FUKUTANI LAB.

[Surface and Interface Science]

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Surface and Interface Physics

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Functional Interfaces and Dynamics of Molecules at Interfaces

■ Overview

Surfaces and interfaces have different electronic states from those of bulk materials because of the lowered dimensionality and symmetry compared to the bulk. Thus, the surfaces and interfaces are expected to reveal characteristic properties such as interface electric conductivity and catalytic activities. Surfaces furthermore play an important role in the formation, storage, and sensing of hydrogen, which is a clean energy source. In our laboratory, along with the development of original experimental techniques that allow us to analyze surfaces and hydrogen, we explore new functional surfaces and investigate the underlying mechanisms of electric conductivity, spin conversion, hydrogen transport and H_2 formation.
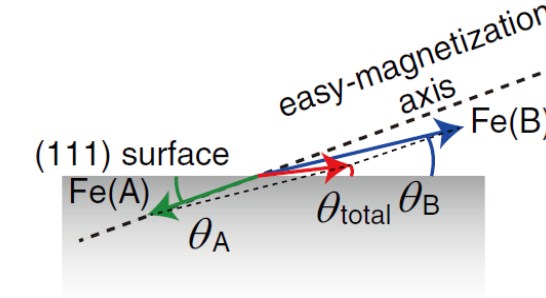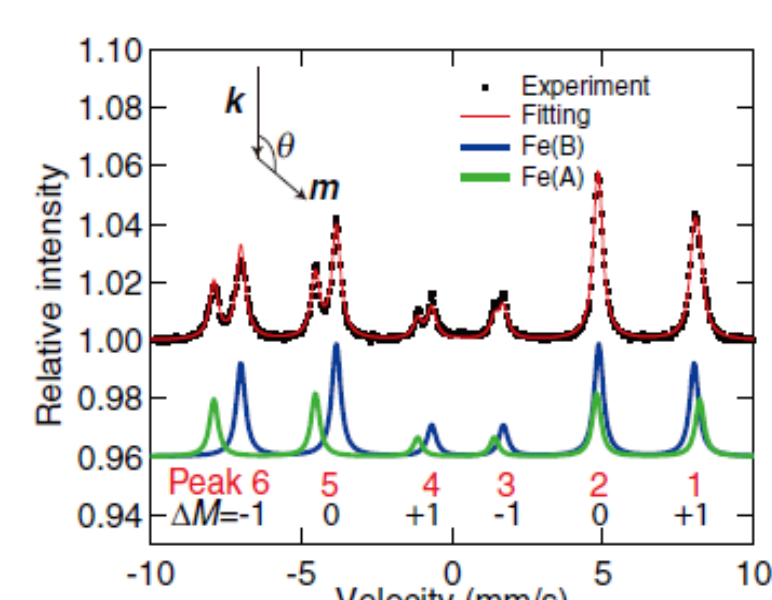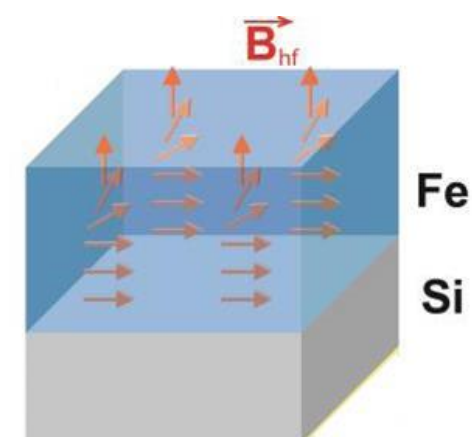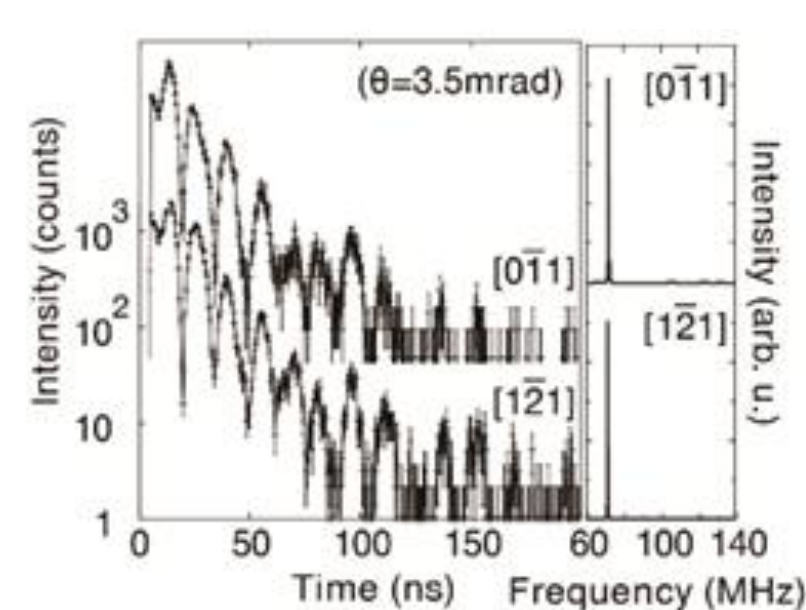
■ Research topics

