Contribution ID: **1043** Type: **Invited talk**

# Nuclear Resonance Scattering at ESRF with submicron spatial resolution

*Friday 30 August 2024 11:00 (20 minutes)*

The nuclear resonant scattering based on the Mössbauer effect in iron has proven to be an important spectroscopic method to address the most advanced scientific issues of physics and chemistry, as well as of material sciences, and is indispensable in Earth and planetary sciences. Synchrotron Mössbauer Source (SMS) spectroscopy<sup>1</sup> is the ultimate method to characterize the electronic states of iron atoms, allowing for an accurate determination of the oxidation and spin states, phase analysis, magnetic structure, and phase transitions in iron-bearing alloys and compounds. In turn, Nuclear Inelastic Scattering (NIS) is a powerful tool for studying lattice dynamics that provides access to vibrational and thermodynamic properties<sup>2</sup>.
The ESRF-EBS upgrade and related refurbishment of the nuclear resonance beamline ID14 resulted in a significant reduction of the beamsize for nuclear resonance scattering methods. The beamline is now equipped with the submicron precision positioning system compatible with the beamsize of 0.6 x 0.6 μm<sup>2</sup> provided through the specially designed short-focal distance Kirkpatrick-Baez mirrors<sup>3</sup>.
The extreme spatial resolution will serve studies employing extreme-high-pressure conditions with implications to geoscience, magnetism, and solid-state chemistry but will also aid the investigation of ultra-small systems like stardust or diamond inclusions. Moreover, this allows for studies of macroscopic samples with sub-micron resolution, enabling for example the mapping of magnetic memory of meteorites or element-partitioning analysis.
In this contribution, I would like to report the recent advances in nuclear resonance methods employing sub-micron spatial resolution. In particular, I will discuss the first examples of experiments at extreme pressure-temperature conditions, studies of micrometeorites, utilization of Young double-waveguide nano-interferometer, and investigation of metamagnetic transition for energy-efficient magnetic devices.
References
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## I plan to submit also conference proceedings

No

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