SIGRAY

QuantumLeap-XAS

X-RAY ABSORPTION SPECTROSCOPY SYSTEM

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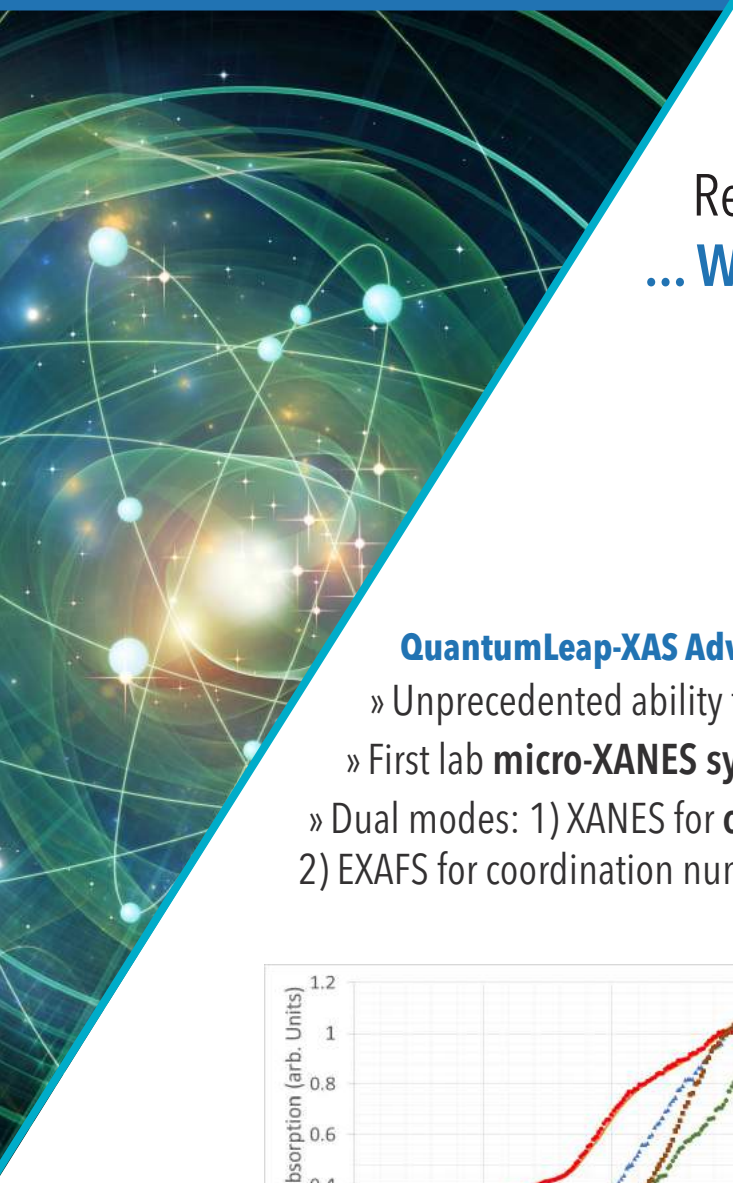
QuantumLeap uniquely enables insight into the electronic structure of elements of interest, including oxidation state and bond lengths.



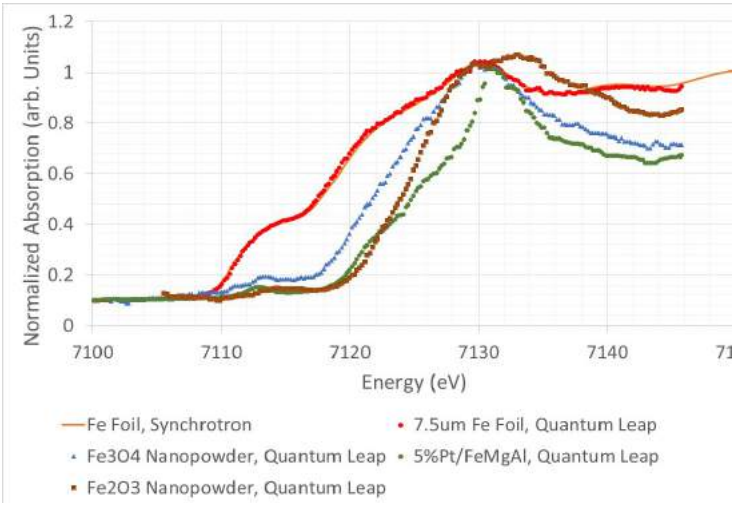
Chemical State Analysis for Geology, Biology, Forensics & Materials Research ... Within Seconds

