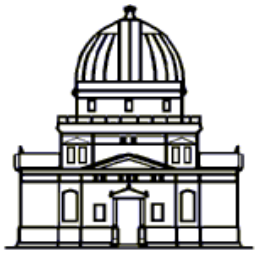
Science Team Highlights

Mark Allen



A scientific data centre needs active scientists

- Scientific expertise commensurate with the diversity of CDS content
- Maintain scientific content and relevance of data and services
- Internal and external collaborations
- Participation in large projects
- Communication – within CDS, observatory, projects, and astronomy community

A diverse science team

- CDS content is diverse
  - multi-λ, specialized, individual objects – all sky
  - Variety of data types - astrometry, photometry, spectroscopic, time domain, cubes, models, …
  - Wide range of observational astronomy and underlying physics
- Expertise required across Astronomy fields
  - Data selection, ingestion, curation
  - Follow evolution of Astronomy to ensure relevance

Expertise of the Science Team

Mark Allen

Caroline Bot

Laurent Cambresy

Sebastien Derriere

Cecile Loup

Francois Ochsenbein

Pierre Ocvirk

Francois-Xavier Pineau

Arnaud Seibert

Bernd Vollmer

Expertise:

Stars and peculiar stars

Star formation

ISM and Extinction

Galactic dynamics

Physics of galaxies

Clusters of Galaxies

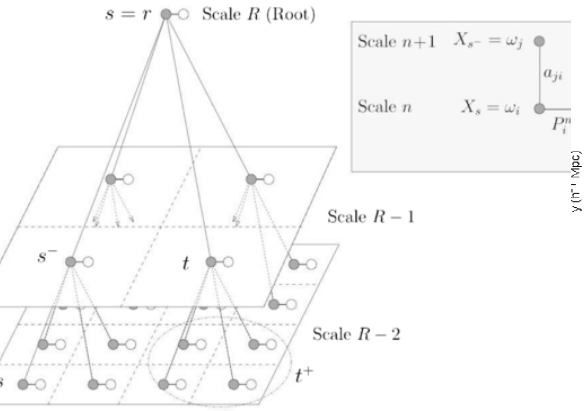
Cosmology and reionization

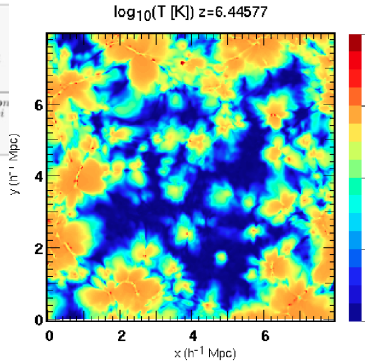
X-ray Astronomy

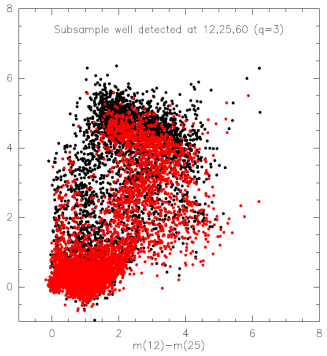
Catalogues and Cross Matching

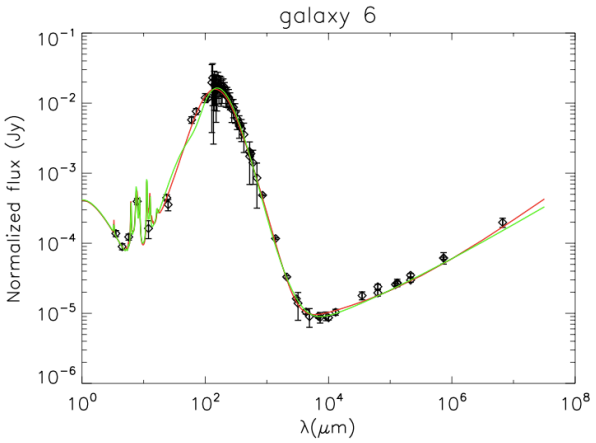
Astroinformatics

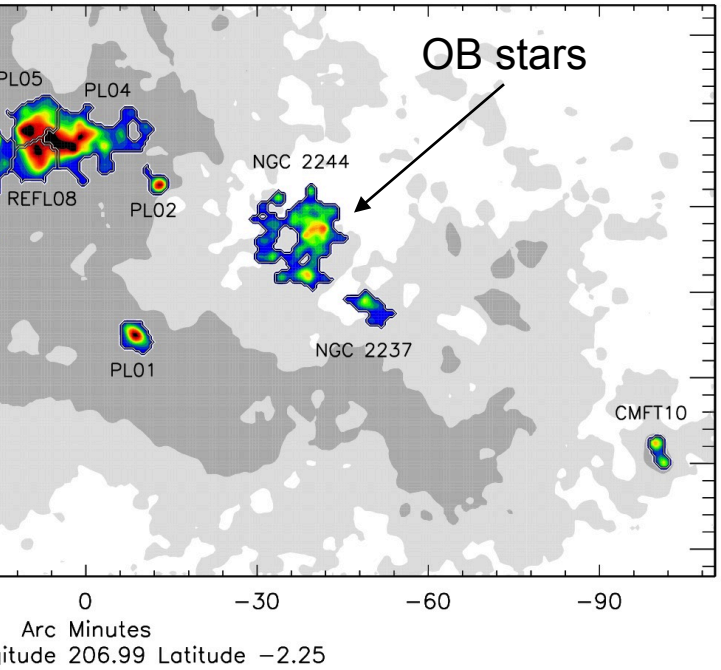
Highlights from the team

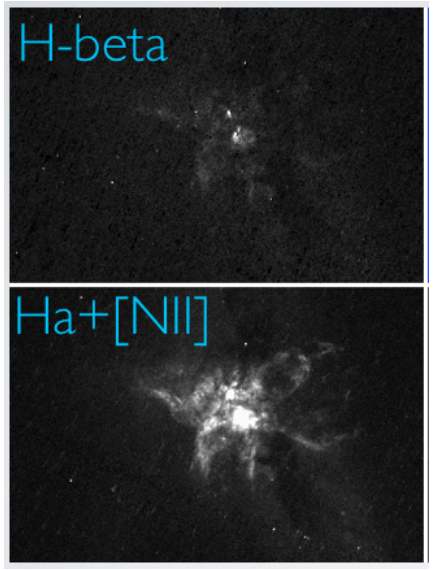


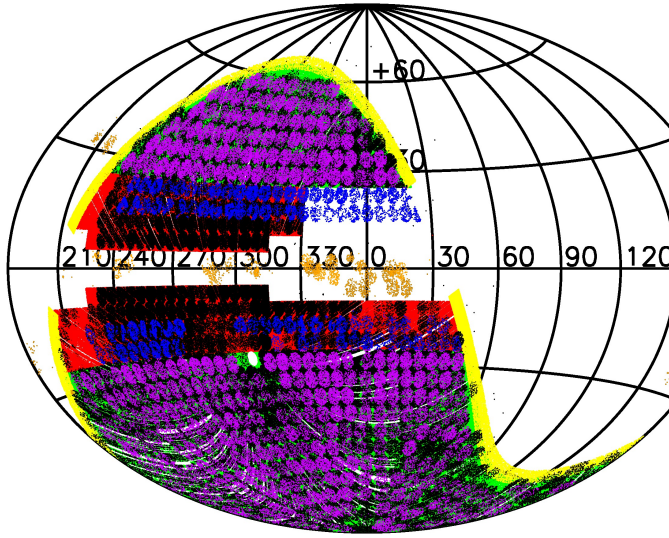










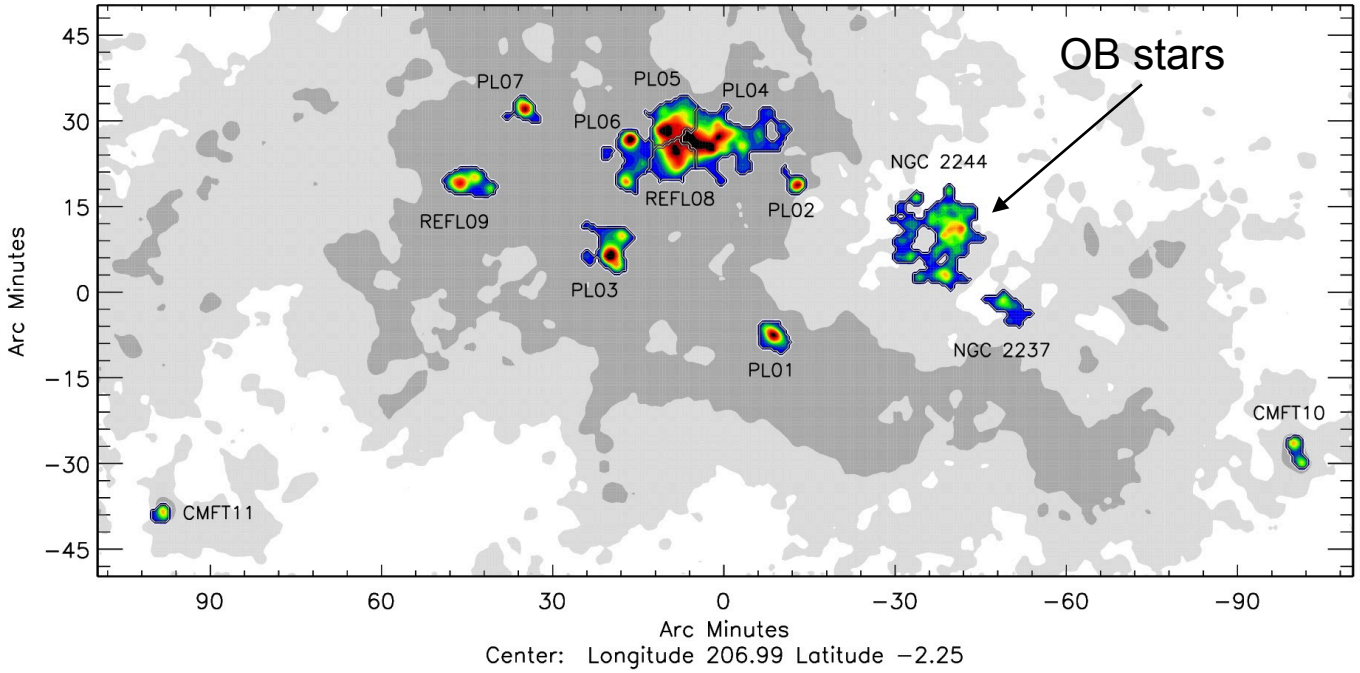


New DENIS input catalogue: |b|>25°, no colour
New DENIS input catalogue: |b|<25°, J−K>0.5
New 2MASS input catalogue: 0°<δ<5°, no colour
RAVE DR4 from old input catalogue
RAVE DR4 from interim input catalogue

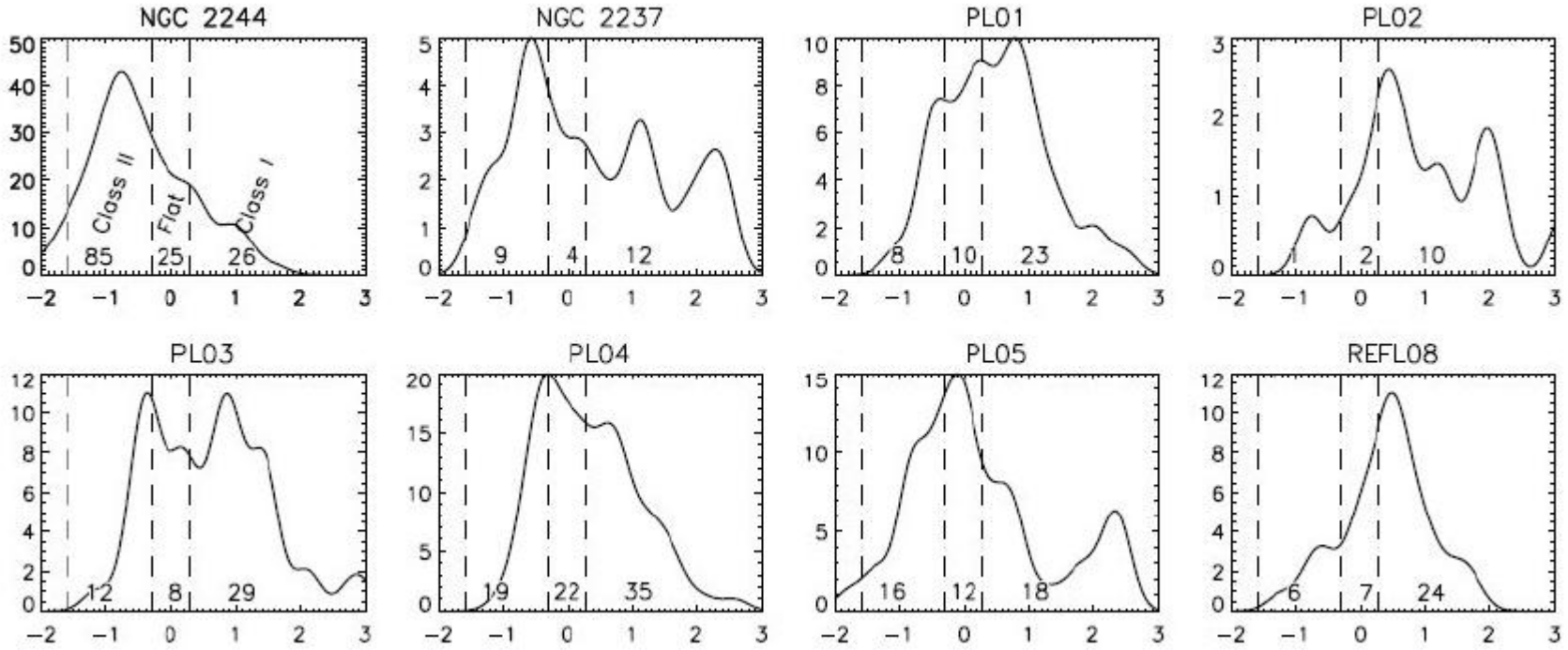
Young stellar clusters in the Rosette molecular cloud

