Interstellar Medium and Plasmas
(IMP; pole 2)

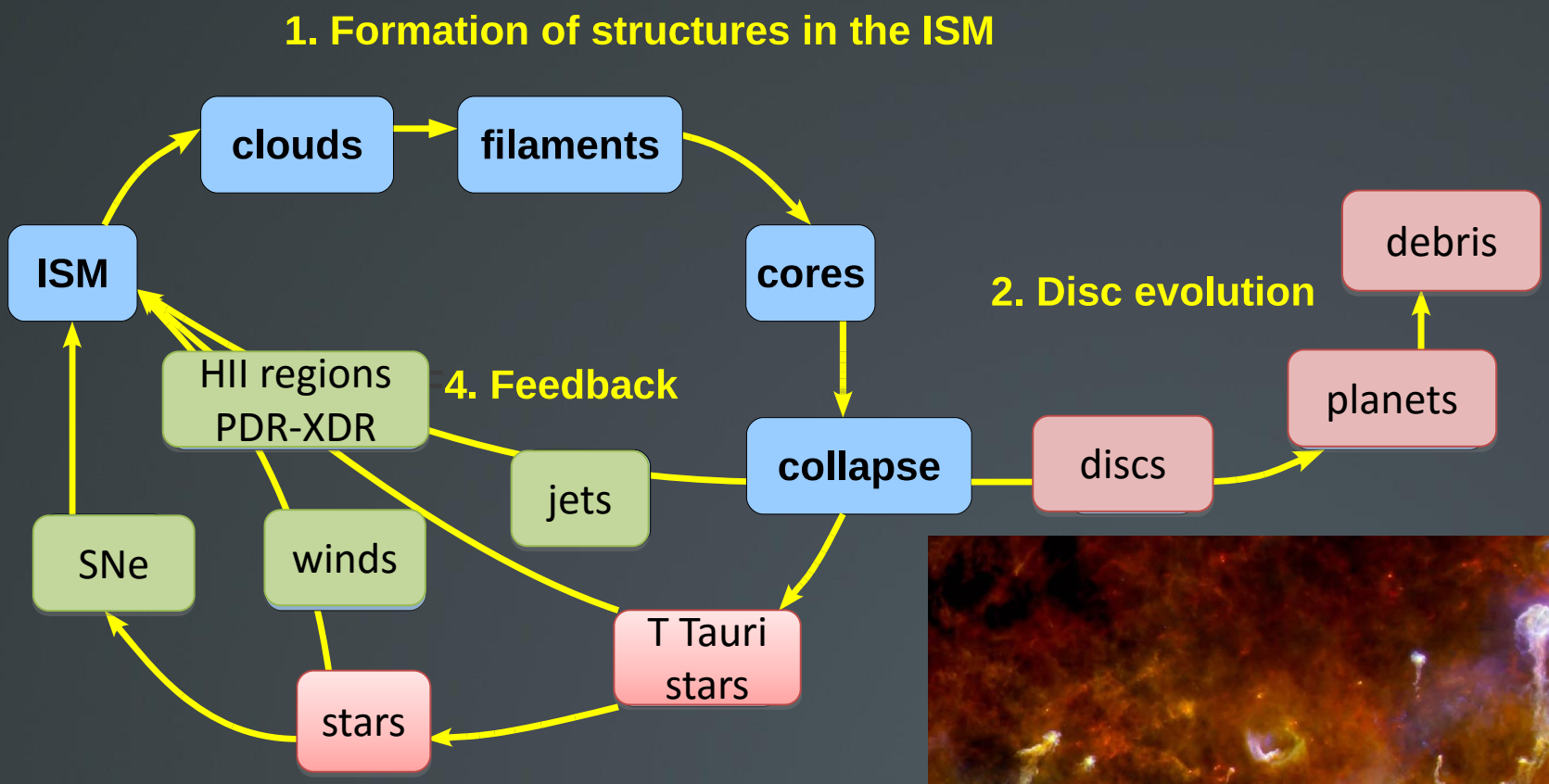
November 19, 2018: 44 members; 4 sites (Denfert, Meudon, ENS, Jussieu)

Permanent members (27):
19 staff scientists, 6 emeriti, 2 research engineers

Non permanent members (17):
10 PhD students, 4 postdocs, 3 CDDs

LERMA's Newcomers meeting; Nov. 19, 2018

Outline : galactic matter cycle



Scientific drivers

1. **Mechanisms regulating the condensation of diffuse interstellar medium (ISM) into stars and protoplanetary discs ? (and back)**

