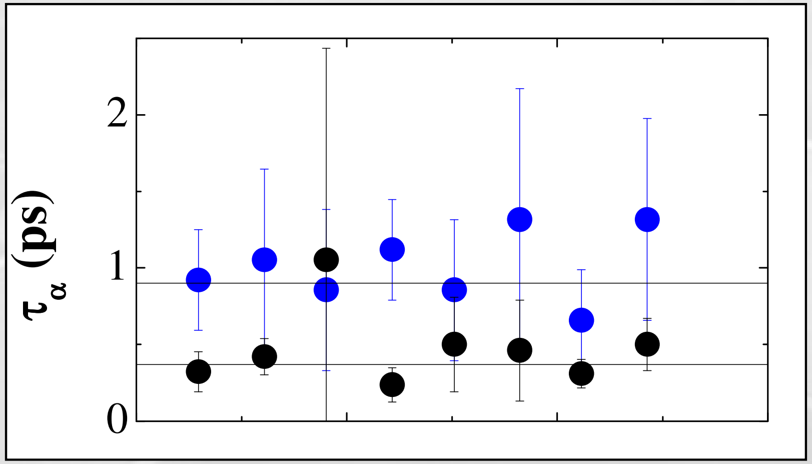
ΔE = 3 meV
α_c = 0.16°
Λ = 4.6 nm

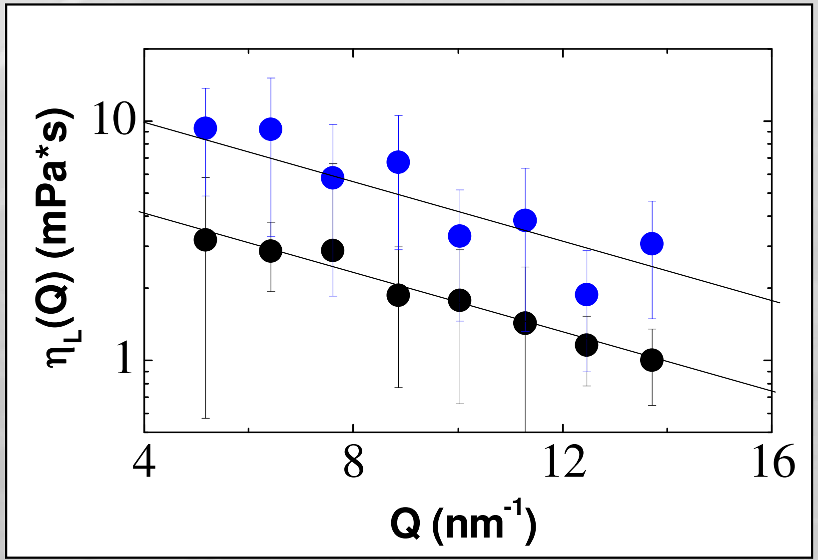


α_i=0.61α_c α_i=(0.03 - 3.4)α_c

H. Reichert et al.; Phys. Rev. Lett, 98, 096104 (2007)







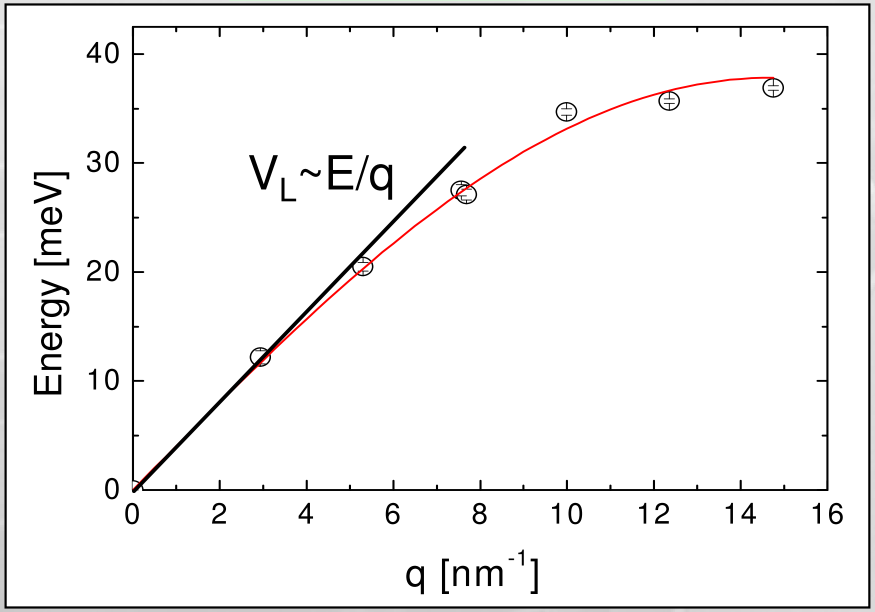
Generalised Hydrodynamics + memory function approach

- Slowing down of structural relaxation processes near the surface.
- Association with layer stratification and average density change.