(*Cambrésy et al. 2013*)

- Cluster detection using extinction-corrected UKIDSS star density analysis
  - Total YSOs population estimated to ~5000 members
  - 2 new clusters discovered (CMFT 10 and 11)



- Spectral Energy Distribution using UKIDSS + WISE
  - The histogram of the spectral index, α, shows the star formation history for each cluster
  - It suggests the cluster ages are not consistent with a triggered star formation scenario in the Rosette complex



$$\alpha = \frac{d \log(\lambda F_\lambda)}{d \log \lambda}$$

Cecile Loup

The IRAS PSC revisited in the AKARI and WISE surveys

IRAS : still a basis of our knowledge on AGBs, Pne, YSOs, IR Galaxies, ...
But blending and proper identifications still a matter of concern

Surveys characteristics :

IRAS MIR+FIR :	245,889	4.5x0.75' (12-25µ)	4.7x1.5' (60µ)
AKARI FIR :	427,071		27"
AKARI MIR :	870,973	10"	
WISE MIR :	563,921,584	6"	

More than a Xmatch :

Search in at least the IRAS detector size (or 5sigma)
Search for blends cuts at 15% of the total flux
Comparison of fluxes, iterative process, rejection criteria

Limits :

AKARI : sky coverage incomplete, especially in the FIR
WISE : fails on bright sources (produces many ghosts)

Results – Historical IRAS colour-colour diagram

<m(12)-m(S9W)> = -0.35(0.31)

<m(12)-m(W3)> = -0.35(0.28)

<m(25)-m(L18W) = -0.43(0.37)

<m(25)-m(W4)> = -0.37(0.30)

<m(60)-m(WS)> = +0.82(0.44)

Subsample detected at 12, 25, and 60

Confirmed PS in 3 bands : 43% (red)

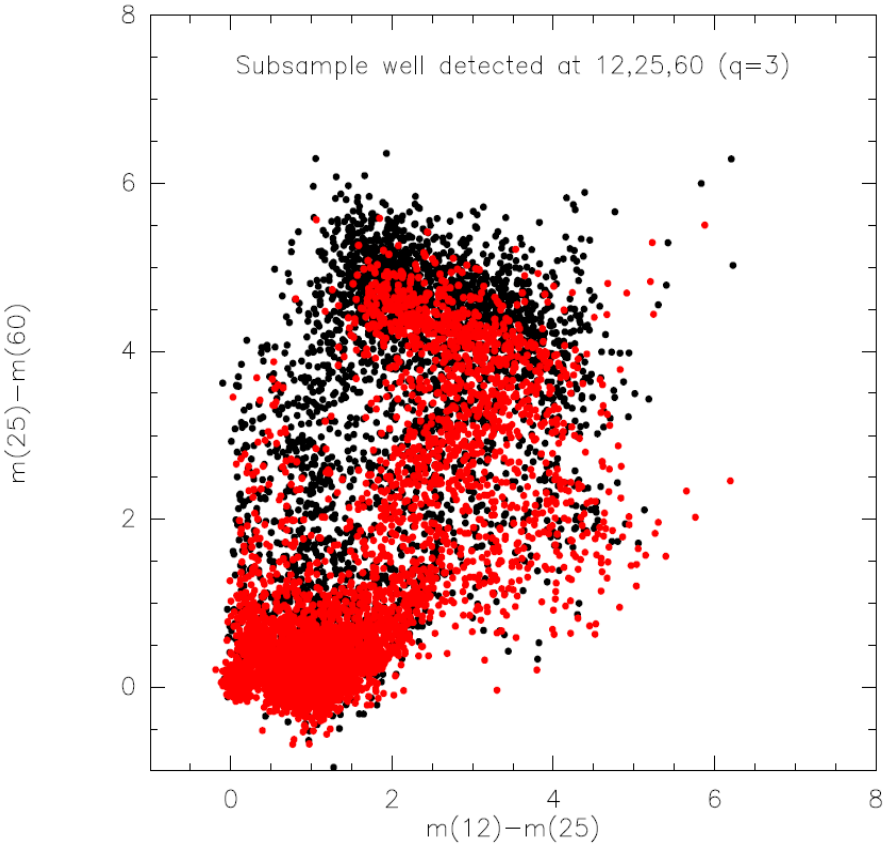
Blends (or extended) : 30% (black)

