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THE GEMINI LIBRARY OF LATE SPECTRAL TEMPLATES FOR STELLAR KINEMATICS ANALYSIS IN THE CO 2.3 mμ REGION[1]

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We present a new spectroscopic library of late spectral type stellar templates in the near-IR range 2.15–2.42 mμ, at R = 5900 resolution, oriented to support stellar kinematics studies in external galaxies, such as the direct determination of the masses of supermassive black holes in nearby active (and non-active) galaxies.

The internal kinematic information from a galaxy spectrum can be obtained through different techniques. The most commonly used employs a cross-correlation method to extract the velocity dispersion from the galaxy spectrum using a single star spectrum as a template.

The CO band heads from evolved stars are the strongest absorption features in the 1–3 mμ range of stellar systems. The features are sharp and deep, and at least the first two overtones are located in regions of the IR spectrum relatively clean from telluric lines. The equivalent width of the CO bands is a function of effective temperature and surface gravity of the star: decreasing the surface gravity or the effective temperature increases the equivalent width.

The fitting technique however is very sensitive to template mismatch, as the characteristics of the stellar spectrum used as template affects the fitting result. The net effect is that the velocity dispersion measured from the galaxy spectrum will increase as the equivalent width of the template star CO band head decreases. To obtain a reliable measurement, one should provide the fitting program with a variety of template stellar spectra, which will be attributed different weights to obtain the best fit, but in the near-IR at R $\sim$ 6000 there are very Little if any stellar template libraries available for this kind of studies.

Observations were carried out in queue mode between 2006 August and 2007 January as a "poor weather" (IQ=ANY, CC = 90%) Director Discretionary programme GS-2006B-DD-3. The configuration used was the GNIRS IFU with the 111 l/mm grating, yielding a resolution of 3.42 Å (44 km s^{-1} FWHM) at 2.293 mμ.

Data reduction was done using the `gemini.gnirs` IRAF package, and following standard procedure (flatfield, sky subtraction, wavelength calibration, 1D spectral extraction from all the slices with sufficient signal, coadding, telluric calibration). Proprietary period has been waived on all data. The raw datasets are available to the general community and can be retrieved from the Gemini Science Archive (GSA) at CADC.

The library currently contains 29 stars observed in the range 2.24–2.42 mμ, ranging from spectral types F7III to M3III. Of these, 23 objects were also observed on a second setting, extending the wavelength coverage down to 2.15 mμ. The sample spans a range of EW(CO 2.32 mμ) = 3–22 Å, and the spectra have S/N > 50 in the continuum at the blue edge of the first CO overtone. We plan to expand the number of stars by retrieving from the GSA observations with GNIRS and NIFS obtained for other programmes as the proprietary period expires.

The reduced spectra can be downloaded (in standard FITS format) from the library pages in the Gemini website `http://www.gemini.edu`:
Instruments → NIR Resources → Spectral Templates

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