# INTEGRAL WIDE-FIELD SPECTROSCOPY OF THE INTERSTELLAR MEDIUM WITH SITELLE : AN IMAGING FTS ON THE CFH TELESCOPE

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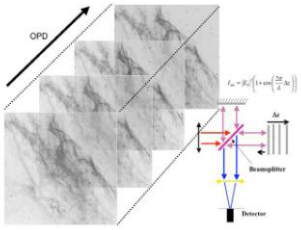
**Abstract:** *In collaboration with Canadian partners (L. Drissen at U. Laval, ABB company in Quebec City) and CFHT, a new Imaging Fourier Transform Spectrometer (IFTS) for the Canada-France-Hawaii Telescope, SITELLE, is currently under construction to be tested on the sky in the second semester of 2013 and to be opened to the community for the following semester. It derived from the experience gained with the BEAR IFTS on the same telescope and more directly from SpIOMM, first wide-field IFTS, in operation on Mt Mégantic telescope. The main characteristic of the spectrometer is a wide field of 11'x11', at seeing-limited resolution (≈ 0.6'' FWHM), on which integral spectroscopy will be possible. The new instrument, with a spectral coverage from 350 to 970 nm, is optimized for the blue and the near UV to efficiently access the [OII] 372.7 nm line in ionized nebulae. The spectral resolution, as for a FTS, can take any value up to ≈ 20,000. A workshop, 12 to 14 May 2013, in Québec City will help to prepare the programs to propose on this new facility.*

## Introduction

**An astronomical Imaging FTS results from the coupling of a Michelson-type interferometer with a 2D detector on which is imaged the entrance field at the telescope focus. The optical path difference (OPD) is scanned in a *step-by-step* mode. At every step an image of the field is recorded. Each interferogram extracted along z in the data cube is replaced by its FFT, making possible integral field spectroscopy of the entire field.**
**For an IFTS defined by the $N^2$ pixels of its square array detector and $S_l$ the beam splitter area, the product of the maximum resolution R, by U the beam étendue accepted by the telescope of collecting area $S_T$ (diameter $D_T$), a field of angular diameter θ is constant with:**

$U = S_T \times \Omega = (\pi^2/16)\, \vartheta^2_{max} \times D_T^2$ $\qquad$ $RxU = 2.61\, NxS_l$ $\qquad$ *(Maillard et al., 2013)*

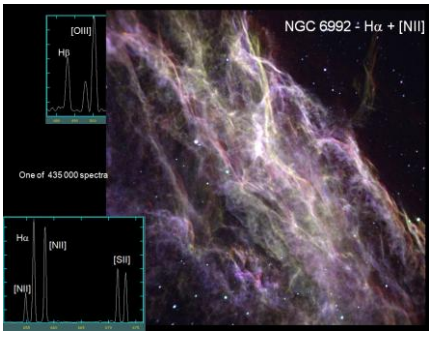
**The adequate increase of N and $S_l$ makes possible to associate a wide field with a high spectral resolution.**




## Scientific programs of integral wide-field spectroscopy

- intergalactic medium in galaxy cluster
- the Galactic Center
- galactic young star clusters
- nearby galaxies
- galactic HII regions, PNs, SN remnants
- comets near perihelion

*Spectral image of the star formation region IC 1805 obtained with SpIOMM in Hα (red) and [NII] (blue). Field size 12'x24'.*




*Spectral image of the Cygnus Loop SN remnant NGC 6992 obtained with SpIOMM in Hα and [NII]. Field size 12'x12'.*

## SITELLE Instrumental parameters -->

An IFTS derived from SpIOMM, **Sp**ectro-**I**mageur de l'**O**bservatoire du **M**ont **M**égantic *(Drissen et al., 2008)* for the 3.6-m CFH Telescope.
Built by ABB/Bomem at Quebec City

| | |
|---|---|
| Spectral Range | **350 nm – 970 nm** |
| Spectral Resolution | variable – max ≈ $2.10^4$ |
| FOV (pixel) | **11' x 11' (0.32" x 0.32")** |
| Image Quality | ~ 0.6'' over FOV |
| Optical Throughput | ~ 60% (Peak) |
| Detector | 2K x 2K CCD (x2) ~ *3e rms read noise optimized in the blue; access to [OII] 372.7 nm line* |
| Observation Efficiency | < 2 s dead time between exposures |
| External Dimension | 2.3 x 1.3 x 1.8 m |

## Project status

| Milestone | |
|---|---|
| Kick-off Meeting | 18-Oct-11 |
| Final Concept Review | 24-Oct-11 |
| Preliminary Design Review + Interface Freeze Point | 22 and 28 Feb 2012 |
| Critical Design Review | 27 and 28 June 2012 |
| Manufacturing Start | 10-Oct-12 |

Delivery to U. Laval: **summer 2013**
Commissioning on CFHT: **autumn 2013**
Opening to observers: **first semester 2014**

**Preparatory workshop**: "La science avec SITELLE"
12 to 14 May, 2013 at Wendake near Québec City (Hôtel-musée des premières nations)

*References*
Drissen, L. et al., Science results from the IFTS SpIOMM, Proc. SPIE 7014, 7K (2008)
Drissen, L. et al., SITELLE: a wide-field IFTS for the Canada-France-Hawaii Telescope, Proc. SPIE 7735, 0B (2010)
Maillard, J.P. et al., Integral wide-field spectroscopy in astronomy: the Imaging FTS solution, Exp. Astron., in press (2013)