Not recovered in 3 bands : 27%

Perspectives

Revisiting IRAS historical samples

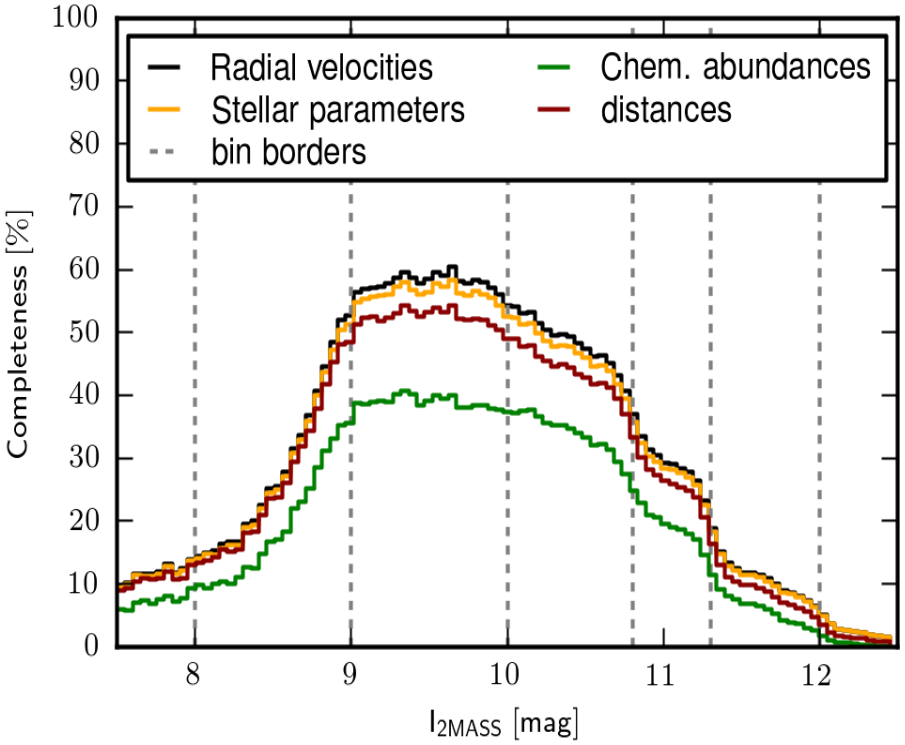
Apply the method to other IR surveys

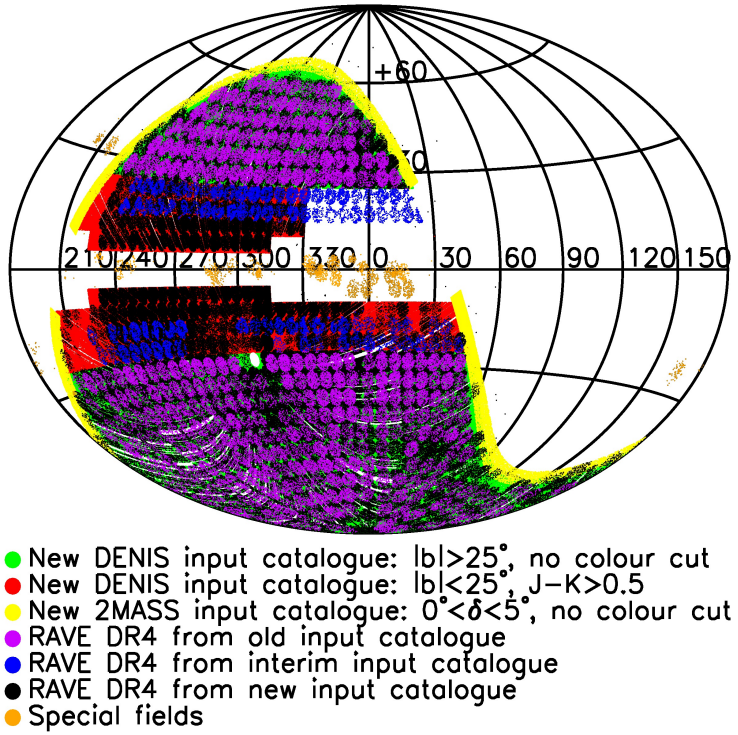


Arnaud Siebert

RAVE DR4:

Radial velocities for 425,561 stars (482,430 spectra)
+ new atmospheric parameters
+ chemical abundances for 9 species for 313,874 spectra
+ spectrophotometric distances, ages, extinction and mass estimates
+ spectral classification
+ SPM4,UCAC,PPMXL proper motions



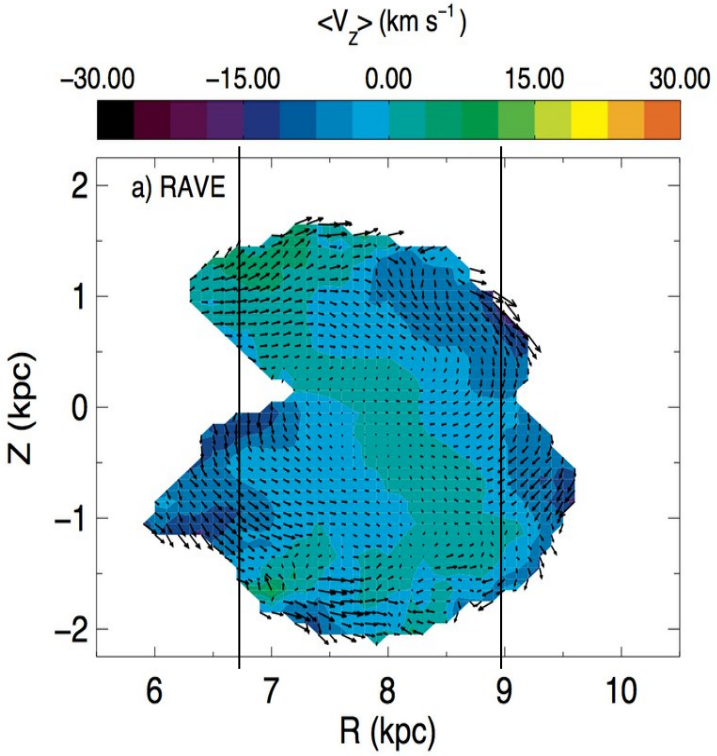


Arnaud Siebert

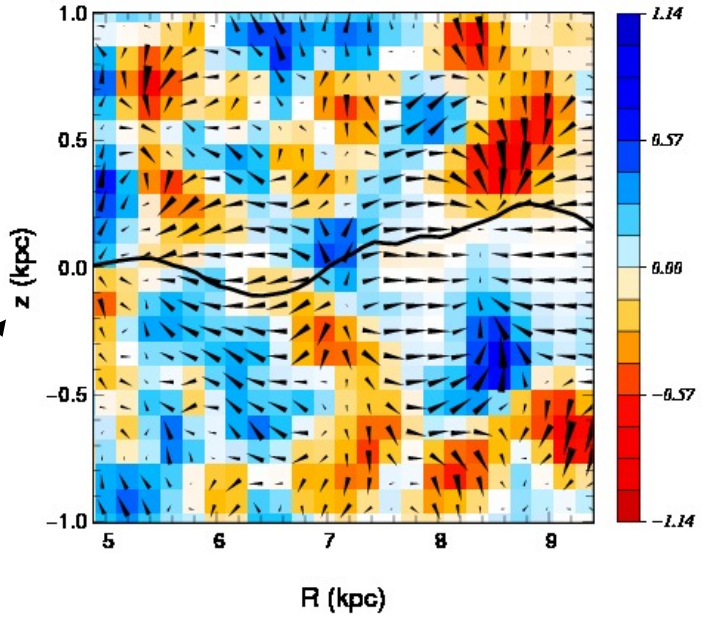
Current project with RAVE data

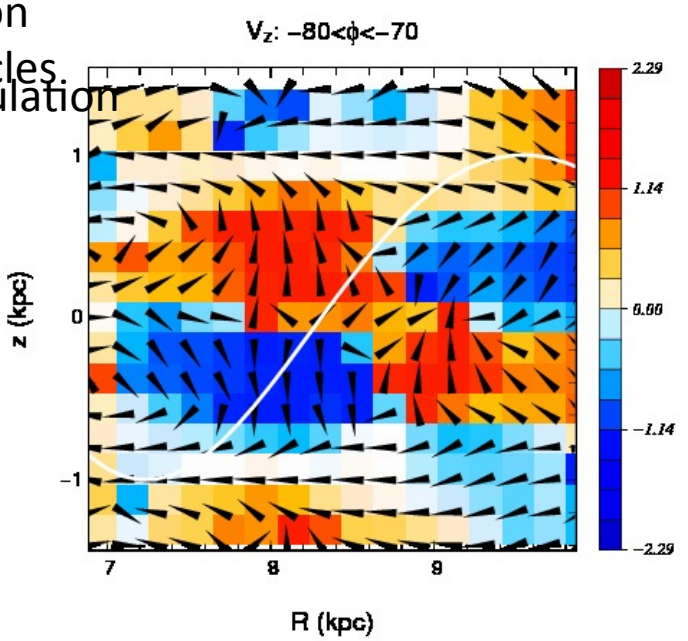
Role of spiral instabilities
on the local velocity field