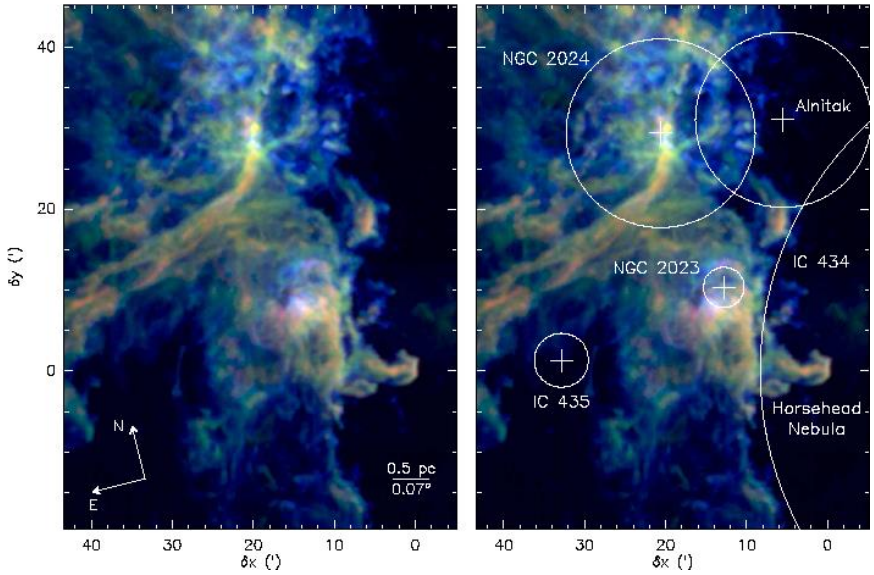
2. **Photodissociation regions (PDRs) : how can we interpret their signatures ?**

3. **Chemical complexity : characterization, origin, impact on ISM physics and star formation**

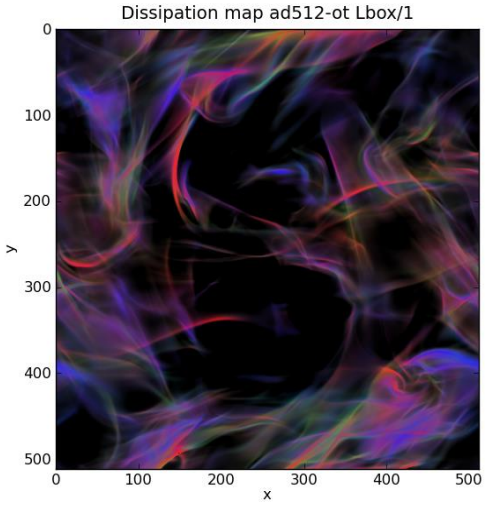
4. **Turbulent cascade: dissipative processes, magnetic field**

