The MaNGA Prototype Sees First Light!

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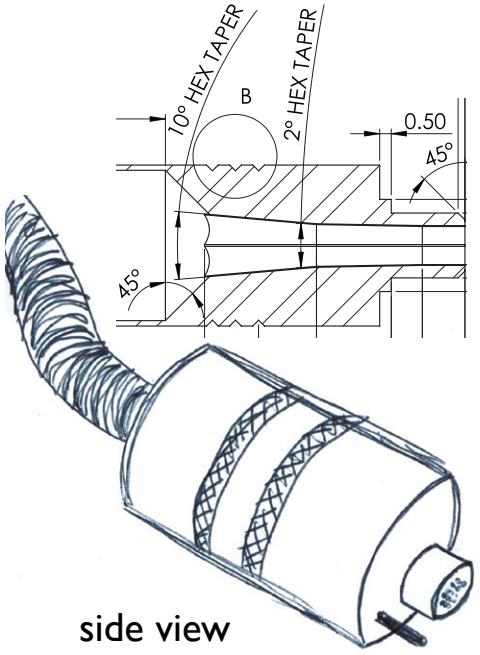
For the last two years, I've been leading a team of scientists that is designing a new instrument and survey to be carried out as part of the 4th-generation Sloan Digital Sky Survey (SDSS) starting in 2014. Instead of previous spectroscopic surveys like SDSS-I that have only measured light from a single point at the center of targeted galaxies, our goal is to obtain spectroscopic measurements at up to 127 distinct locations across each galaxy in an unprecedented sample of over 10,000 local galaxies. Our project is called MaNGA for Mapping Nearby Galaxies at Apache Point Observatory. In December, I visited Apache Point Observatory (New Mexico) to help install a prototype of the MaNGA instrument. MaNGA builds on the existing BOSS instrument, which has two telescope-mounted spectrographs that are fed by 1000 fibers, a similar concept to the Prime Focus Spectrograph that Kavli IPMU is designing for the Subaru Telescope.

The key advance is the ability to "bundle" sets of BOSS fibers into hexagonal, closely packed arrays of 19 to 127 fibers per bundle. Engineering drawings by U. Washington grad student, Nell Byler, show examples of the 'fiber bundle' we have developed in work led by MaNGA's Chief Engineer, Nick MacDonald. We have designed a metal ferrule with a hole that begins as a gently tightening cone and then transitions to a hexagonal shape. When a bundle of optical fibers is inserted, they arrange themselves in the optimal configuration. The ferrule, about 1cm across and one of 20 to be deployed in a single pointing, is then plugged into an aluminum plate which locates it on a galaxy target in the sky. Over the course of our 6-year survey, we will observe roughly 500 plates, each covering a circular area with a diameter spanning the equivalent of 6 full moons.

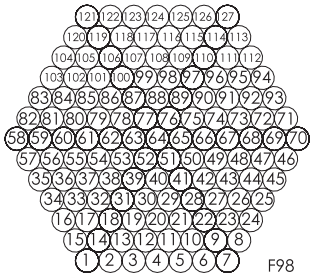
The prototype bundles performed even better than expected in our December tests. Afternoon calibrations determined that the sensitivity was high and on the night of December 20th, MaNGA achieved First Light. An example is shown below in which one of 127-fiber bundles targeted a close grouping of three stars. While MaNGA obtains a spectrum at each point across the bundle, we can integrate this "data cube" over the wavelength dimension to create a psuedo-image and compare it to an actual image of the same sky location (see below). An example of a spectrum extracted from the brightest star is also shown.

In January 2013, we will train the MaNGA

MaNGA Fiber-bundles' First Light



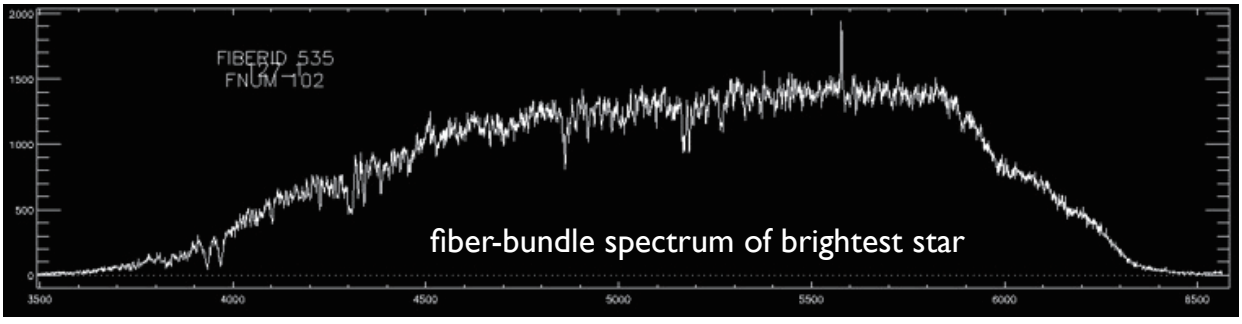
side view



front view

bundle psuedo-image

real image



fiber-bundle spectrum of brightest star

prototype bundles on galaxies for the first time. When the full survey begins, MaNGA will have the power to reveal patterns in the internal composition of galaxies and chart the motion of their stars and gas, providing substantial new clues about their formation histories, evolution, and the physical laws that govern them.