Super-Resolution of Galaxy IFU Spectra

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Imaging is less expensive than spectroscopy and can offer smaller pixel sizes in many astronomy surveys. Our approach aims at combining the strength of both types of data, in order to obtain the highest resolution representation of galaxies both spatially and in wavelengths.

The CALIFA IFU spectra have 1 square arc-second per pixel.
The SDSS images have 0.4 square arc-second per pixel.

Integral Field Unit (IFU) spectra are starting to accumulate in astronomy and have the promise to revolutionize our understanding on galaxy evolution by resolving the gas, star, and dust on the galaxies. The spatial resolution of these spectra are currently limited by technology and cost. We are developing a Compressive-Sensing based algorithm to super-resolve the IFU spectra from their native spatial resolution.

A pilot study shows very promising results. The (SDSS r band filter-convolved) broadband image of CALIFA reveals much more details after we apply a stand-alone flux conservation constraint, at matched pixel size and position, between the CALIFA IFU spectra and the SDSS image. Using Compressive Sensing, our work plans to super-resolve the CALIFA IFU spectra to meet the SDSS spatial resolution, and at the same time, retain the wavelength resolving power.