1. Design of functional interfaces

  ・Electronic state/magnetism/reactivity of metal nanostructures
  ・Electronic state/conductivity/reactivity of metal oxide
    surfaces (TiO_2, $SrTiO_3$, Fe_3O_4 etc.)
  ・Structure/phase transition/reaction of molecular layer
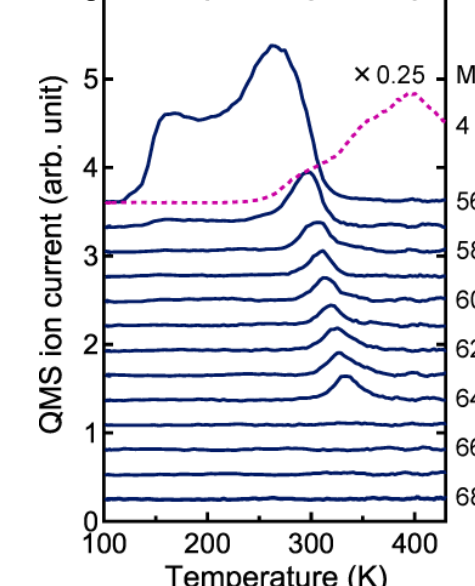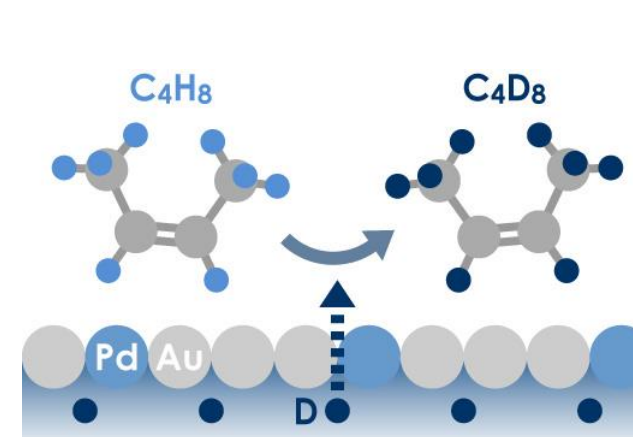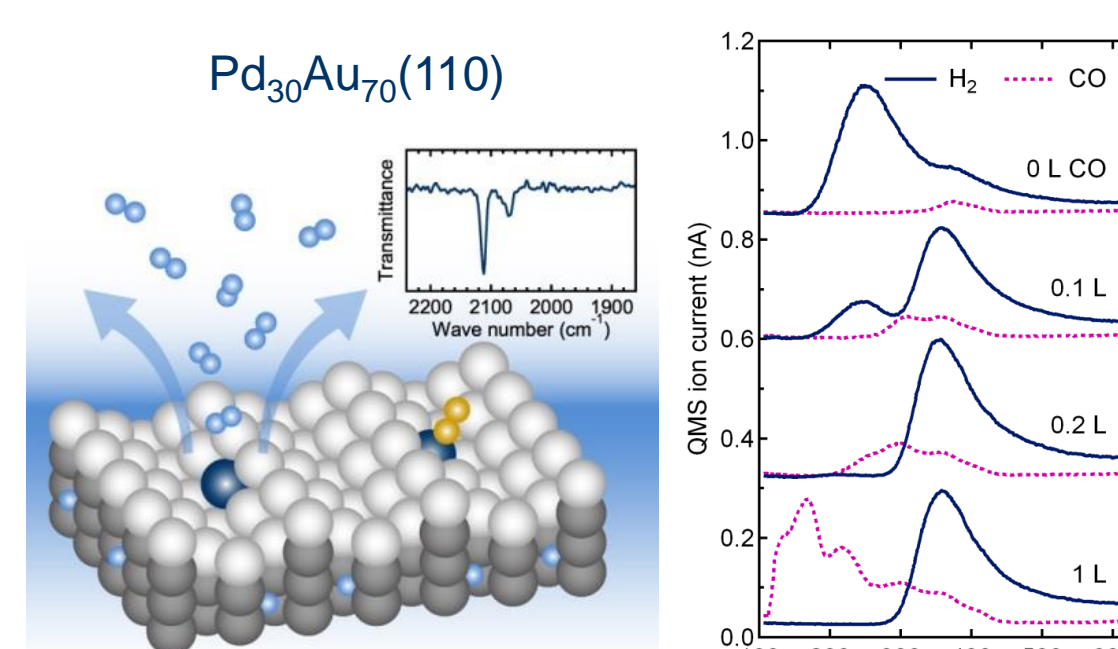 ・Physics and control of excited states