5. **Accretion/ejection: stellar radiative and mechanical feedback**

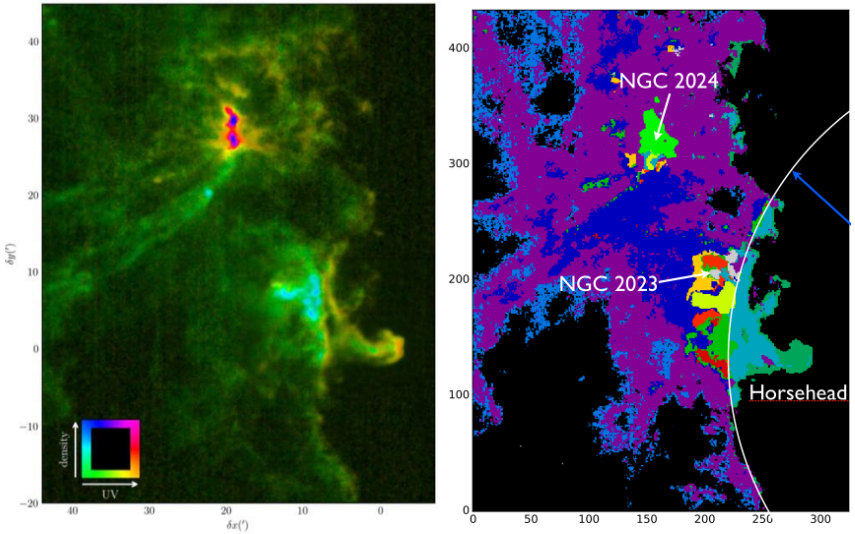
Complementary approaches



Observations



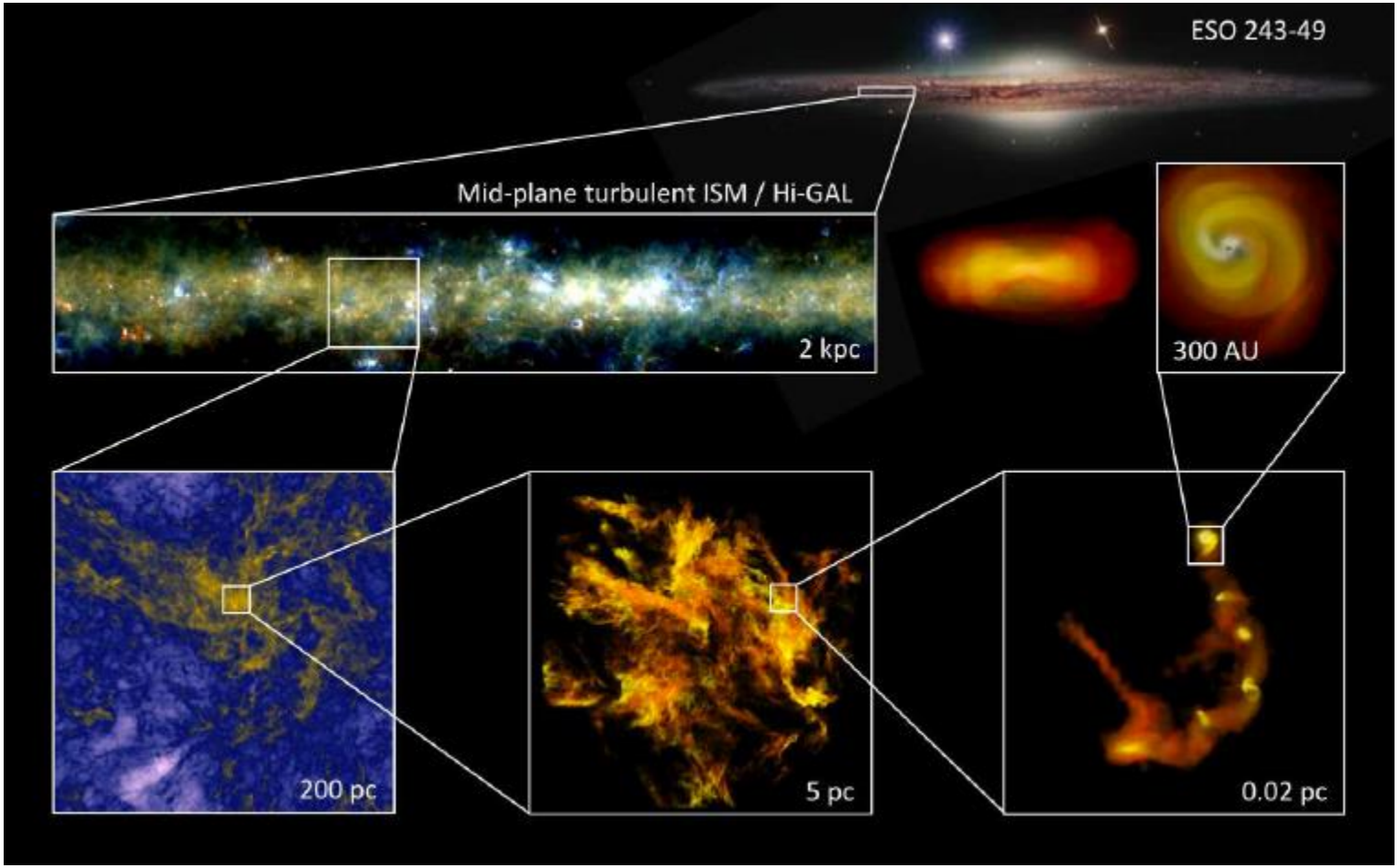
Theory and numerical simulations



Analysis, modeling and interpretation

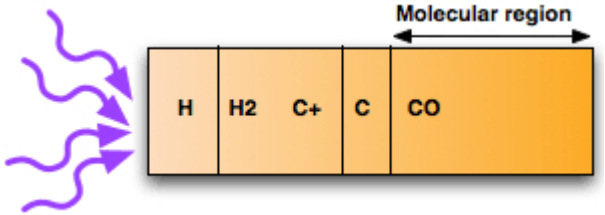
