

Nearby galaxies seen through the eyes of SpIOMM



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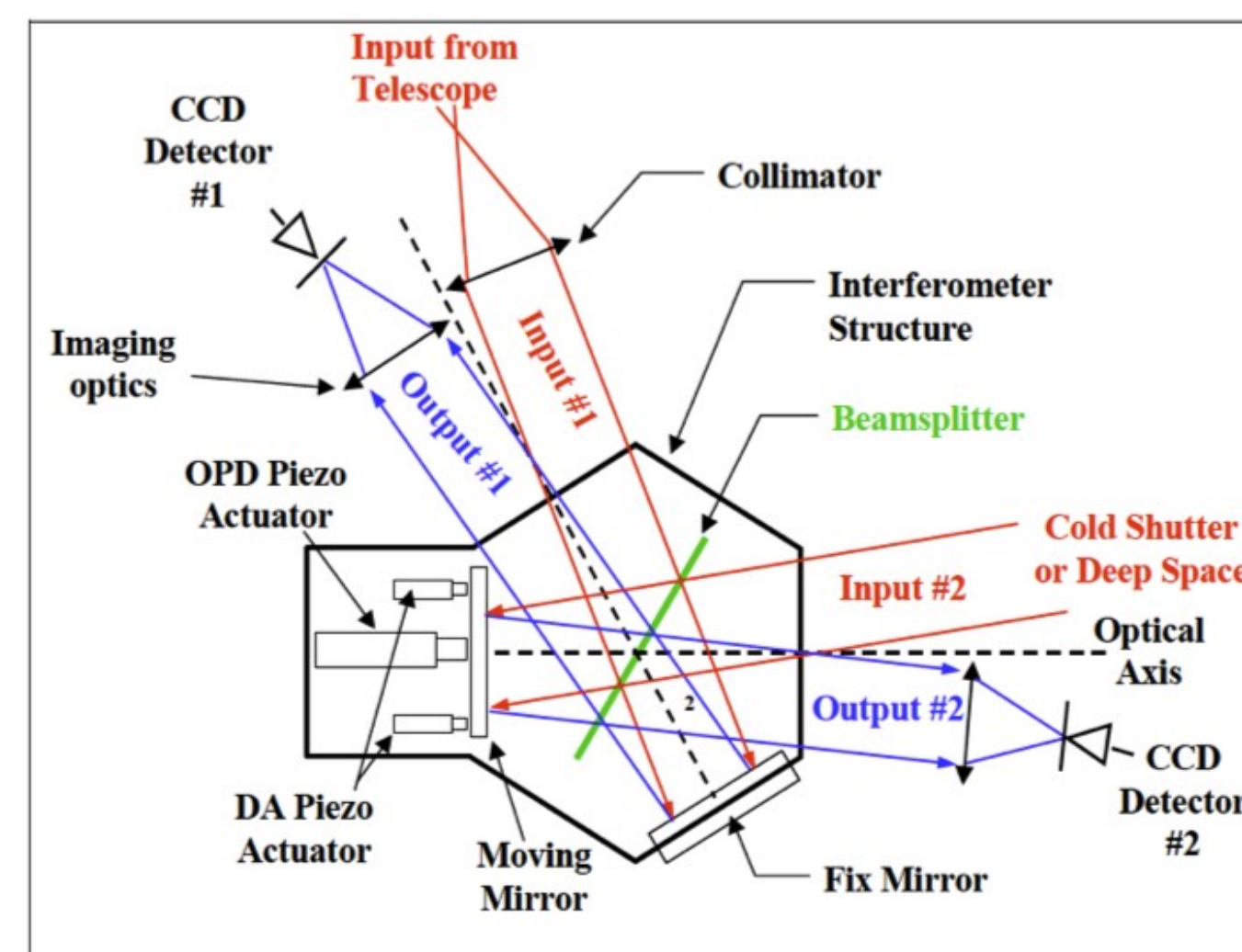
Summary

The Spectromètre Imageur de l'Observatoire du Mont-Mégantic is an Imaging Fourier Transform Spectrograph that has been in operation since 2007. We explain the basic principles of this instrument and focus on early results of metallicity studies of nearby spiral galaxies.

