INTERACTING GALAXIES AS SEEN WITH SITELLE

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Project description

We aim at studying the properties of the gaseous structures and stellar populations of a sample of interacting galaxies, from the main bodies up to large distances where the tidal features are detected. We present radial velocity field distribution of the ionized gas in NGC3227 using observational data from the imaging Fourier transform spectrometer SITELLE[1] at CFHT.

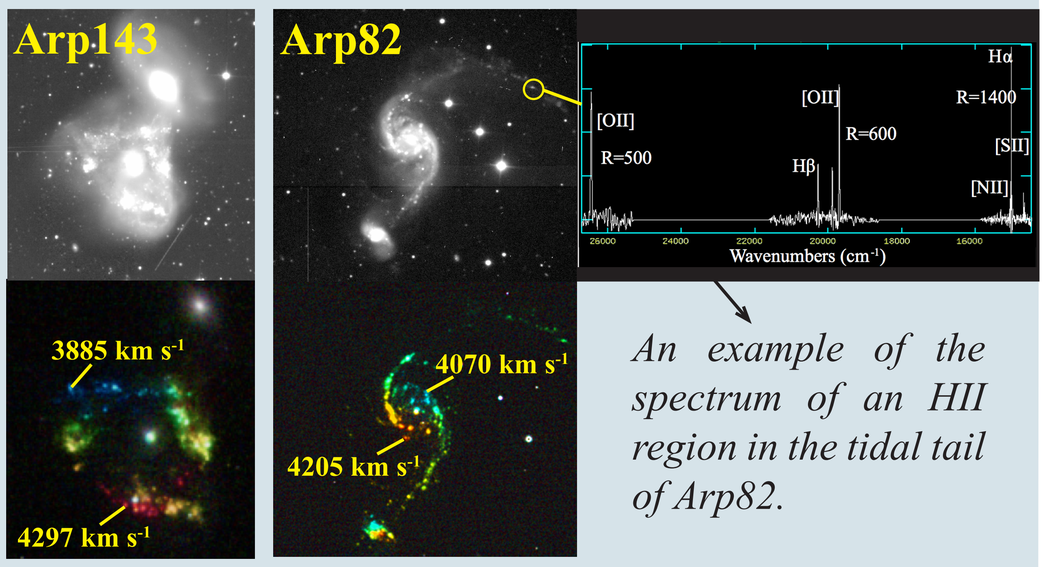
SITELLE

- FOV : 11'x11'
- One spectrum for every pixel (4 million)
- **Filters** :
  SN1 (365-385nm)
  SN2 (80-520nm)
  SN3 (651-685nm)
  C1 (385-490nm)

CFHT

Sample set

Our data set includes archetypes of the different structures/morphologies resulting from interactions between gas-rich galaxies with sizes that allow detecting induced star formation activity as well as tidal features within the large field of view of SITELLE. So far we have obtained data for Arp82, Arp94 and Arp143 in SN1, SN2, SN3 and C1 filters.



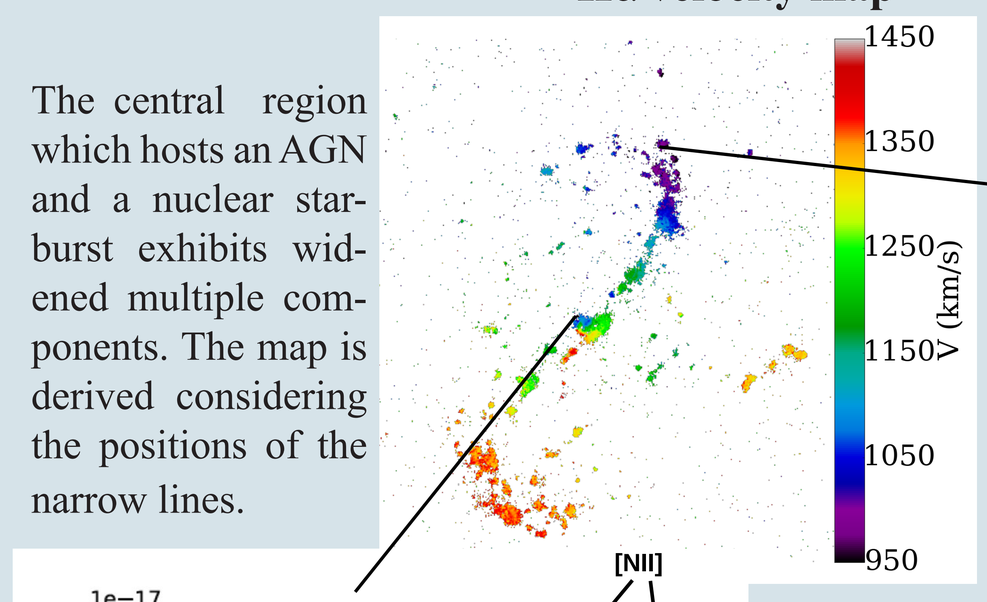
An example of the spectrum of an HII region in the tidal tail of Arp82.

Top : SITELLE deep images of Arp143 (SN3), Arp82 (SN2). **Bottom** : Hα Doppler maps of the galaxies.