RAVE observations



Nbody simulation
2.107 disc particles.
Particle test simulation

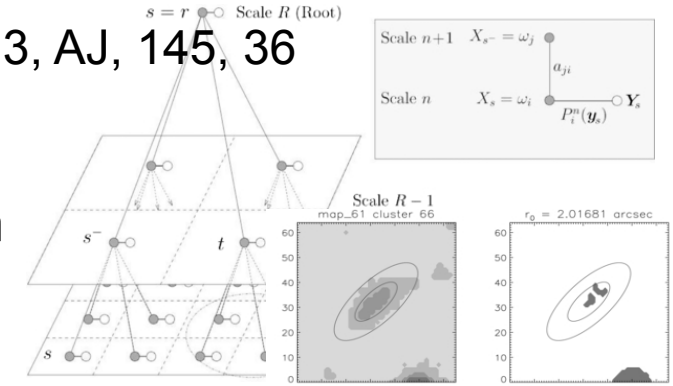




Bernd Vollmer

Simultaneous Multi-band Detection of Low Surface Brightness Galaxies with Markovian Modeling

Vollmer, Perret, Petremand et al. 2013, AJ, 145, 36
R&D project launched in 2001



MARSIAA: algorithm for the detection of low surface brightness (LSB) galaxies in images

multi-scale Markovian modeling. MARSIAA can be applied simultaneously to different bands

application to Next Generation Virgo Survey (NGVS) gri-band images

MARSIAA/DetectLSB recovered ~20% more mock LSB galaxies and ~40% more LSB galaxies identified by eye than SExtractor/DetectLSB

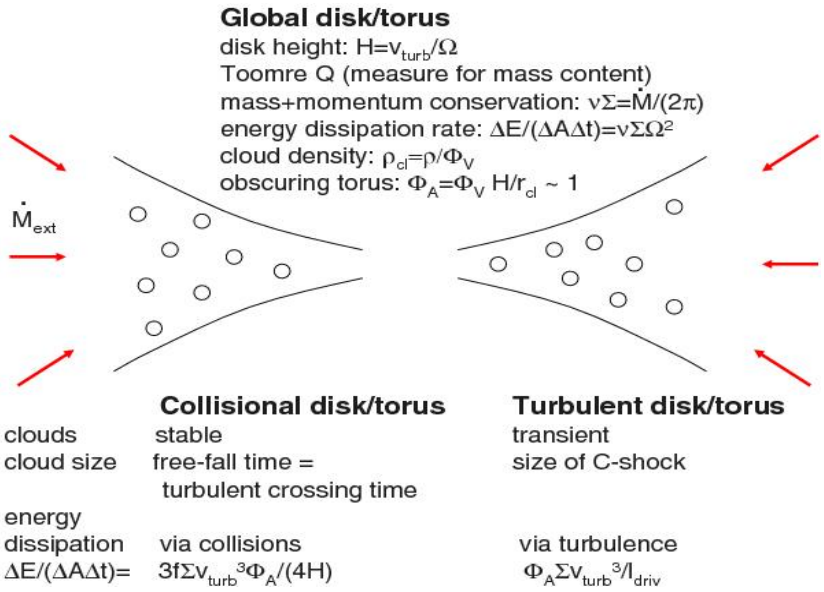
Bernd Vollmer

The quenching of star formation in accretion-driven clumpy turbulent tori of AGN

Vollmer & Davies 2013, A&A, 556, A31

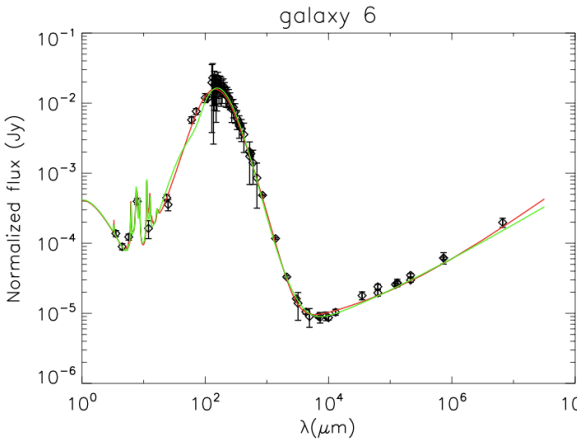
- Gas-gas interaction involving the ISM
- Adiabatic compression leads to an enhanced turbulent velocity dispersion
- Turbulent gas clouds are overpressured and star formation is quenched
- Analytical framework of clumpy accretion disks

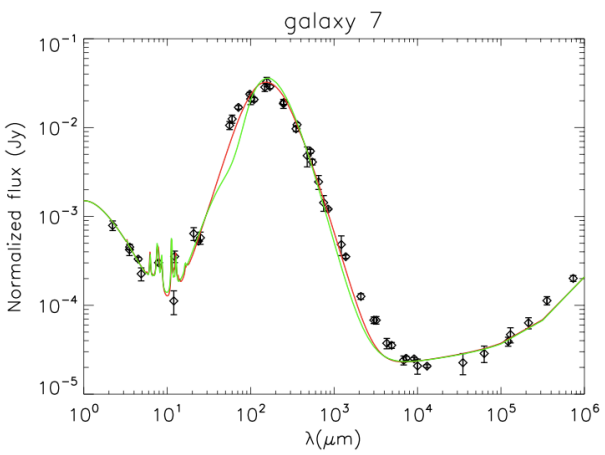
- Results are consistent with observations of the CND in the Galactic Center and high-resolution H2 observations in nearby AGN



Caroline Bot

dust modelling in nearby galaxies





SED benchmark

lead by K. Gordon

blind fitting of 6 galaxies + 1 Milky Way SEDs with many different dust models

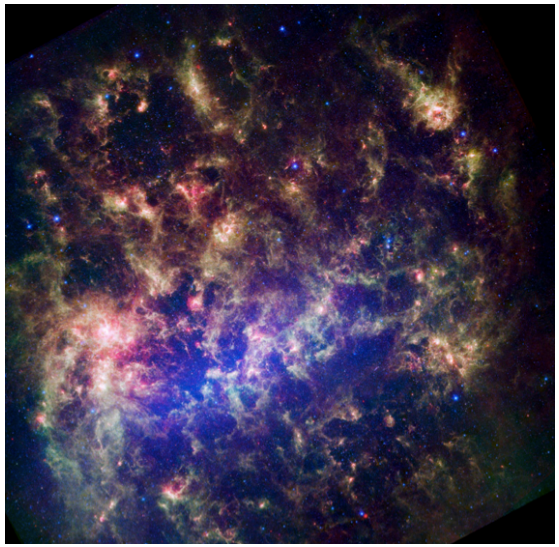
DUSTEM model with single or multiple radiation field components (+stars, free-free, synchrotron)

