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## The meV-resolved Inelastic X-ray Scattering Spectrometer at NSLS-II: Recent Performance Improvement and Science Capabilities Update

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The ultrahigh resolution inelastic x-ray scattering (IXS) beamline at NSLS-II is designed to achieve sub-meV resolution at moderate energy of 9.1 keV for IXS experiments with high momentum resolution and high spectral contrast [1]. The key instrument is a novel spectrometer with a new type of analyzer optics based on post-sample collimation coupled with angular dispersive flat crystal optics in highly asymmetric Bragg reflections [2,3] to achieve comparable angular acceptance of the scattered photons as that of the spherical backscattering analyzer used in conventional meV-resolved IXS facilities operating at above 20 keV. As the first instrument of its kind, the spectrometer has demonstrated unique research capabilities in studying low-Q, THz dynamics in soft material systems with mesoscopic heterogeneity and complexity such as liquid crystals [4] and biomembranes [5]. Continuous effort in improving the performance, especially via the temperature control of high-resolution crystal optics with sub-mK stability, has led to a state-of-the-art energy resolution of less than 1.4 meV with sharp Gaussian-like tails and much enhanced counting efficiency in routine operation, making it a premier IXS spectrometer for studying dynamics of soft materials and further enabling the study of phonon dynamics in hard condensed matter systems including most quantum materials. In this presentation, an update on the operation and the latest performance of the spectrometer will be presented and discussed with recent examples.

- Work supported by the US Department of Energy, Office of Science, Office of Basic Energy Sciences, under contract No. DE-SC0012704. † Corresponding author. E-mail: cai@bnl.gov ‡ Current address: Spallation Neutron Source, Oak Ridge National Laboratory, Oak Ridge, TN 37831, USA.

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### I plan to submit also conference proceedings

Yes

**Primary author:** CAI†, Yong (NSLS-II, Brookhaven National Laboratory)

**Co-authors:** SUVOROV, Alexey (NSLS-II, Brookhaven National Laboratory); COBURN, Scott (NSLS-II, Brookhaven National Laboratory); GOFRON‡, Kazimierz J. (NSLS-II, Brookhaven National Laboratory); YIN, Zhijian (NSLS-II, Brookhaven National Laboratory)

**Presenter:** CAI†, Yong (NSLS-II, Brookhaven National Laboratory)

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