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Infrared and THz radiation from relativistic electron beams and applications in condensed matter physics[1]

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Many spectroscopic methods used in condensed matter physics investigations become throughput limited as the far-infrared range is reached. These include studies of materials at low temperatures, in high magnet fields, or under the extreme pressures available with the diamond anvil cell. Other techniques, such as spectroscopic ellipsometry, are inherently throughput limited due to constraints on angle-of-incidence. Infrared and THz synchrotron radiation from storage ring light sources, such as NSLS-II at Brookhaven, can overcome these limitations. Indeed, the brightness is sufficient for wide-band near-field infrared spectroscopy to be performed with a spatial resolution on the order of 10 nm. This presentation will describe the first infrared beamline, presently under construction at NSLS-II, and the various measurement methods it will enable. Example results from materials physics will be reviewed. Additionally, a proposed second infrared beamline, designed for far-infrared nanospectroscopy of materials, will be described.

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