Primary Objective Grating Astronomical Telescope
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We propose a new architecture for astronomical telescopy with objective gratings. Unlike a slitless objective grating telescope, we include a slit and a spectrometer in a secondary that is configured at grazing exodus. Resulting anamorphic magnification produces a ribbon shaped aperture that can achieve kilometer scale along one axis. The telescope could disperse light from all objects within a 1° x 40° field-of-view with sub-Ångstrom resolving power and milliarcsecond spatial resolution across the wider angle. Taking advantage of the earth's rotation, a ground-based version can make observations with no moving parts. The secondary spectrometer uses a novel data reduction algorithm that can assemble millions of spectrograms simultaneously. To defeat wind pressure, the primary can be seated flatly on ground level with the secondary sheltered below ground. Lunar observatory deployment and operation are simplified, because the flat primary is lightweight, and as a staring instrument it has no moving parts. In space deployment, the thin primary lends itself to construction from flat gossamer membranes. The science drivers are broad - spanning most astronomical observational arenas, but in terms of NASA's roadmap this new telescope could be a life planet finder. In terms of NASA's core service programs, special features of this design could be exploited to survey for millions of small objects in near earth orbit.

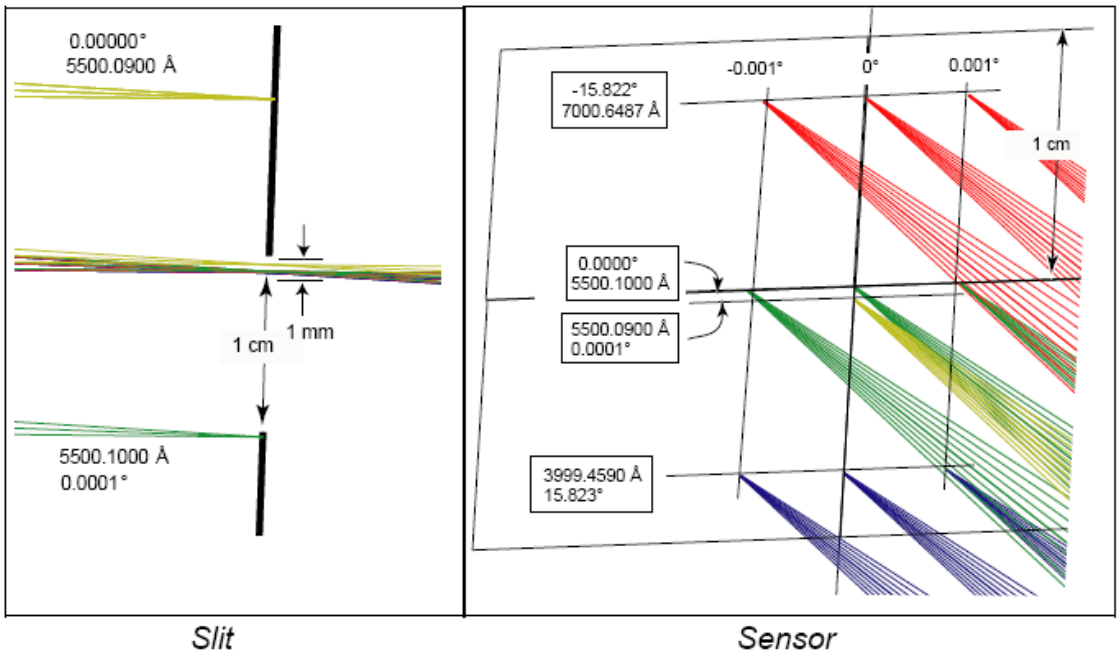

Figure: The ZEMAX simulation shows that a slit of 1 cm passes a 30° arc diffracted into the free spectral band. A detail shows a window on a 0.1 Å or 0.0001° portion of the band. Their rays fall inside a 1 mm subset of the slit and are widely spaced on the sensor, suggesting methods for exoplanet coronagraphy. Also shown are lateral offsets of 0.001° in the non-diffraction axis. Laterally positioned sources are coherently imaged - proving that this spectrometer is a true high resolution imaging MOS. The sensor shown is 4 cm2 but minor adjustments in the secondary allow a wide range of sensor dimensions.