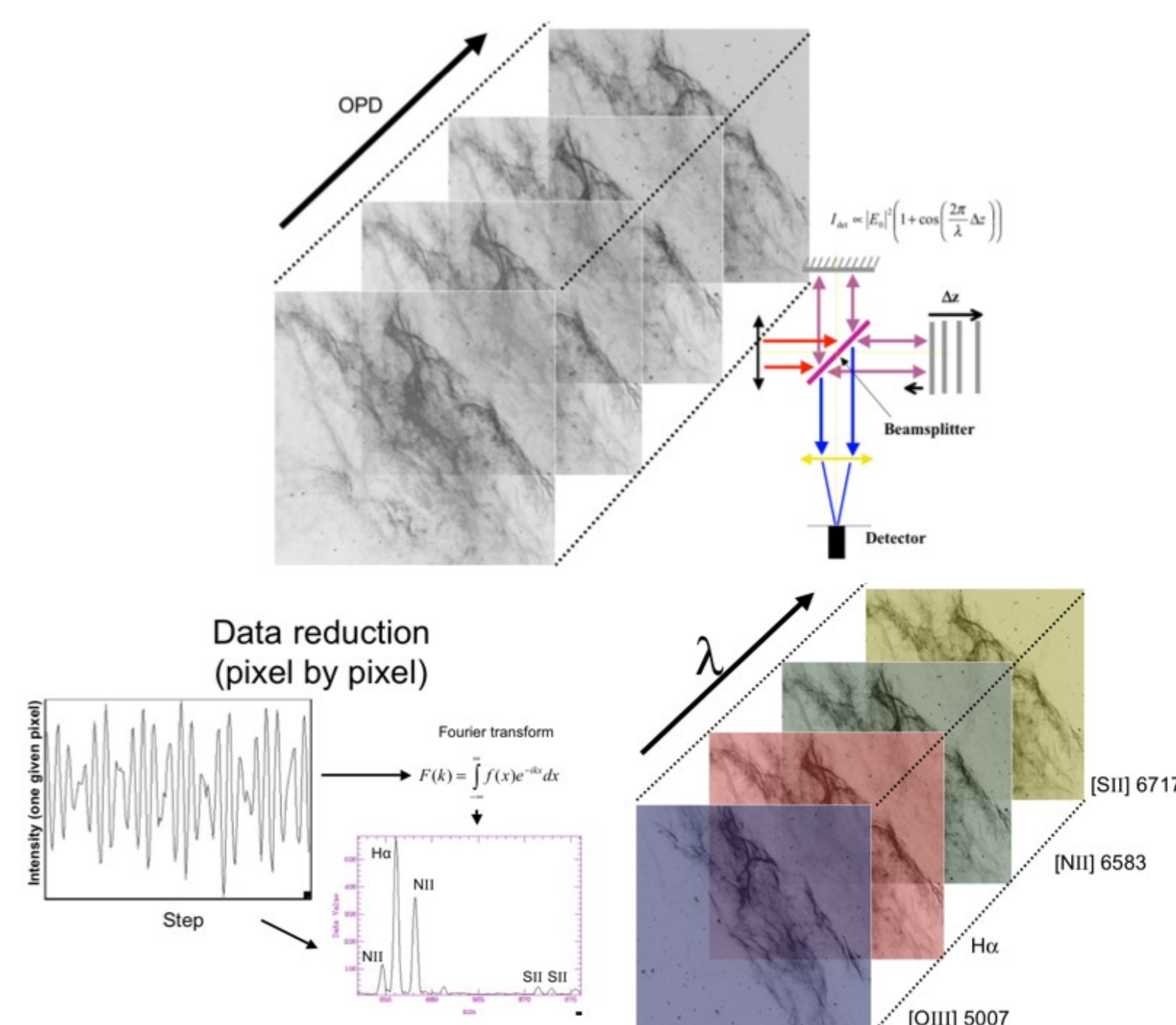
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Instrument Features

- Design schematic: Michelson interferometer
- Imaging Fourier Transform Spectrometer at Mont-Mégantic Observatory
- Spectral range: **350 to 850 nm**
- Field of view: **12'** circular
- Spectral resolution: $R = 1 - 25000$ (limited by length of night)
- Spatial resolution: seeing-limited ($\sim 1.5''$)
- CCD: 1340x1300, $\sim 0.55''$ pixel separation + 2048x2048 (to be installed)
- Typical observing time needed for hyperspectral datacube: **1 – 4 hours**



When to use: crowded fields, extended objects (nearby galaxies and Galactic nebulae). At Université Laval, primary focus is on ISM in the Milky Way and nearby spiral galaxies.