Kinematics of NGC3227

Hα velocity map

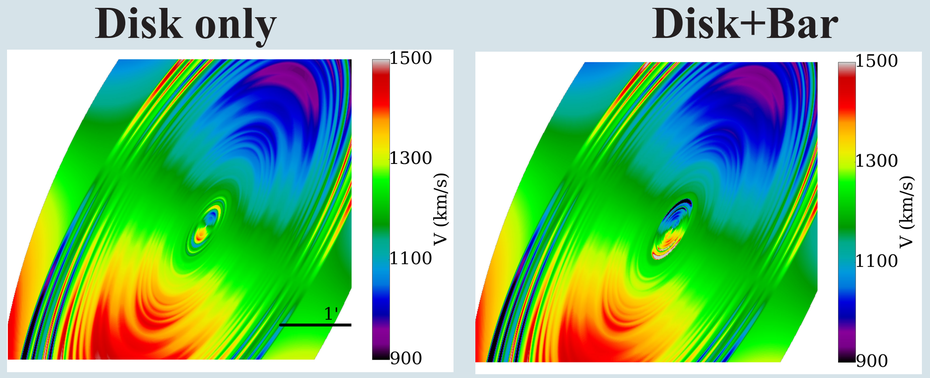
The central region which hosts an AGN and a nuclear starburst exhibits widened multiple components. The map is derived considering the positions of the narrow lines.



Spectral lines of the ionized gas in the disk are fitted with a single narrow component.

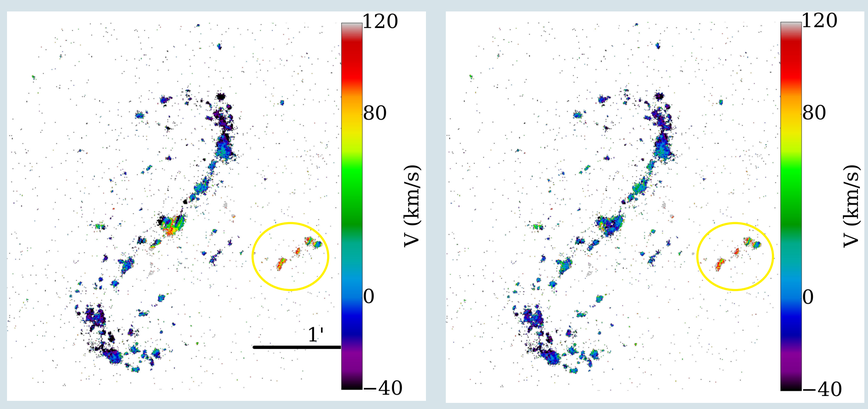
Kinematic models

Disk only **Disk+Bar**

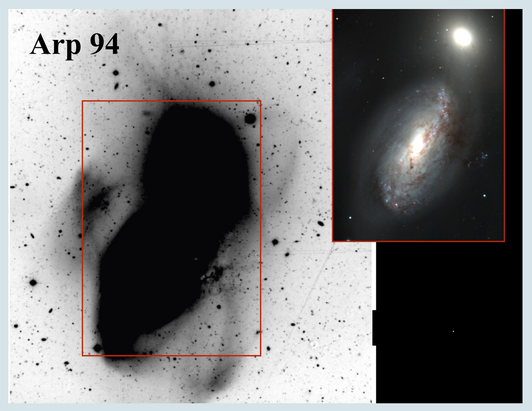


- Models were generated by applying DiskFit[2] on the Hα velocity map ($P.A_{disk}$ = 328°, $P.A_{bar}$ = 349°, ε_{disk} = 0.62, V_{sys} = 1201 km s^{-1})

Residuals



- Comparison between residuals reveal a bar as expected
- The deviations from circular motion are large at the location of the tidal dwarf galaxy (encircled in yellow)

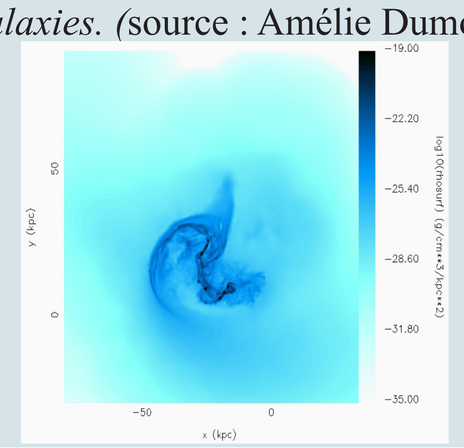


SITELLE C1deep image of Arp94 : NGC3227 (SABa), a gas-rich spiral galaxy, interacting with its neighbor, an elliptical galaxy. Tidal tails extend far from the parent galaxies. A tidal dwarf galaxy has formed at the tip of the gaseous tails

References

[1] Drissen L. et al. 2014, AdAst, 293856
[2] Sellwood & Spekkens 2015, arXiv:1509.07120
[3] Robert et al. 2016, CFHT users meeting poster
[4] Kawata & Gibson 2003, MNRAS, 340, 908

Future work

- Complement the study of the properties (such as metallicities) of the ionized gas using [OII], [OIII] and [NII] lines;
- Use a long wavelength baseline (UV to IR data) to trace the properties of stellar populations in interacting galaxies (Robert et al.[3] reported an old stellar population in NGC3227 from the absorption lines in SITELLE C1 data);
- Compare our results with numerical simulations generated with the chemo-dynamical SPH code GCD+[4] to constrain the models of evolution of interacting galaxies.

*An example of a numerical simulation of a collision between gas-rich galaxies obtained with GCD+, showing tidal features and tidal dwarf galaxies. (*source : Amélie Dumont*)*