QuantumLeap-XAS Advantages at a Glance

» Unprecedented ability to analyze electronic (chemical) state of elements

» First lab **micro-XANES system**, providing spatial resolution down to **100 µm**

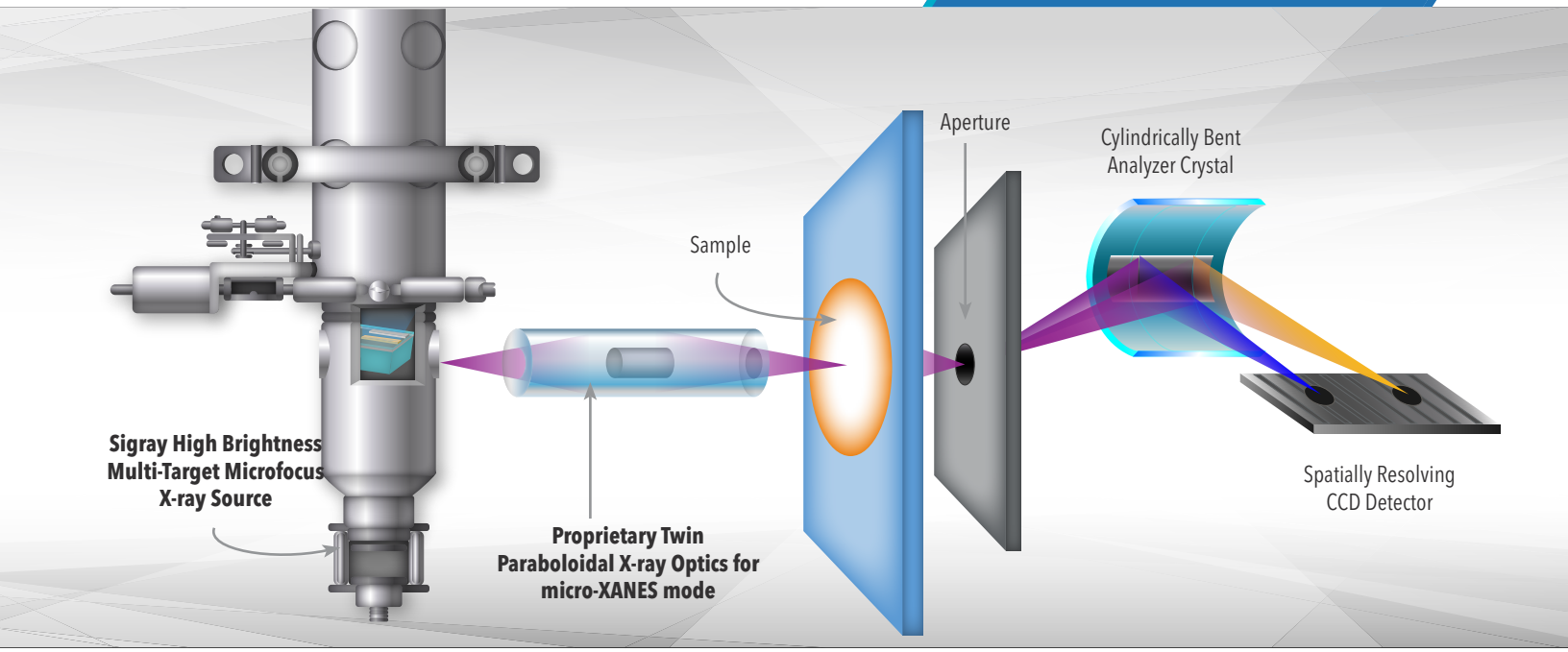
» Dual modes: 1) XANES for **oxidation state analysis** and bond covalency and 2) EXAFS for coordination number, types of donors, and interatomic distances



XANES spectra for Fe oxidation states: QuantumLeap results shown left of high resolution (down to 0.2 eV) results of hematite (Fe_2O_3, brown dots), magnetite (Fe_3O_4, blue dots), Fe-based catalyst of 5% Pt/FeMgAl (green dots), and a reference Fe foil (red dots). A synchrotron dataset (orange line) was included to show the excellent agreement between QuantumLeap and synchrotron data.