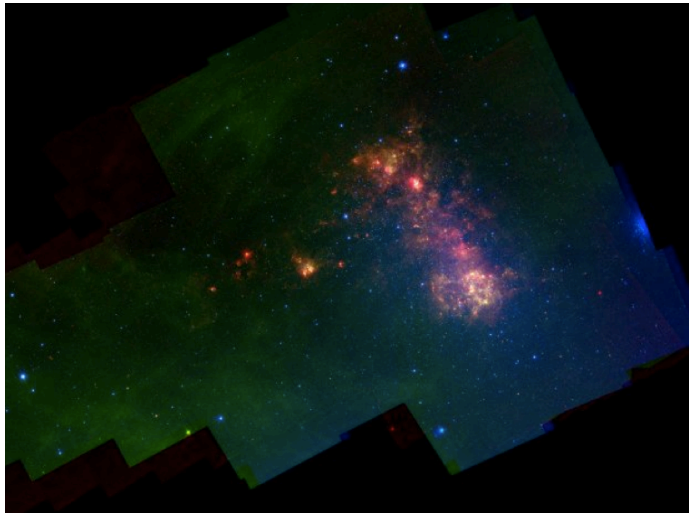
comparison of the results on the way

Caroline Bot

part of the HERITAGE project (P.I. M. Meixner)

Herschel survey of the Magellanic clouds





Bayesian approach to dust emission modelling

first tests, master training + Ph.D. thesis subject

goal: apply to the Magellanic Clouds then other nearby galaxies

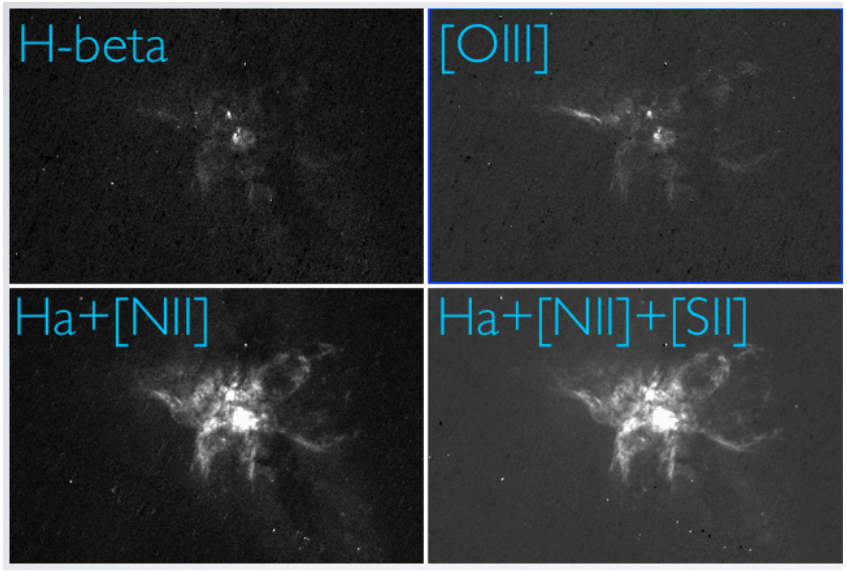
Mark Allen

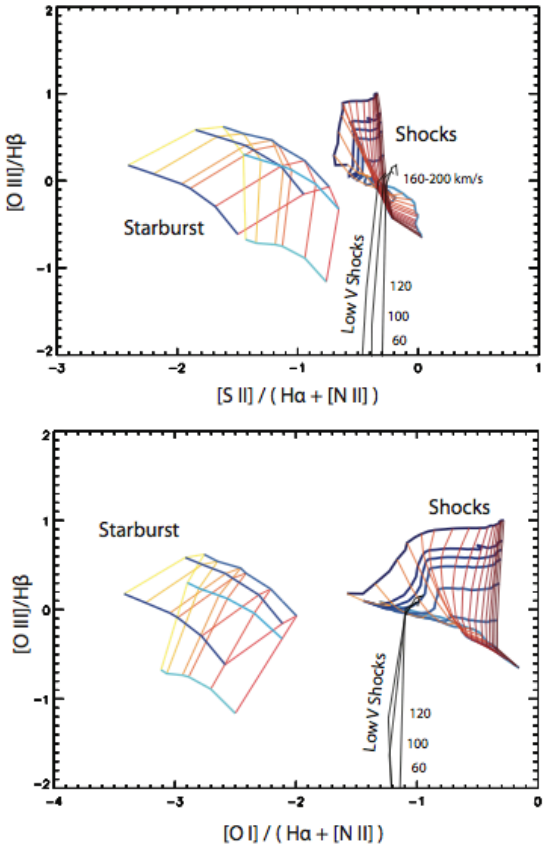
Current Project: Shocks in Merging Systems

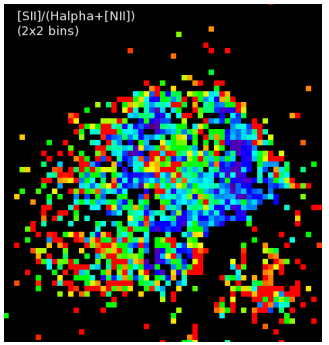
Allen, Kewley(U. Hawaii), Lockhart (U. Hawaii), Dopita (ANU)

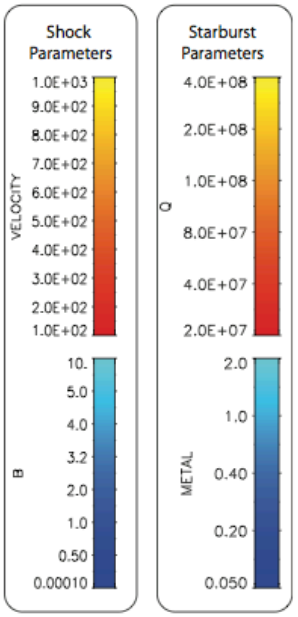
HST Cycle 19 WFC3 deep emission line imaging of NGC 6240 and Arp 220

Spatially resolved emission line diagnostics to establish shock, stellar and AGN contributions to overall energetics