2. Hydrogen dynamics

  ・Nuclear spin conversion/energy dissipation
  ・Molecular hydrogen formation reaction
  ・Hydrogen transfer/storage in metal/nanotubes
  ・Hydrogen-induced surface conductivity
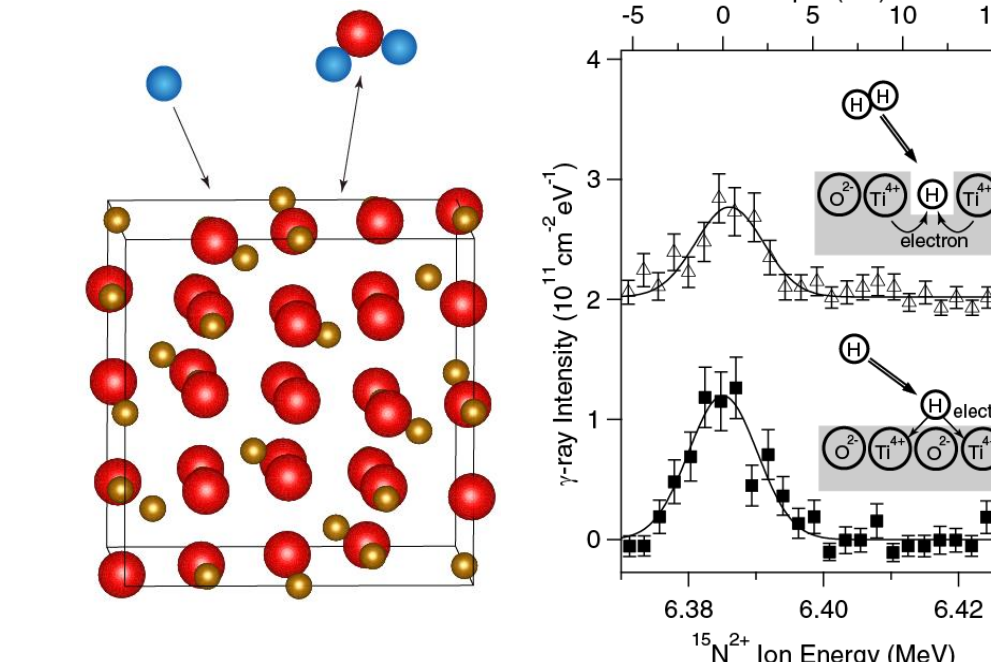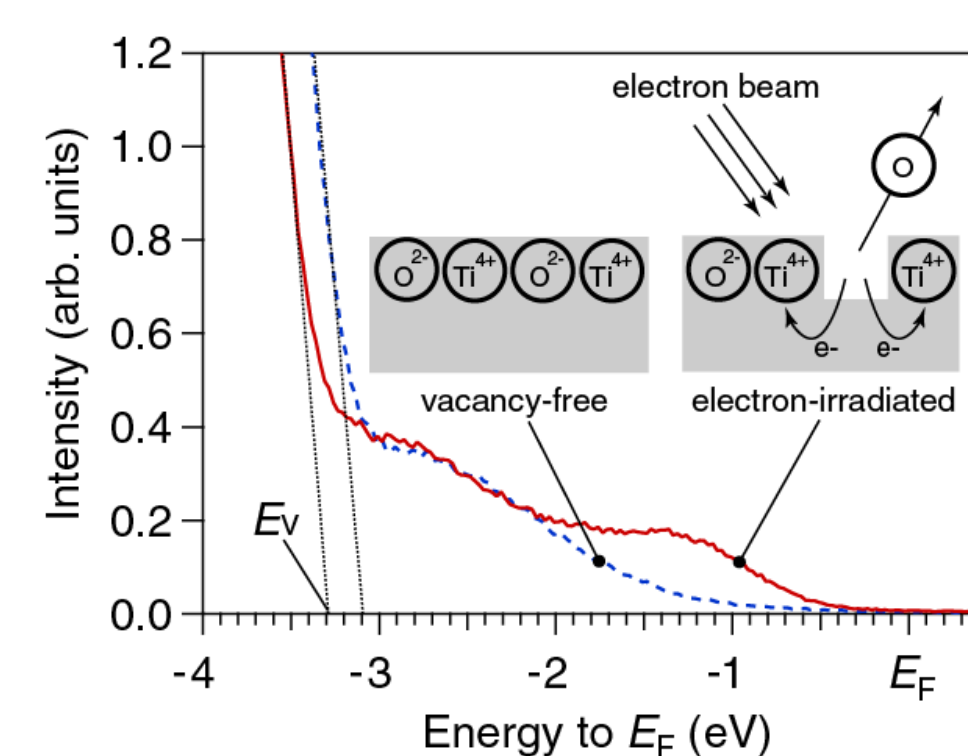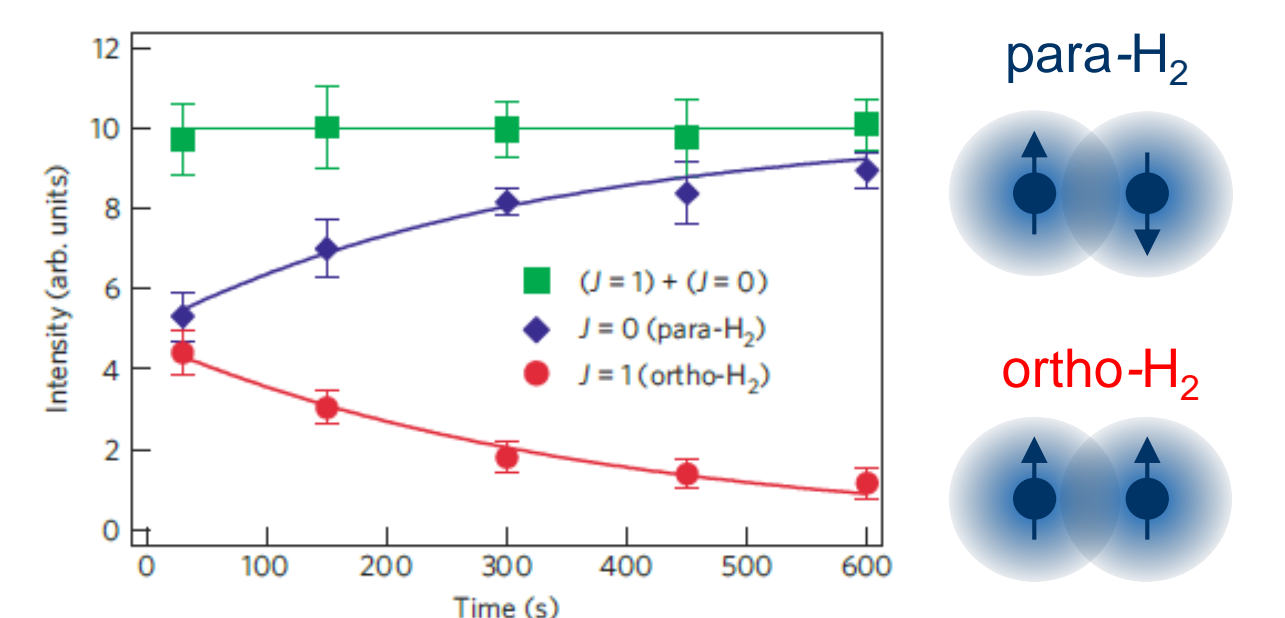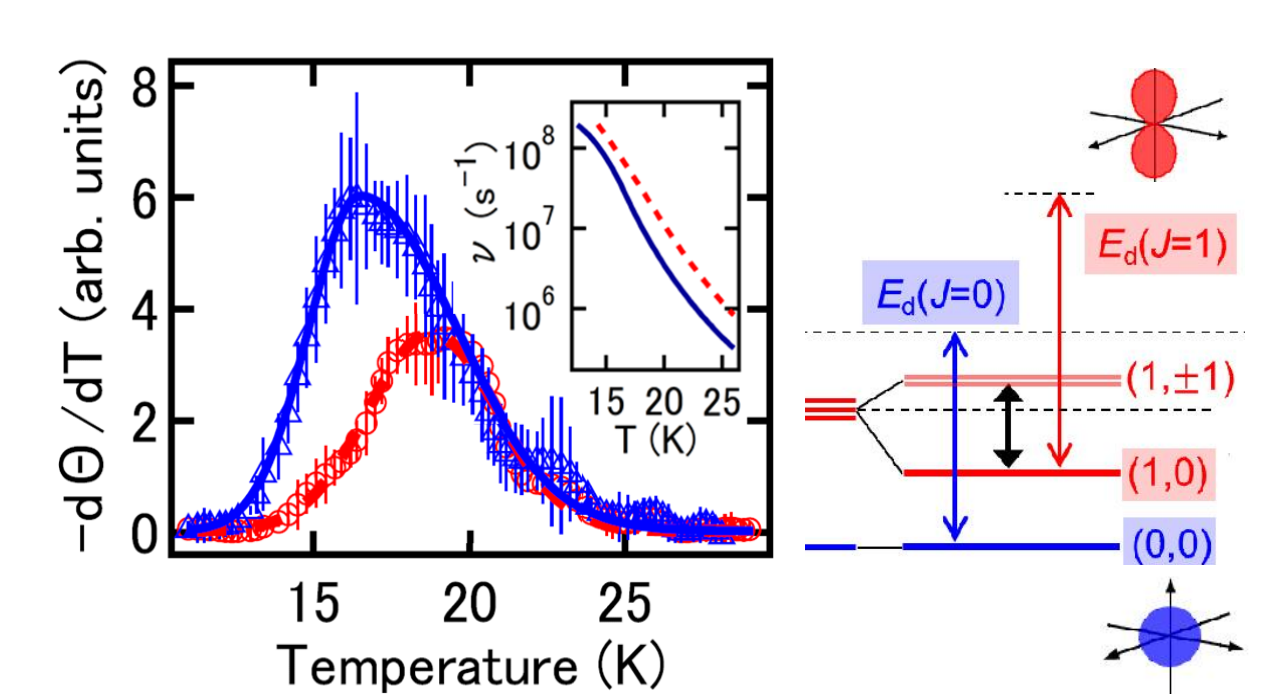 ・Development of spin-polarized atomic H beam