Laboratory experiments

Structuration of the ISM

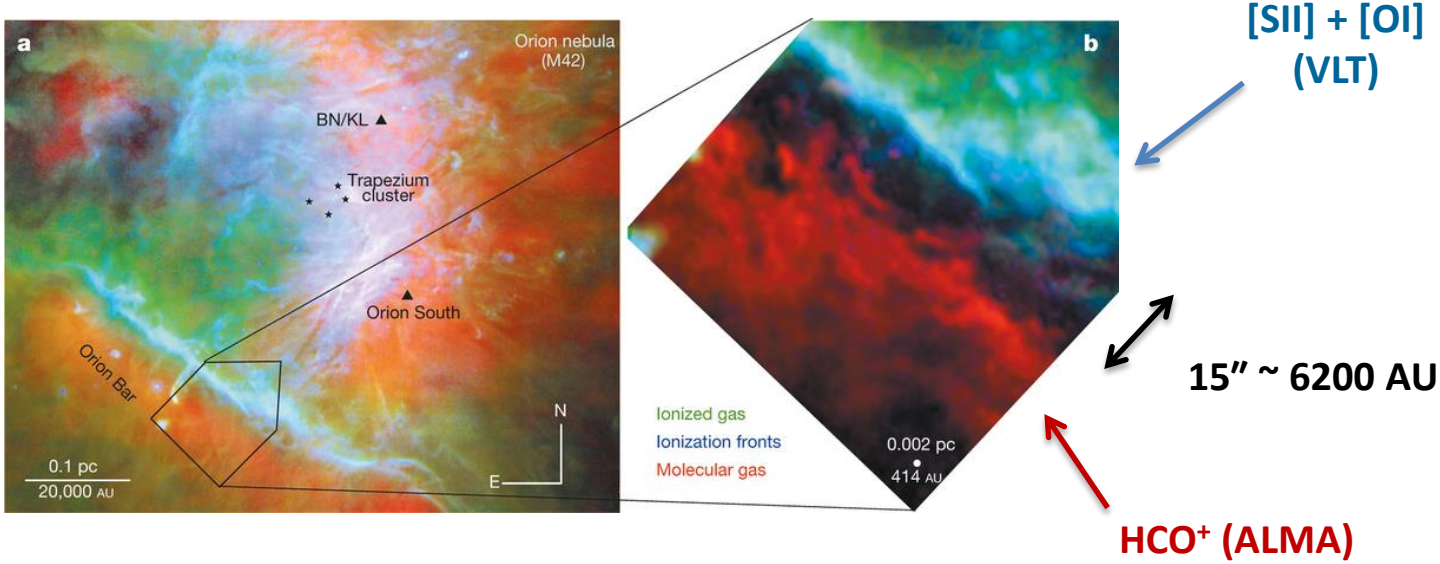


Magnetic fields are significant on all scales

PhotoDissociation Region (PDR) models



- **Compute the atomic and molecular structure of interstellar clouds**
- **Require an analysis of (gas & dust) physical and chemical processes**

