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Two-Dimensional Quasi-Elastic Scattering Imaging Technique To Visualize Nanosecond Atomic Dynamics

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The dynamics study of microscopic structures provides information about the microscopic states, which is often the most fundamental origin of some material properties such as viscoelasticity. Inelastic/quasi-elastic scattering techniques allow us to study the microscopic dynamics of the selected structures of interest in the wavenumber vector space. Mössbauer gamma rays generated by synchrotron radiation (SR) provide the directed and highly monochromatic beam that can be used for quasi-elastic scattering experiments. Time-domain interferometry is the SR-based quasi-elastic scattering technique that uses the Mössbauer gamma rays to study the microscopic dynamics in the time domain between 10 ns and several 100 μs [1-3]. The energy domain counterpart has also been demonstrated [4-6]. However, the low measurement efficiency has prevented its widespread application. In this presentation, we introduce a novel SR-based energy-domain quasi-elastic scattering technique using the multi-line Mössbauer gamma rays emitted/analyzed by the 57Fe2O3 monochromator/analyzer [7]. The resulting resolution function of the multi-line system shows the multiple energy widths, allowing to effectively cover relatively wide time scales from 100 ps to sub 100 ns. In addition, the introduction of the two-dimensional X-ray detector CITIUS greatly improved the measurement efficiency and enabled two-dimensional quasi-elastic scattering imaging [7,8]. We introduce the principle of the new system and how the new system is useful for the study of various condensed matter systems.

References
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I plan to submit also conference proceedings

Yes

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