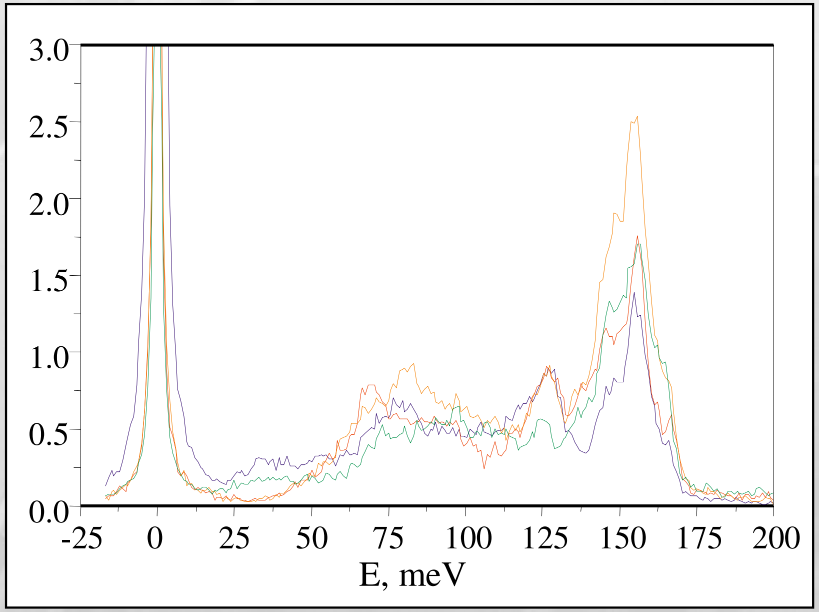
H. Reichert et al.; Phys. Rev. Lett, 98, 096104 (2007)

Studies on polycrystalline materials

At low Q (1. BZ)



At high Q (50–80 nm^{-1})



Orientation averaged longitudinal sound velocity

(Generalised) phonon density-of-states

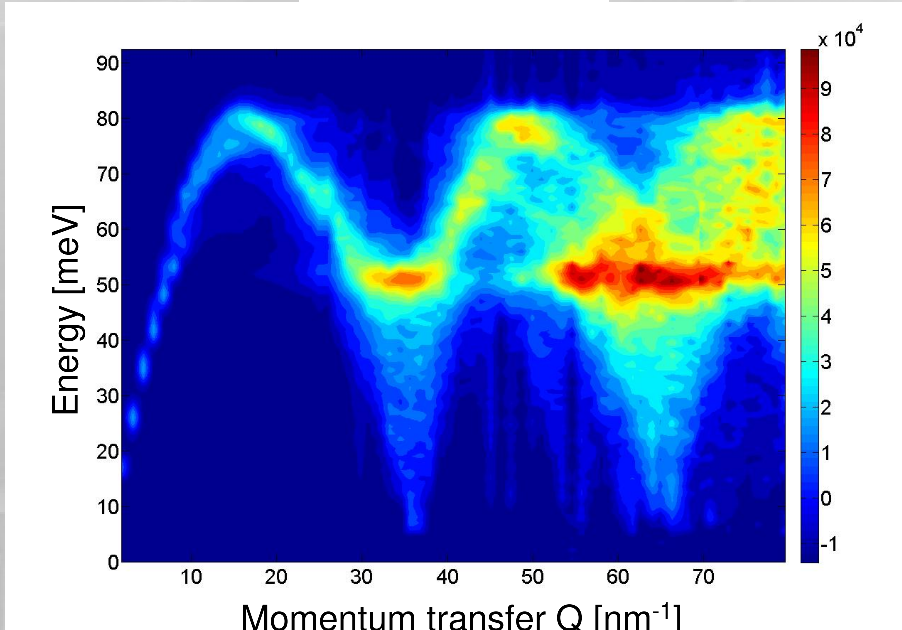
Information content is incomplete!