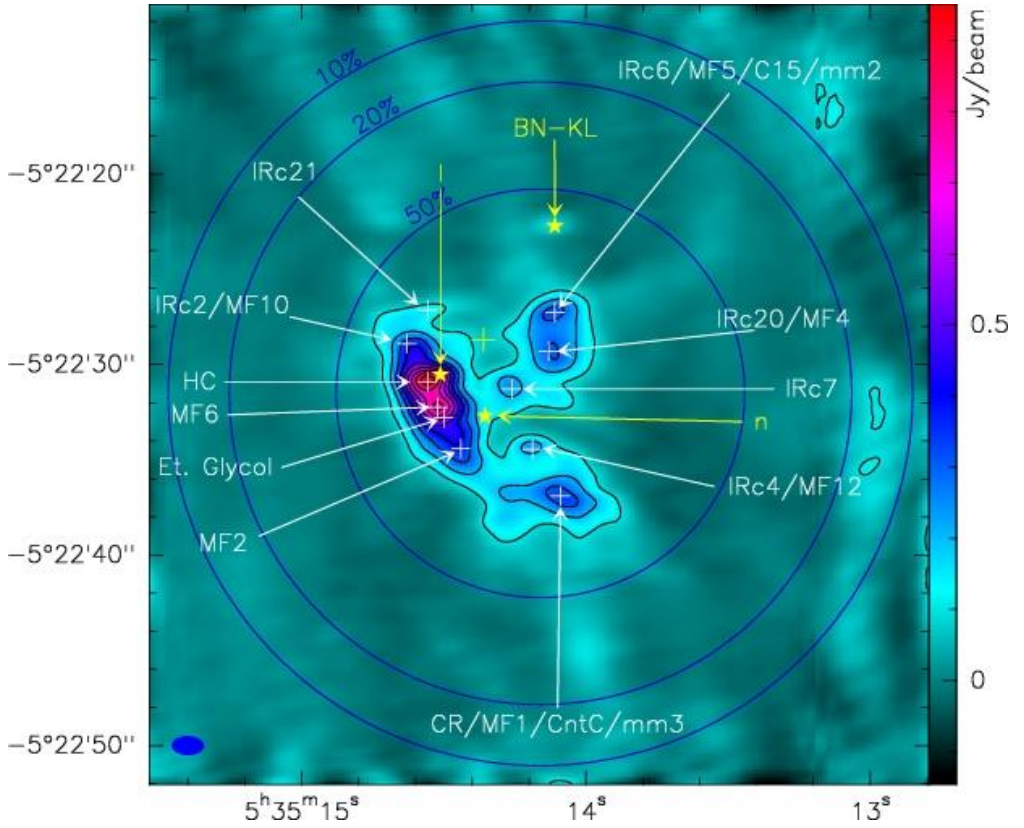


essential for interpreting observations

Anatomy of interstellar clouds

Orion; ALMA (215-252 GHz),
1” (400 au)
thousands of lines,
70 species (HC_3N, CH_3OH, HCOOH, etc.)

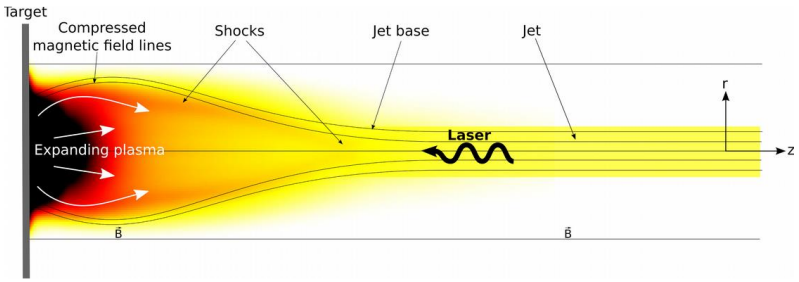
Pagani et al. (2017)

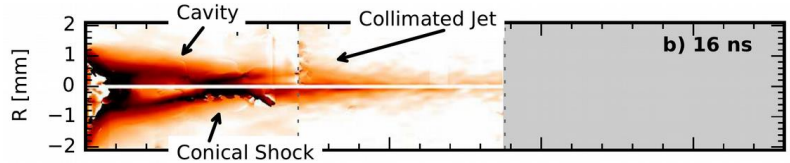


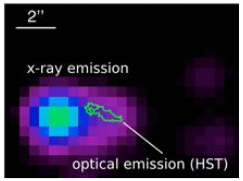
→ **grasp on the chemical complexity of the ISM**

→ **new techniques for exploiting the data (Machine Learning)**

Plasma laboratory experiments and modeling







First magnetically confined laboratory jet (LULI, Ciardi et al.)

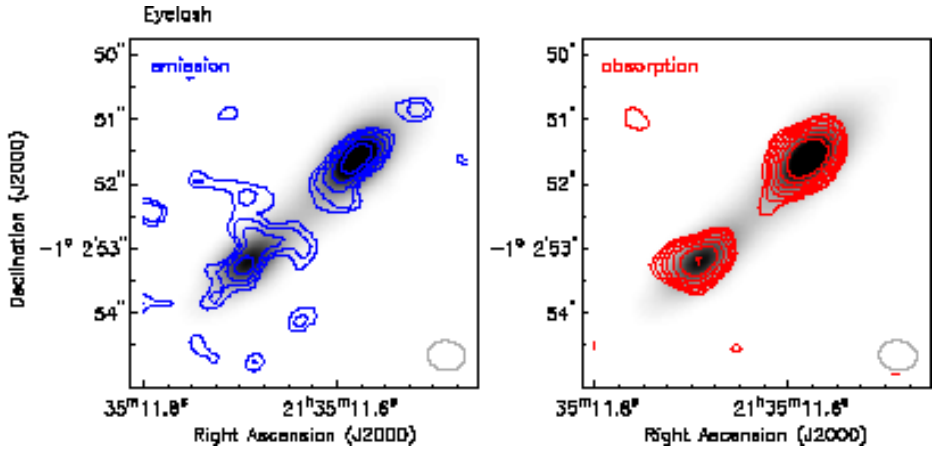
Chandra observations (X-ray)