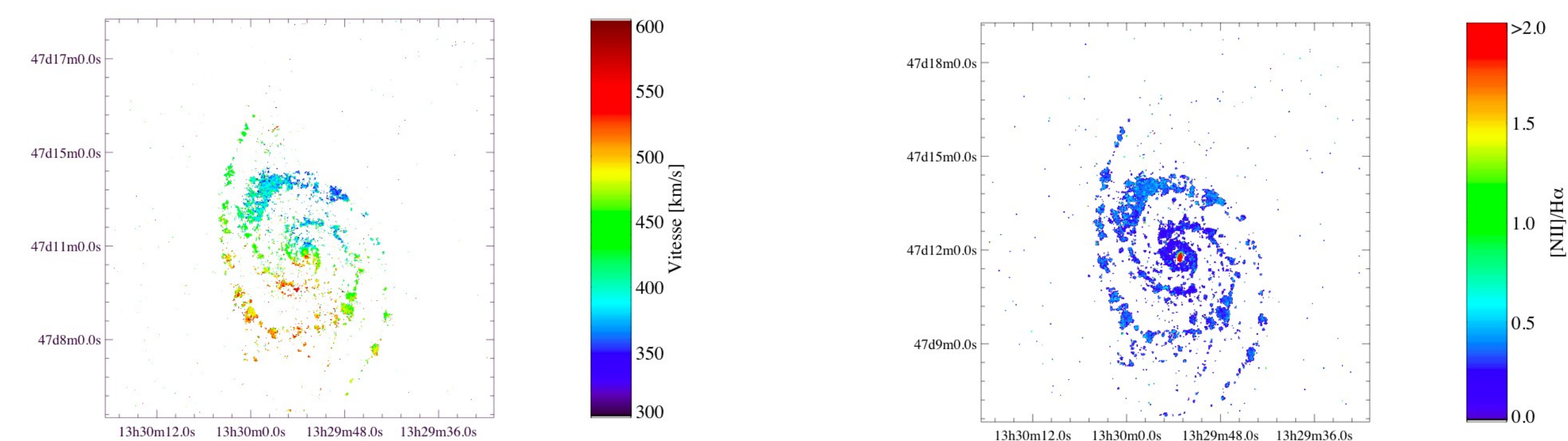
The hyperspectral datacube is constructed by sampling the interferogram of each pixel by varying the optical path difference (OPD). Afterwards, this can be Fourier-transformed into the desired spectrum at each pixel.

SpIOMM's successor SITELLE is being constructed for the Canada-France-Hawaii Telescope. It is expected to provide an overall factor 15 efficiency improvement and have a significantly better response at the blue end. It is expected to start operations in early 2013.

Figures: Drissen et al. (in press)