Single crystal properties from polycrystalline materials

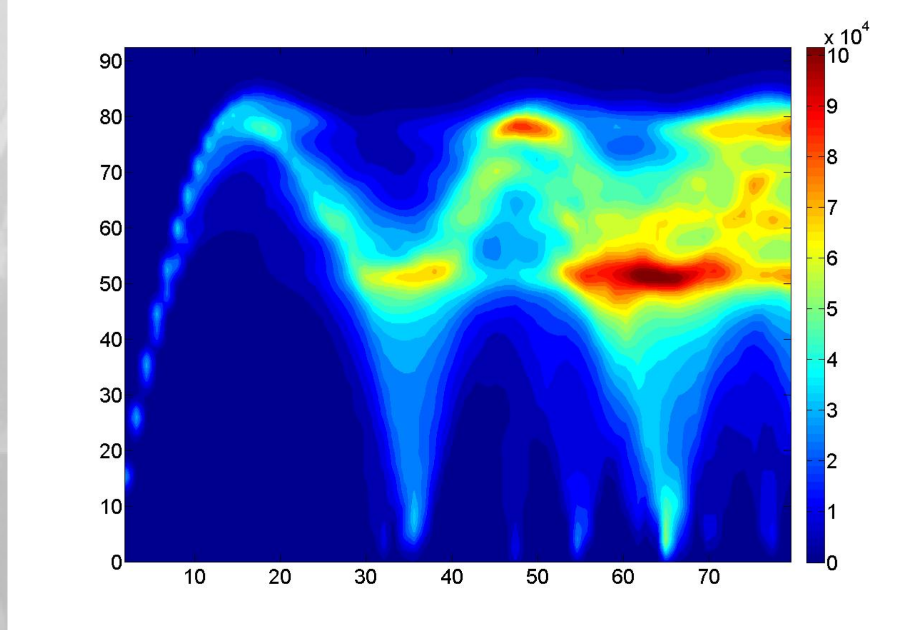
- Record IXS spectra for $2 < Q < 80\ nm^{-1}$.
- Confront experiment with simulations.
- Least-square refinement of experimental data.

Test case: polycrystalline Beryllium (thesis: I. Fischer)

