SAN FRANCISCO STATE UNIVERSITY

Physics & Astronomy

Fall 2014 Colloquium

Monday, September 29th

Dr. Claire Poppett

Lawrence Berkeley National Lab

4:05 PM in TH 411
Refreshments served at 3:50 PM

Dark Energy Spectroscopic Instrument: Probing dark energy with optical fibers and 5000 robots

Abstract:

The Dark Energy Spectroscopic Instrument (DESI) is a Stage IV ground-based dark energy experiment that will be installed at the Mayall Telescope in Arizona. This five year survey covering 14,000 deg2 to z=3.5 will use five thousand robotically positioned optical fibers that can be quickly reconfigured with a 5 μm positioning accuracy. I will present an overview of the entire instrument with a focus on the fiber performance in the near and far field of two types of robotic positioners: tilting spine mechanical simulators and eccentric axis (or θ−φ) positioners. The far field performance of the fiber is important since the instrument efficiency is adversely affected if light from the fibers enters the spectrograph at a faster focal ratio than the spectrograph can accept (f/3.57 in the DESI design). Degradation of the focal ratio of light is caused by light entering the fiber off axis (tilting positioner) or bending, twisting, and stress of the fiber (eccentric axis) positioner. The stability of the near field intensity distribution of the fiber determines the spectrograph point spread function (PSF). If the PSF changes from the calibration to the science exposures, this will result in an extraction bias. For DESI, a particular concern is the distortions in the PSF due to movement of the fibers during re-pointing.