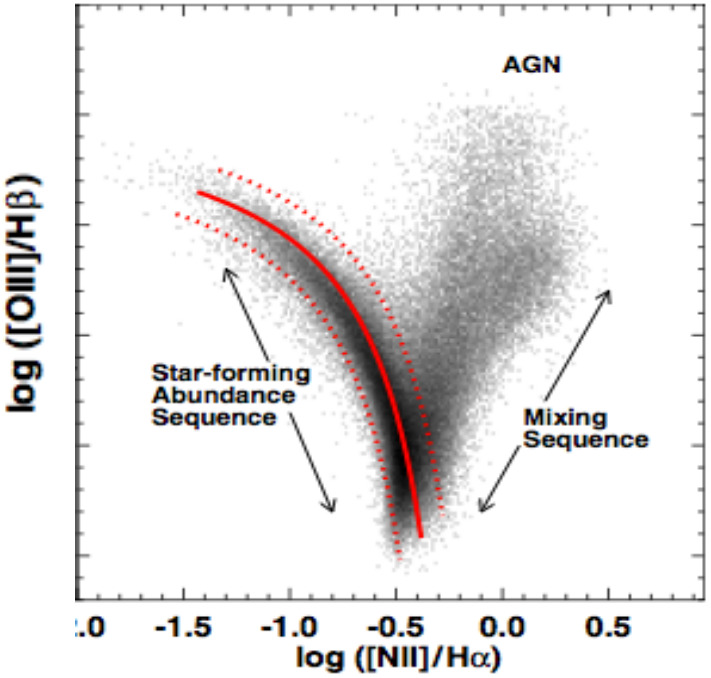


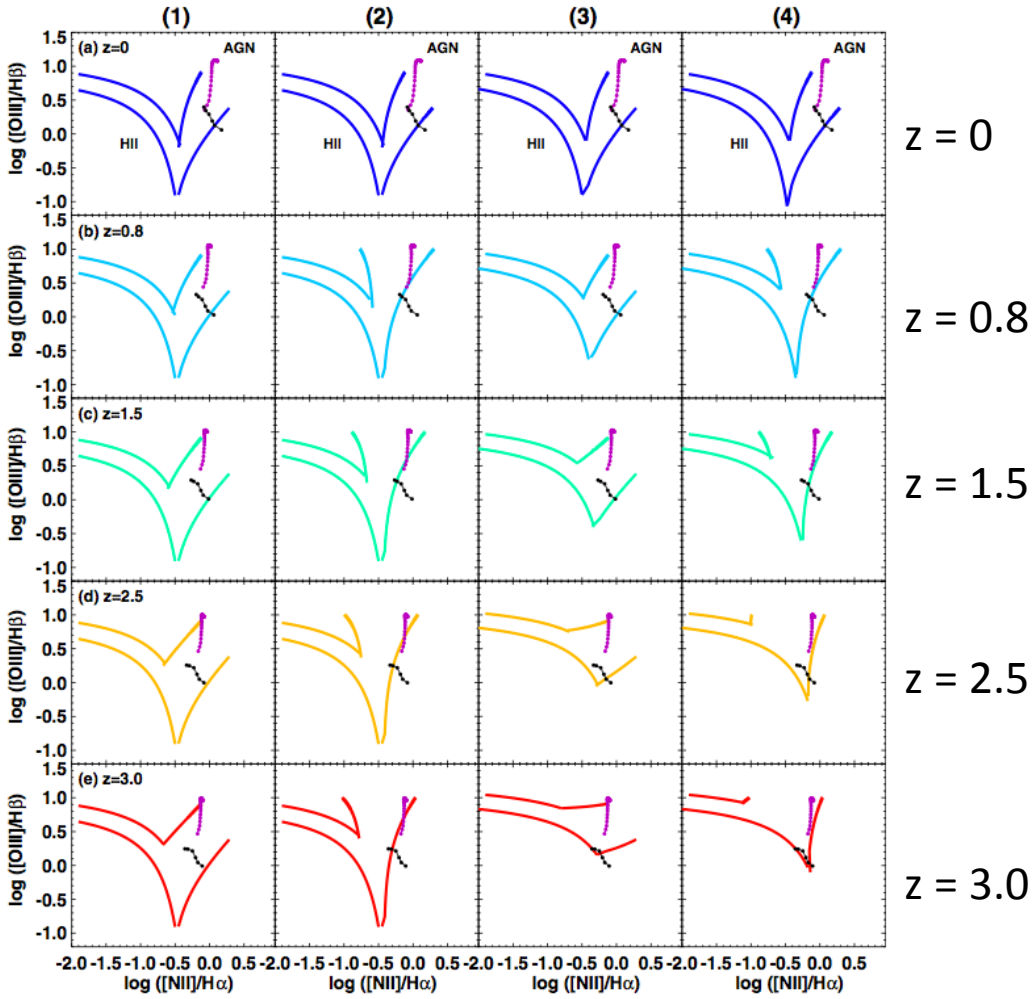


Mark Allen

Shock and Photoionization modeling applied to Theoretical Galaxy Evolution of Optical Strong Lines Across Cosmic Time

Combined models/observations to analyse AGN and Starburst contribution as function of z. Incl Allen shock models 2008, 2010.





Kewley, Dopita, Leitherer, **Allen**, Yuan, Groves, Sutherland, **ApJ 2013**, 774, 100

Reionization of the local group of galaxies (MW-M31)

Exploration of reionization scenarios (strong dependence on source nature/physics) using:

High res simulation of local group formation

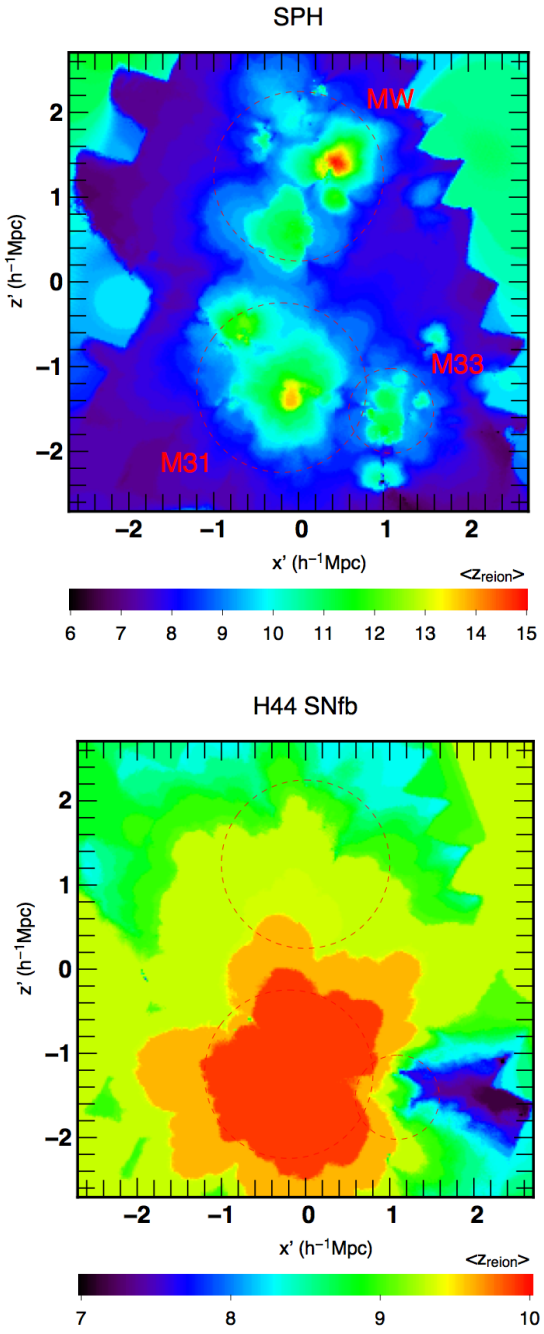
+ radiative transfer in the UV (post-processing with ATON)

Internal, inside-out reionization of MW and M31 in most cases but not always!