Experiment

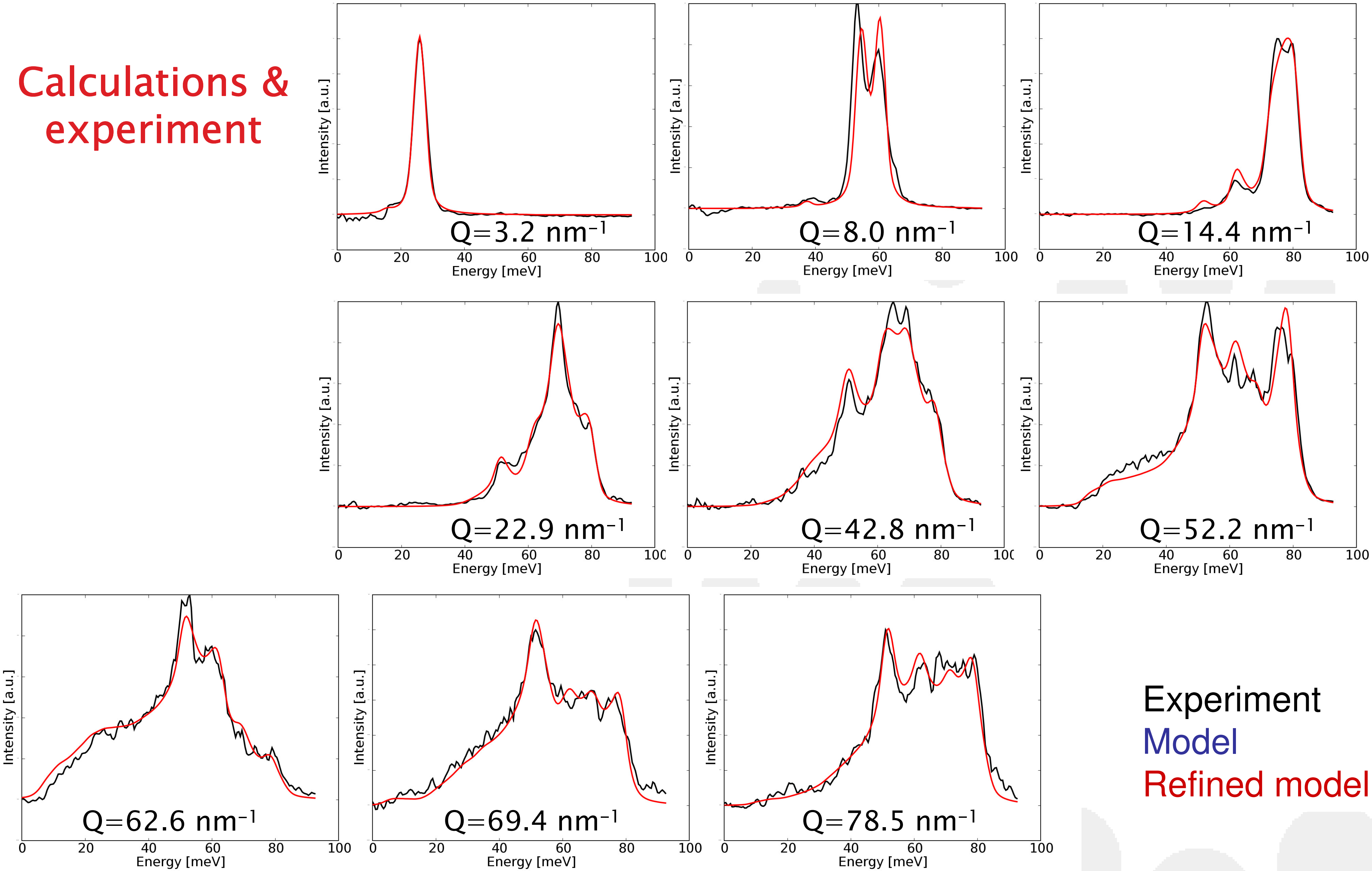


Fit

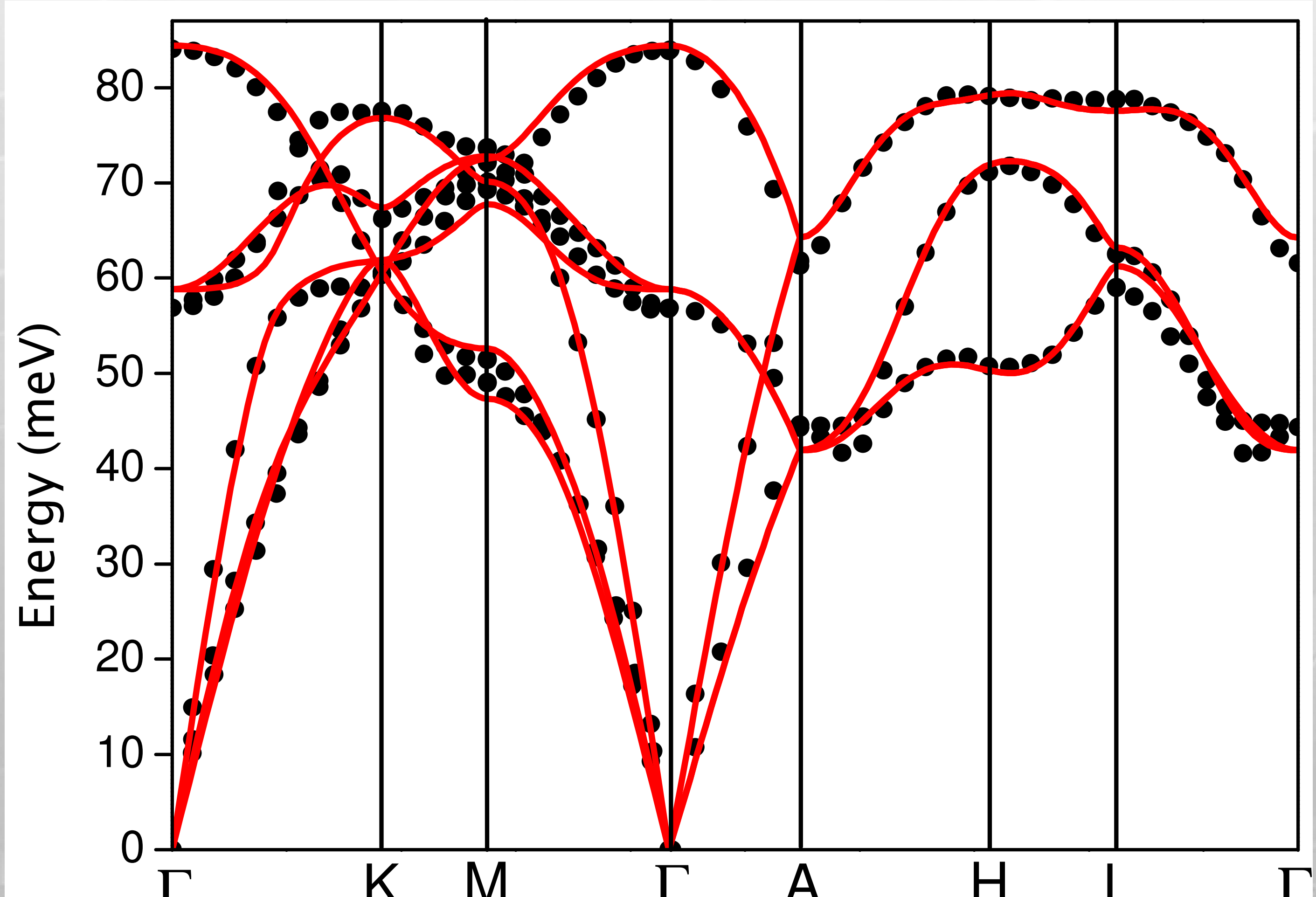


I. Fischer et al.; in preparation

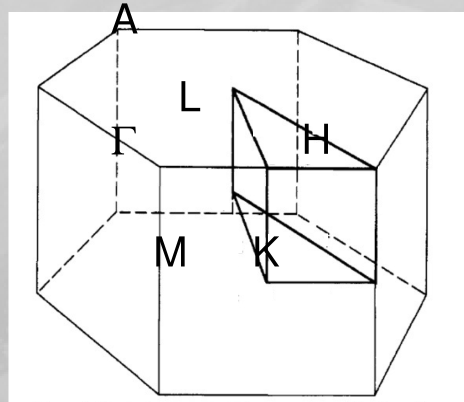
Calculations & experiment



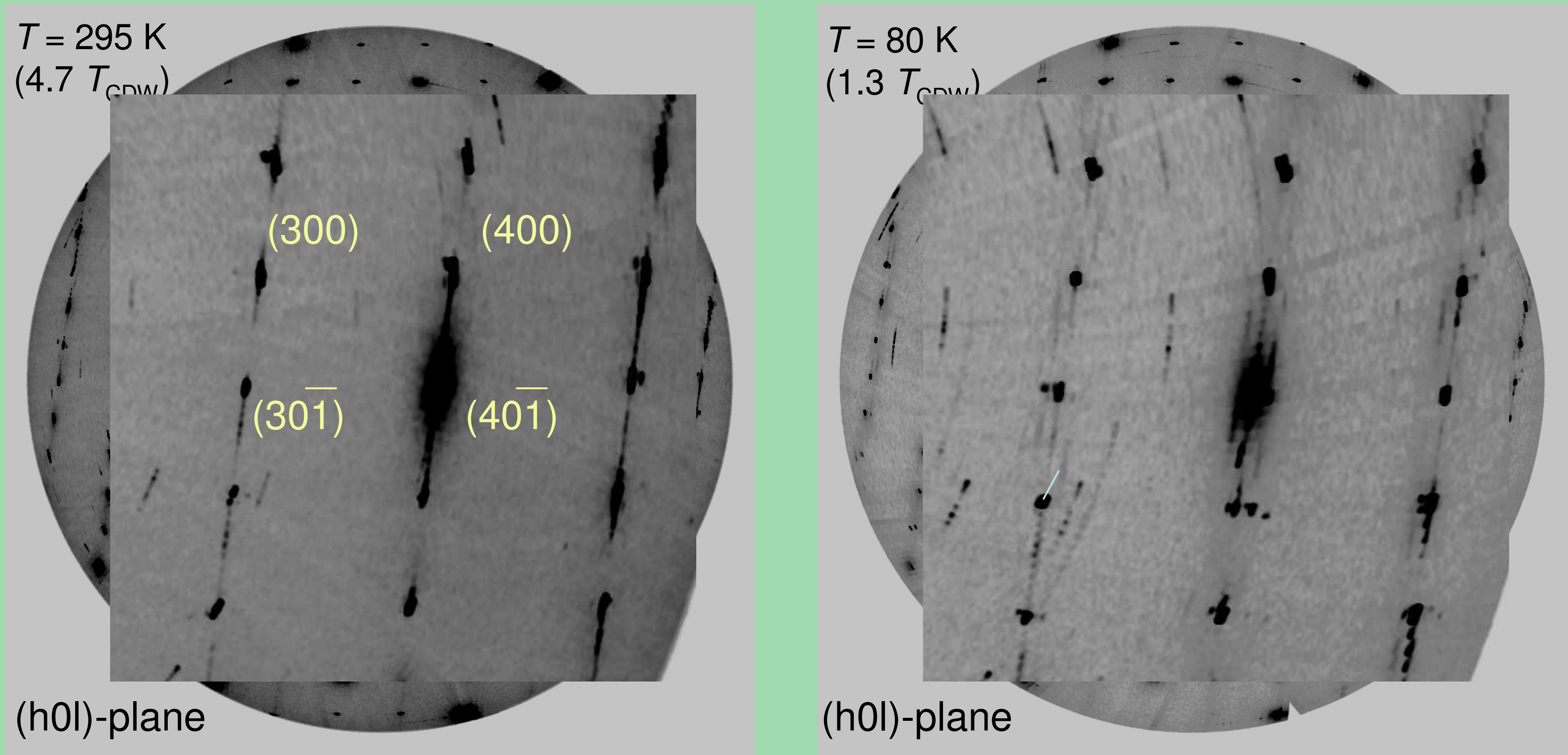
Dispersion relations



Neutron data
Refined model

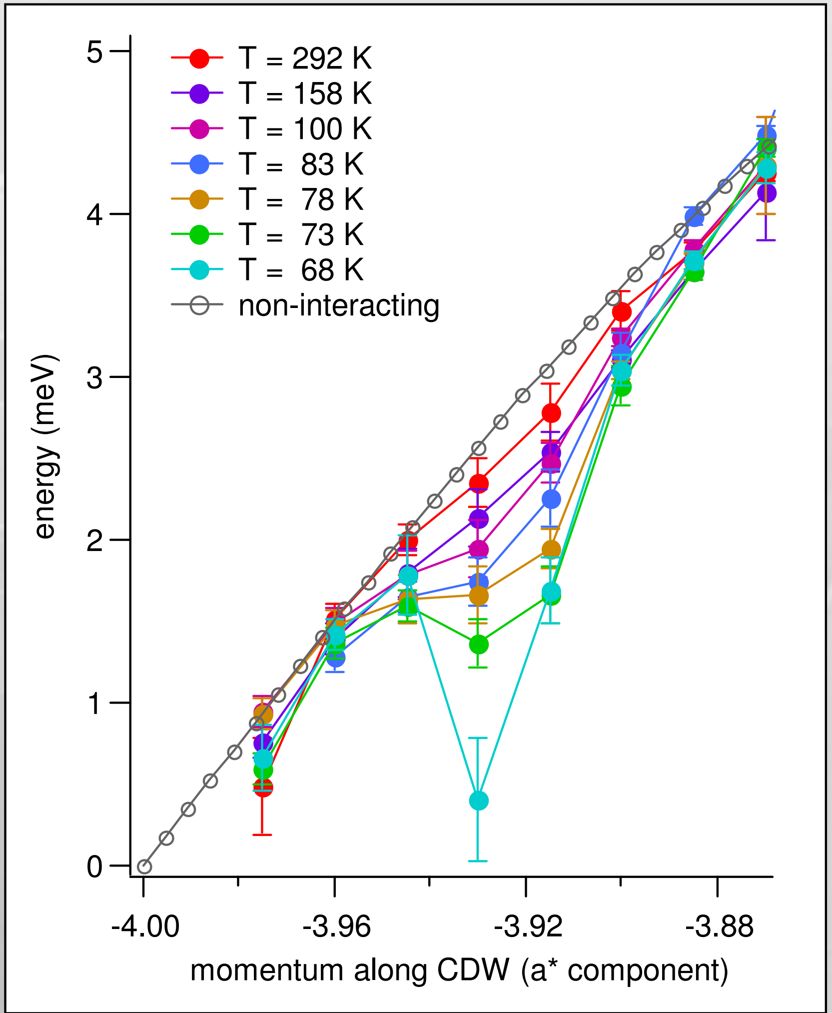


