

Rings and things: far-infrared spectroscopy of large molecules at the CLS

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Abstract: While many users will consider the Canadian Light Source as a strong source of hard radiation (ultraviolet light or x-rays), the synchrotron can also provide very intense and well-confined beams of deep infrared radiation. On the far-infrared spectroscopy beamline, this long-wavelength light is coupled into a Bruker IFS125HR Fourier transform spectrometer, which is capable of providing spectra resolved up to 0.001 cm^{-1} . The high brightness and stability of the synchrotron light between $400\text{-}800\text{ cm}^{-1}$ allows us to collect data at the highest resolution with a signal-to-noise ratio up to 8 times greater than that provided with a standard globar. We have exploited this advantage to study rotation-vibration spectra of molecules like acrolein (CH_2CHCHO), and the 5-membered rings pyrrole ($\text{C}_4\text{H}_5\text{N}$), furan ($\text{C}_4\text{H}_4\text{O}$), and thiophene ($\text{C}_4\text{H}_4\text{S}$), all of which are considered large targets for rotationally-resolved spectroscopy. We will present results of the rotational analyses completed for some bands of acrolein and pyrrole, and discuss the potential relevance of these spectra to pollution monitoring and astrophysics.