=> Question: impact on satellite populations? (photo-evaporation)

=> Question: impact of Virgo?

Ocvirk et al. 2013



Pierre Ocvirk

Reionization of the local group of galaxies (MW-M31)

The largest (8192 nodes, 8192 GPUs, 1 snapshot = 18 TB, ~45 millions node-hours allocation) coupled radiative hydrodynamics simulation of the local group (work in progress)

running on titan (2nd largest supercomputer, 1st at the time of proposal acceptance)

hybrid config: gravity+hydro on CPU, RT on GPU: RAMSES-CUDATON

ICs from CLUES project: representative of the 64Mpc local volume, including Virgo

resolves satellites progenitors (~10^8 Msun haloes)

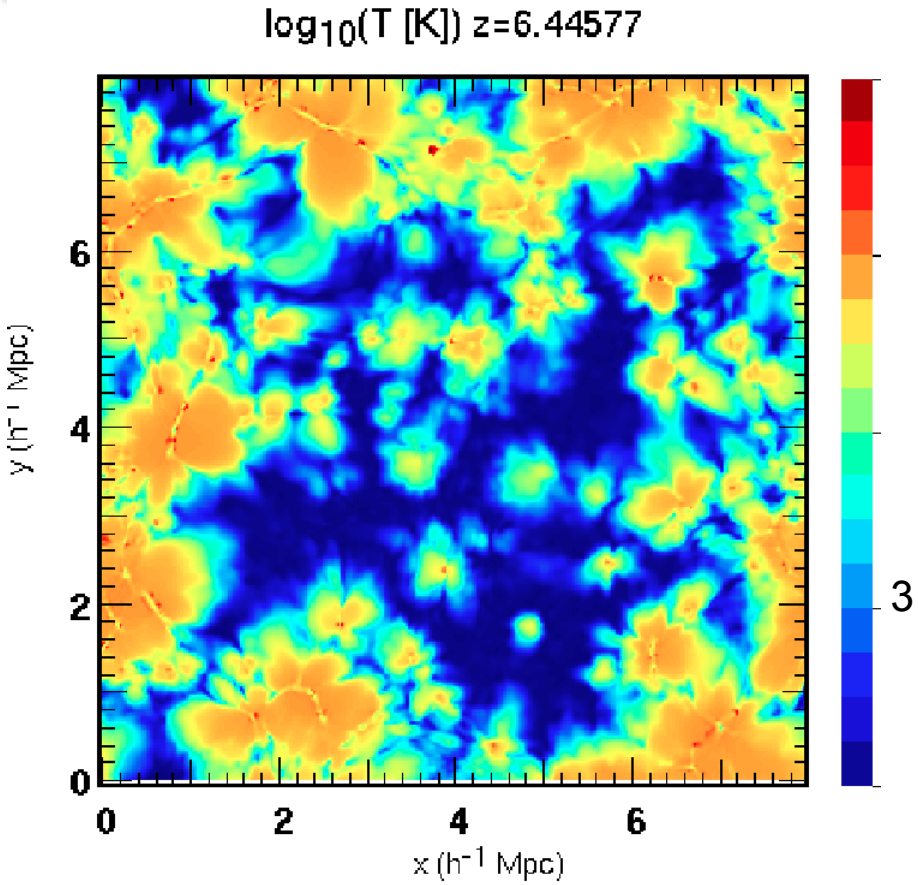
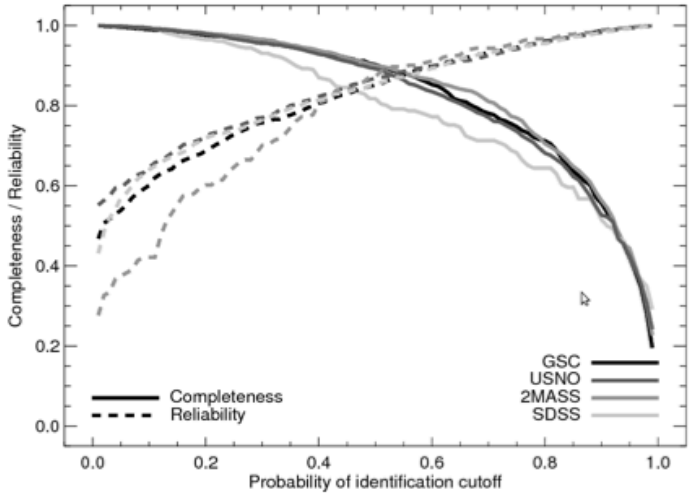
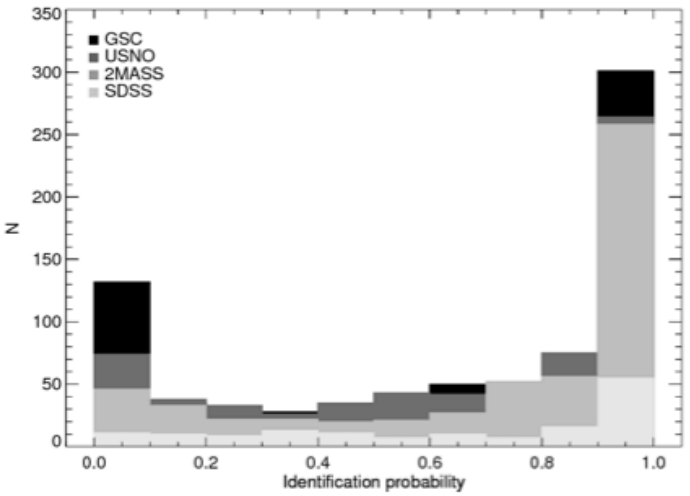


Fig - test run proto-galaxies forming, linked by gas filaments. Red=> SN feebdack (~10^5-6 K gas, very local), yellow: Photo-heated gas (much more extended, ~2.10^4K), blue: cold IGM.

- A. Nebot Gómez-Morán et al. "The XMM-Newton SSC survey of the Galactic plane" (2013A&A...553A..12N)
  - Study of the galactic X-Ray population
  - Identification of sources in 26 XMM FOVs by
    - ★ spectroscopic follow-up
    - ★ cross-correlation with multi-wavelength catalogues
  - Uses the cross-correlations and propabilities of Pineau et al. 2011 (2011A&A...527A.126P, PhD work)
- Paper of A. Nebot Gómez-Morán in prep. on XMM versus GLIMPSE xmatches.
  - Uses a xmatch Aladin plugin (by F.-X. Pineau)





Communication across fields

A necessity for CDS scientific/technical work and for use of CDS services and tools in Astronomy

- With CDS technical expertise
- With providers on data ingestion and curation and scientific support of content *e.g Annontations*
- With astronomers using CDS services and tools – training events, demonstrations, VO schools
- Contributions to wider Astronomy policy at National and European levels

Summary

- CDS Science team covers a wide range of expertise as required by CDS content and services
- Scientifically active researchers
- Participating in important astronomy projects
- Communicating with technical expertise and across fields to realize CDS mission