

Cyra – Cryogenic Infrared Spectrograph

The BBSO facility infrared spectrometer, Cyra, will consist of a fully cryogenic folded Czerny-Turner spectrograph utilizing a 2048x2048 HgCdTe array sensitive through the 1 - 5 μ m region with a maximum frame rate of 76 Hz. Spectral resolution (R_o) will range from 150,000 up to 750,000 depending on wavelength. The instrument fore-optics will include a correlation tracker for tip-tilt correction, an image de-rotator plus scan mirrors to allow scanning fields of up to 100 arcsec across the 80 arcsec long slit. A rotating waveplate and polarizing beamsplitter are used for dual-beam full-Stokes polarimetry. Zeeman splitting is accentuated in the infrared giving greater sensitivity for mapping weak magnetic features. \Carbon Monoxide (CO) forms within the temperature minimum region that resides just above the photosphere and is thus a good probe of that dynamic region. There are several CO bands spread throughout the spectrum, however, the fundamental rotation-vibration lines around 4667 nm are unique in that they are not obscured by the Earth's atmosphere. The S/N for a given integration time will be dependent upon the actual grating efficiency, which has yet to be measured. The instrument scan cadence will be a function of total integration time, number of Stokes parameters and field of view. The resulting cadence is expected to be less than 1 min.

Region	Species	Wavelength	g_{eff}	R_o	Spectral Coverage	Diffraction Limit	
Photosphere	Fe I	1564.85 nm	3	450,000	2.18 nm	0.20"	
	Ti I	2231 nm	2.5	300,000	2.46 nm	0.29"	Sunspot only
	Fe I	4063.7 nm	1.25	180,000	3.27 nm	0.52"	
	Si I	4142.5 nm	1.626 or 2.25	170,000	7.76 nm	0.53"	
Chromosphere	Ca I	3697.4 nm	1.1	200,000	4.94 nm	0.48"	
	Mg I	3681.6 nm	1.17	200,000	5.86 nm	0.47"	
	CO	4667 nm	-	250,000	4.74 nm	0.60"	Spectroscopic