[Interface magnetic canting]   [Control of H ab/desorption]   [Electronic control of metal oxides]   [o-p conversion/separation]

■ Experimental techniques

[NRA Hydrogen microscope]
  3D H distribution under atmosphere
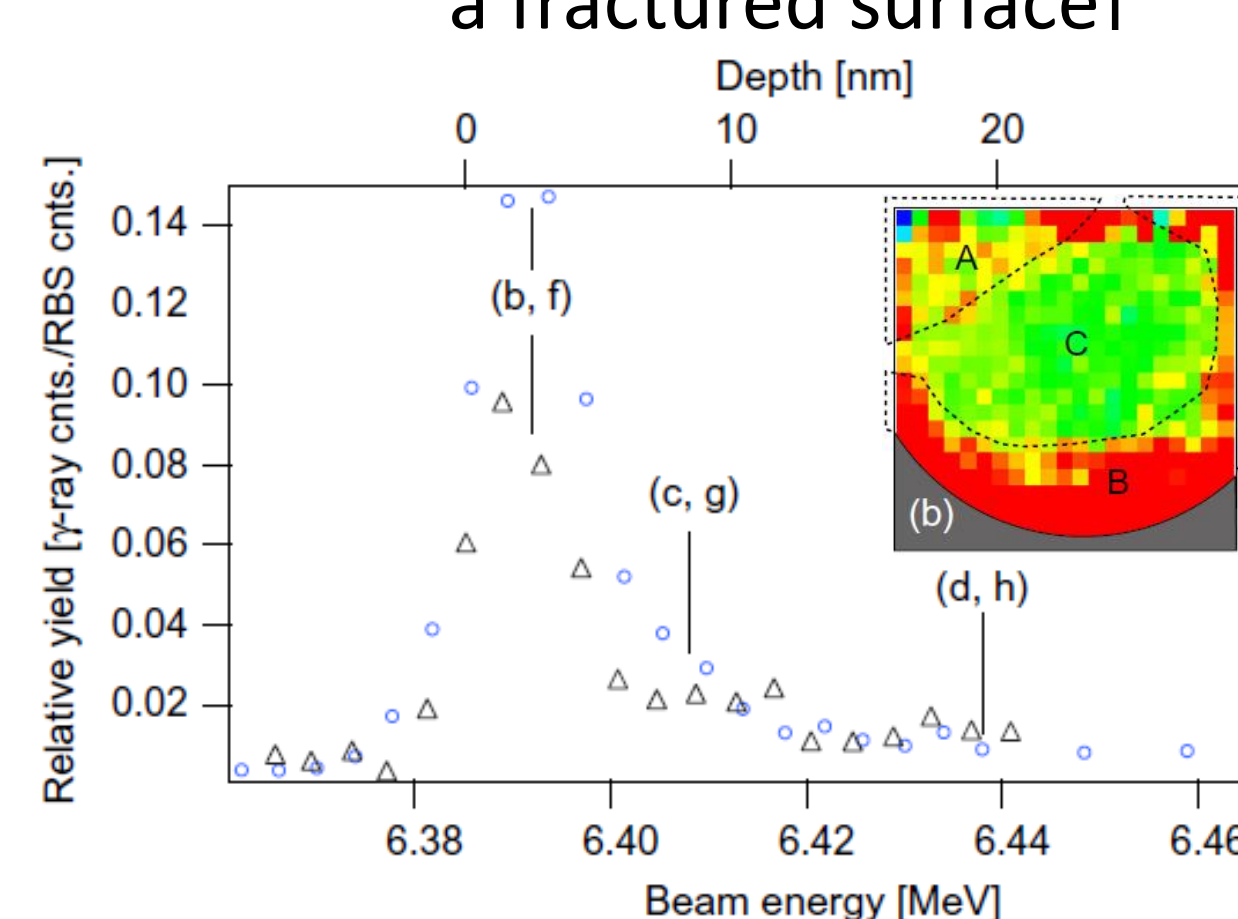[REMPI / LIF]
  Atomic and molecular spectroscopy