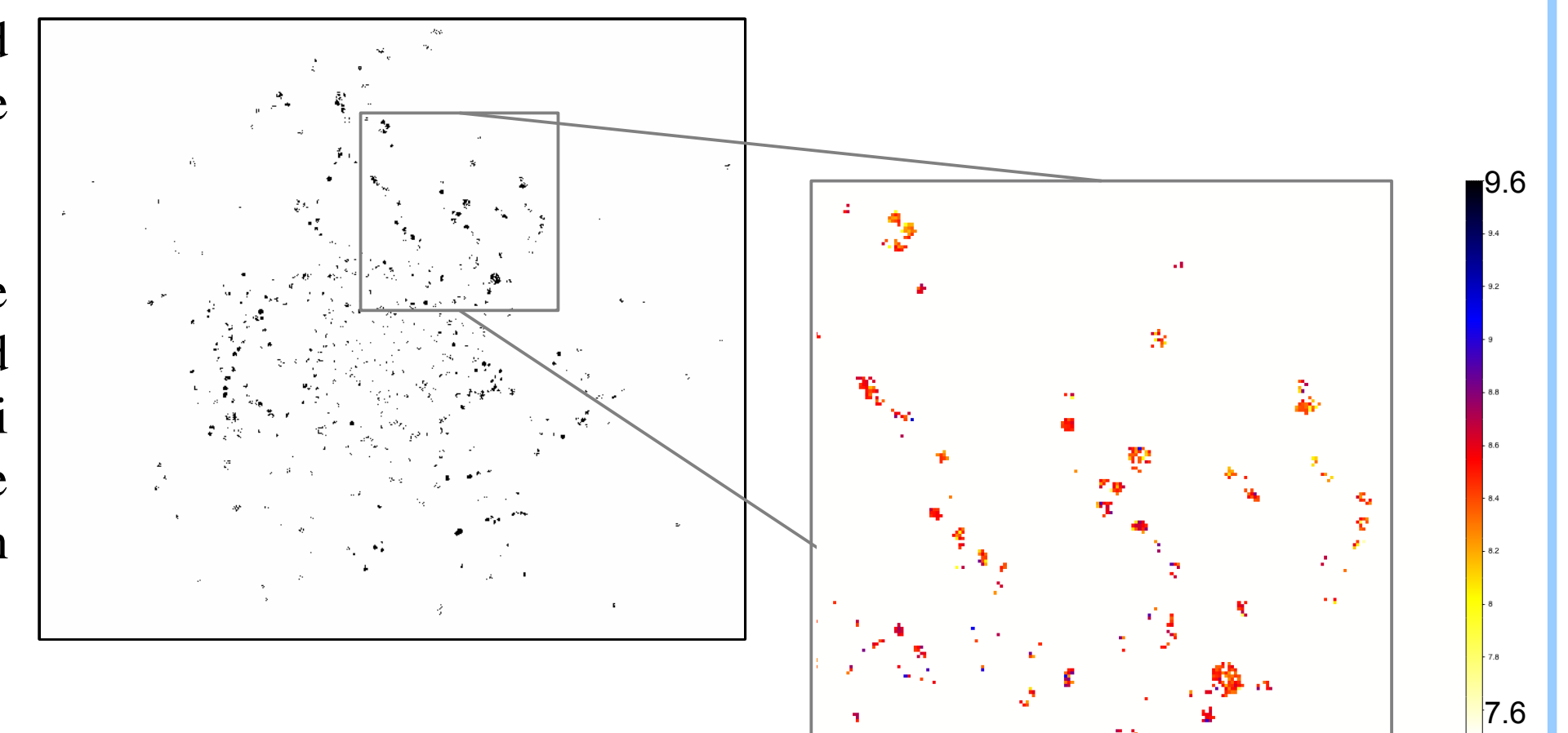
Metallicity Imaging

The spectral range of SpIOMM facilitates convenient imaging of $H\alpha$, $H\beta$, $[NII]$, $[SII]$ and $[OIII]$ emission lines. Detection of the $[OII]$ line at 3727\AA is hindered by instrumental response and sensitivity and is ultimately not detected. Preliminary maps of the nearby spiral galaxies M51, M74 and NGC 2403 are shown here.



M51 velocity field and $[NII]/H\alpha$ are displayed above, showing the level of detail that can be achieved resolving individual HII regions.

On the right (inset), $12+\log(O/H)$ values of M74 are shown, derived from maps of $[NII]/H\alpha$ and $[OIII]/H\beta$, using the procedure described in Pettini & Pagel (2004). Individual HII regions were identified before extracting the line strengths, shown on the left.



On the left, an $[NII]/H\alpha$ map of NGC 2403 is displayed. Here, pixels were binned before extracting the emission lines, without identifying or resolving HII regions first.

SpIOMM greatly increases the efficiency of galaxy metallicity measurements. Its successor SITELLE will provide greater sensitivity and is expected to detect the $[OII]$ line at 3727\AA as well.

References

- Pettini, M. and Pagel, B.E.J. 2004, MNRAS 348, L59
- *Imaging Fourier Transform Spectroscopy for Astronomy*, Drissen, L., Bernier, A.-P., Charlebois, M., Alarie, A., Grandmont, F. and Mandar J. (in press), in "Fourier transforms and their application", Intech Open Access Publisher

Conclusions

We describe the capabilities of the SpIOMM instrument at Mont-Mégantic Observatory. We present early results of spectral mappings of nearby spiral galaxies in the optical regime, showing resolved HII regions and metallicities in M51, M74 and NGC 2403.