- **Development of numerical codes**
- **Validation through laboratory experiments**

from our Galaxy to external galaxies (Lyrics, MIST)

- **ISM lines discovered by Herschel at high frequencies can be detected in the sub-mm/mm range by ALMA/NOEMA in redshifted galaxies**

ISM in external galaxies (redshift + grav. amplif.-x35-)



CH^+ (J=1-0) at z = 2.5 (835 GHz)
ALMA in band 6
(Falgarone et al. 2017, Nature, 548, 430)

→ dynamics and chemistry at high z/earlier stages of the evolution

Pole 3

Molecules in the Universe

gas-grain physico-chemistry

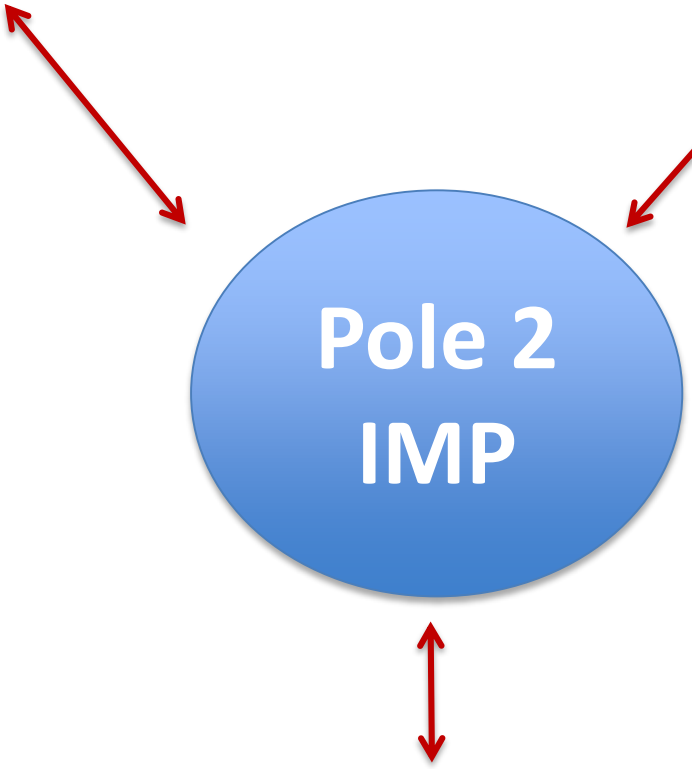
VAMDC (ANO5)

Pole 1

Galaxies & Cosmology

mm/sub-mm/IR observations

ISM in external galaxies; Lyrics foregrounds



Pole 4

Instrumentation & Remote sensing

Herschel, SOFIA, (OST)

Distributed in 4 sites:

ENS – LRA
ISM : dynamics, chemistry, turbulence and B-field
Stellar plasmas: dynamo and convective transport

UPMC Plas@Par - **Jussieu**
Stellar plasmas: accretion-ejection, diffusion theory.

OP-**Meudon**
Stellar feedback: UV irradiation, PDRs
Stellar Plasmas: atomic data, stellar models

OP-**Denfert**
Prestellar cores, star / planet formation,
stellar feedback : AGB winds, protostellar jets

IMP; pole 2

coordination: Thibaut Le Bertre (thibaut.lebertre@obspm.fr)
+ 1 representative per site :
Sylvie Cabrit; Laurent Ibgui; Franck Le Petit; Michel Perault
[with support of the administrative team]

- **ISM seminars and Joint Astrophysics Meeting (JAM) organised by Antoine Gusdorf (next ones: Dec. 10 and Dec. 17, 2pm, ENS)**
- **Web pages: maintained by Benjamin Godard**
- **General IMP meetings : twice a year (spring & autumn) → Nov. 26**
- **e-mail distribution list (quinquennal.lerma-pole2@sympa.obspm.fr)**