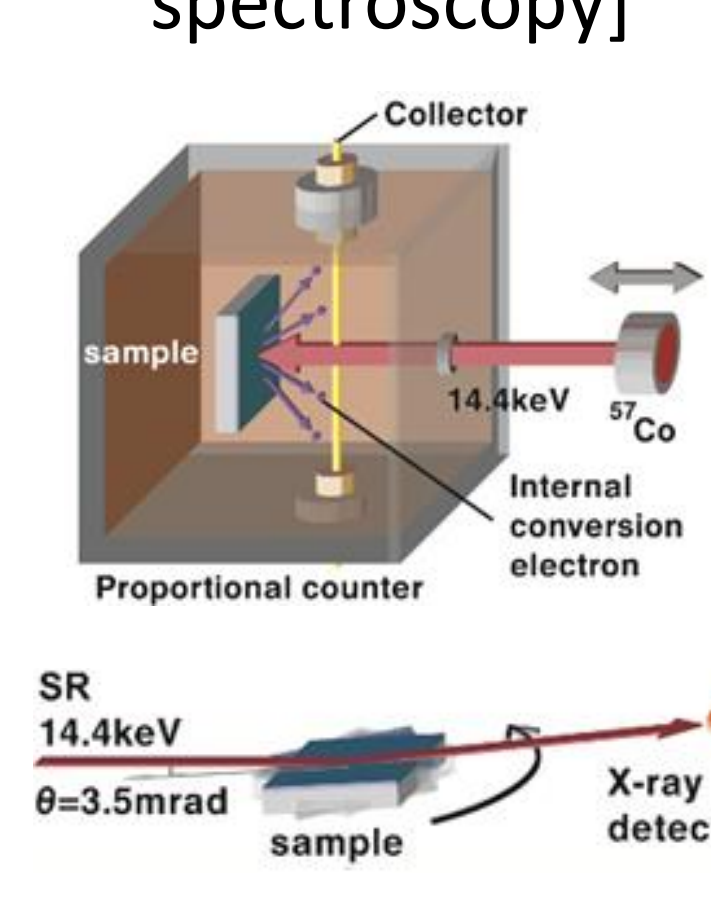[Isotope-labeled Mössbauer]
  Cross-sectional magnetism analysis
[1-photon & 2-photon PES]
  Electronic ground & excited states

[3D H distribution of a fractured surface]

[Mössbauer spectroscopy]

[H₂ Rotational spectroscopy]

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