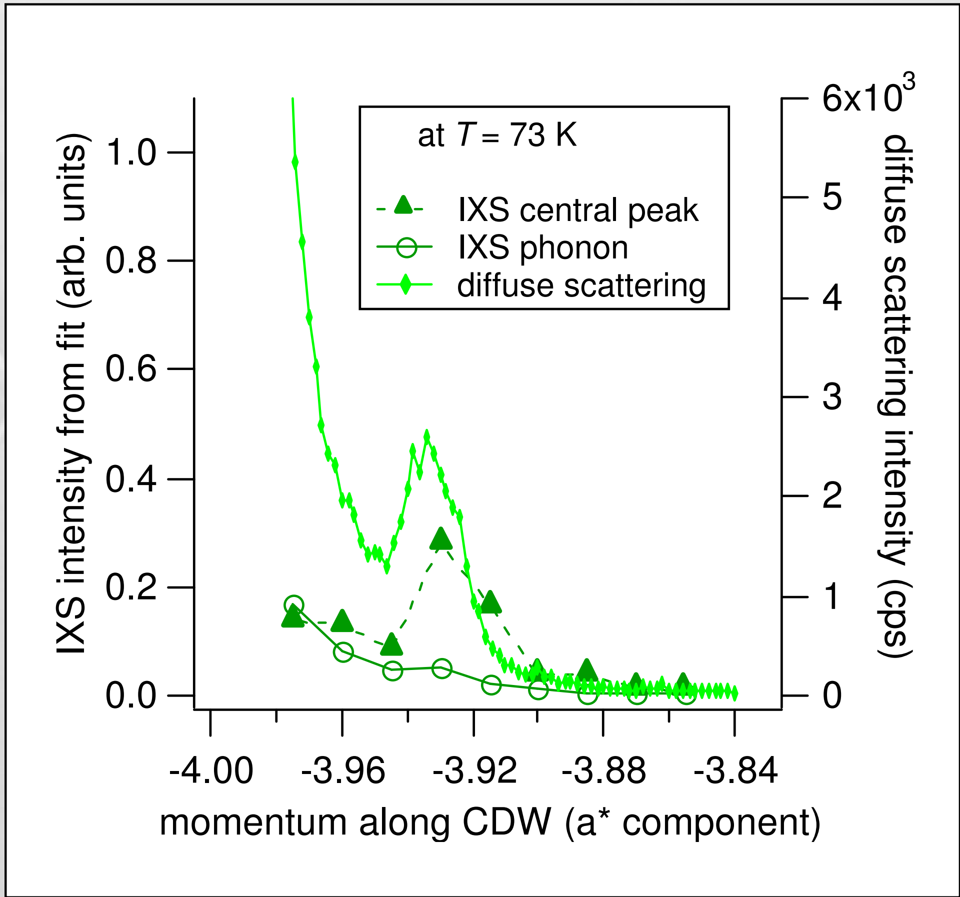
Combined diffuse scattering and IXS study on $ZrTe_3$



diffuse scattering at SNBL BM01A / q_{CDW} = (0.07 0 0.3333)

M. Hoesch, A. Bosak, D. Chernyshov, H. Berger, A. Mirone, and MK; in preparation





- Diffuse scattering is dominated by non-dynamical scattering
  --> disorder contributes strongly to diffuse scattering

M. Hoesch, A. Bosak, D. Chernyshov, H. Berger, A. Mirone, and MK; in preparation

Conclusions

- IXS complements INS capabilities
  - samples in very small quantities.
  - extreme conditions (high pressure and temperature).
  - dynamics at surfaces and thin films.

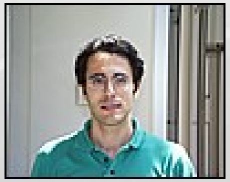
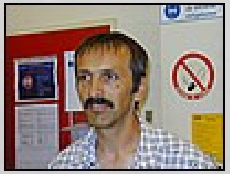
- Technical developments
  - efficient spectrometer (5 -> 9 -> 50 crystal analysers)
  - efficient experiment preparation and data analysis

Thanks to:







- ***the ESRF colleagues***
- ***the management for support and inspiration***
- ***proactive User Community***