Acquisition parameters are QuantumLeap-210 scaled times and energy resolutions of: Fe foil: 20 min @0.8 eV resolution; Fe_3O_4: 49 min @0.2 eV resolution; Fe_2O_3: 3 hours @0.2 eV resolution (note: times longer due to thinness of sample); and 5%Pt/FeMgAl: 1.3 hours @0.2 eV resolution

System Design features interchangeable geometries: a von Hamos geometry (as shown below) for EXAFS, and an off-Rowland geometry for XANES



Finally... Synchrotron XAS Capabilities in Your Lab

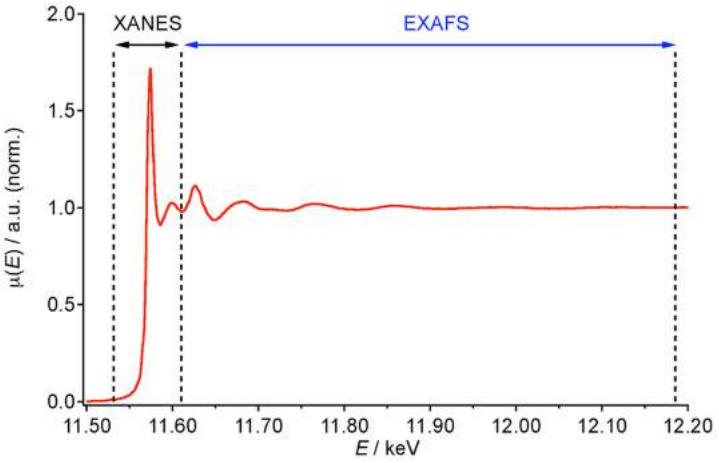
Conduct Chemical State Analysis without Needing to Apply for Beamtime

Sigray's QuantumLeap™ brings the long-awaited power of x-ray absorption spectroscopy (XAS), a synchrotron technique for determining electronic structure of elements, to individual laboratories. With QuantumLeap, researchers will now be able to identify and quantify the chemical species of elements of interest.

What is XAS?

X-ray absorption spectroscopy (XAS) is a technique in which the x-ray energy is scanned in incremental steps near the specific absorption edge (binding energy) of an element of interest. At this energy, x-rays typically are absorbed by an electron that is then emitted from the atom. XAS is comprised of two regimes: XANES and EXAFS.

- The near-edge XANES region contains features and shifts in the absorption peak values caused by the transition of core electrons to non-bound levels, and is sensitive to local atomic states such as oxidation states.
- Extended fine structure (EXAFS) above the edge are formed by the wave-like nature of the emitted photoelectron, which is scattered by surrounding atoms and forms oscillations from constructive and destructive interference that can be then used to infer bond lengths and information on neighboring atoms.



Dual Modes of XAS: The Sigray QuantumLeap™ provides a "quantum leap" in laboratory compositional analysis by providing access to XANES at sub-eV and high throughput EXAFS. XANES provides local atomic information such as valence state and geometry; EXAFS provides interatomic information such as interatomic distances, near neighbor coordination numbers, and lattice dynamics.

QuantumLeap™ Specifications

Parameter	Specification
Dual Modes	XANES at sub-eV | Geometry: off-Rowland with Johansson crystals EXAFS at high throughput | Geometry: von Hamos with mosaic crystal
Energy Coverage	Model A410: 4 - 10* keV | Model A210: 2 - 10* keV *Possible to extend to higher energy x-rays with reduced throughput & energy resolution
Energy Resolution	XANES: Down to 0.1 eV EXAFS: <10 eV
Spatial Resolution	Bulk mode | Micro-XAS mode at 100 µm
Crystal Analyzers	HAPG/HOPG, Ge (111), Ge (220), Ge (400). Others on request.
Source	Sigray High Brightness Microfocus Source
Target Materials	A410: Dual energy of W and Mo | A210: W, Mo, and Cr. Others on Request
Power | Voltage | Current	300 W | 20-50 kV
X-ray Optic	Sigray Twin Paraboloidal X-ray Optic
Transmission Efficiency	>70%
X-ray Detector	Deep Depletion, Direct Detection CCD
Digitization	16 bit
Pixels	13 µm
X-ray Fluorescence Detector	Si SDD Detector (10 mm^2)
Energy Resolution	<135 eV at Mn-Ka

Sigray QuantumLeap™ is the first laboratory XAS system with synchrotron capabilities

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