

# **Development of Synchrotron Infrared MicroSpectroscopy Imaging using a Multi-Element Detector (IRMSI-MED) for Diffraction-Limited Chemical Imaging**

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A mid-infrared (IR) beamline, extracting 312 x 25 mrad from a bending magnet radiation source, will be developed to couple to a commercial IR microscope and homogeneously illuminate its multi-element detector. This project has a potential to impact a wide variety of research areas ranging from soft matter condensed physics, nanoscience, biology, chemistry, veterinary science, engineering, environmental science and geology.

The beamline will consist of 12 26 x 25 mrad<sup>2</sup> beams that will be demagnified and independently steered to fill a 35 x 35 mm<sup>2</sup> sample area at the sample plane of a commercial infrared microscope, a Bruker Hyperion Microscope with a 64 x 64 pixel focal plane array detector. It will be equipped with a 15x Schwarzschild condenser and a 74x Schwarzschild objective achieving effective geometric pixel sizes of 0.54 x 0.54 mm<sup>2</sup> at the detector. This design is motivated by a prototype experiment performed at the National Synchrotron Light Source [1]. This pixel size is equal to  $1/2.8$  for even the shortest wavelengths of 2 mm, providing adequate information for point spread function (PSF) deconvolutions of the chemical images to obtain high quality diffraction-limited (or higher) resolution. Deconvolution methodologies will be implemented at the beamline, and made available for other users.

Initial research projects include chemical imaging of living cells, probing genetic functions in the post genomic era, and characterization of bacteria/hematite interface. This will provide a one-of-a-kind experimental station (globally) for the large and growing infrared imaging community.

[1] "Multichannel detection with a synchrotron light source: design and potential", G.L. Carr, O. Chubar and Paul Dumas, in Spectrochemical Analysis Using Infrared Multichannel Detectors, R. Bhargava & I. Levin, eds. (Blackwell Publishing, 2005) Chpt. 3.