



International
Centre for
Radio
Astronomy
Research

Gas Accretion and Star Formation in Galaxies with WALLABY



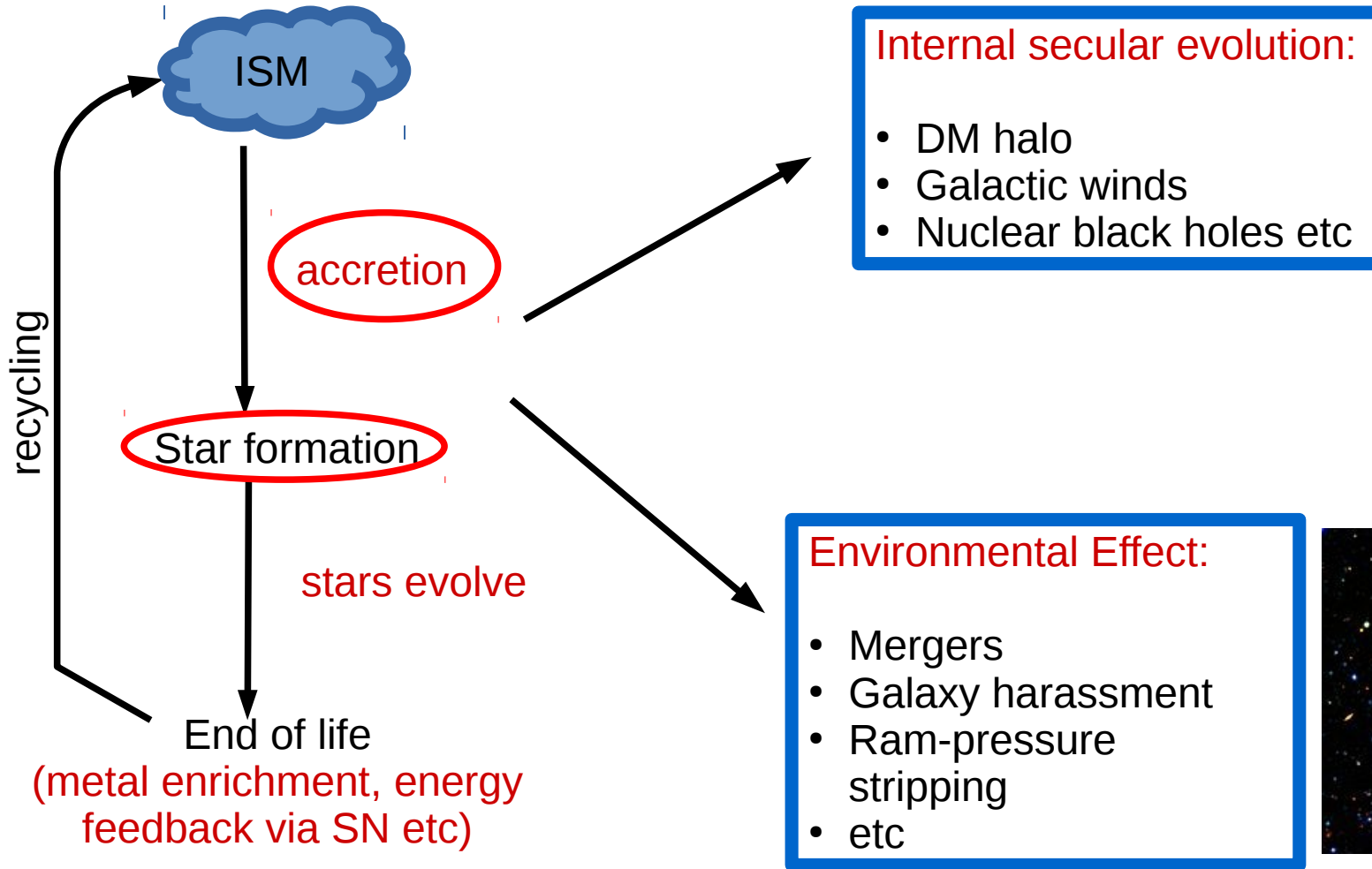
Bi-Qing For
University of Western Australia



Curtin University



THE UNIVERSITY OF
WESTERN AUSTRALIA

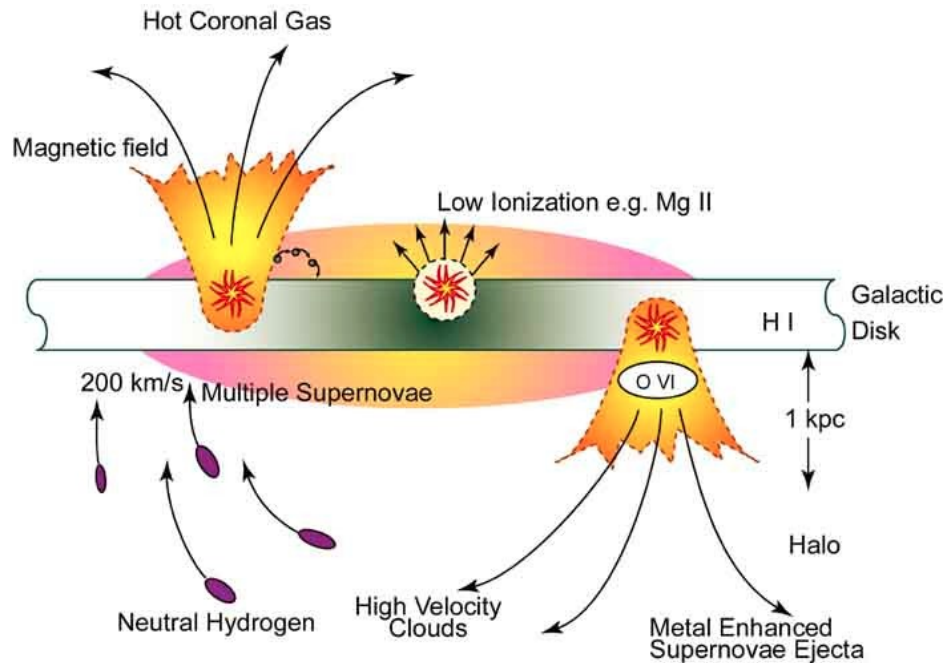


IC 3418
Credit: NASA/JPL



How do galaxies accrete gas and form stars?

Galaxies are actively forming stars. They will run out of fuel --> turn “red” and dead.



Fountain model



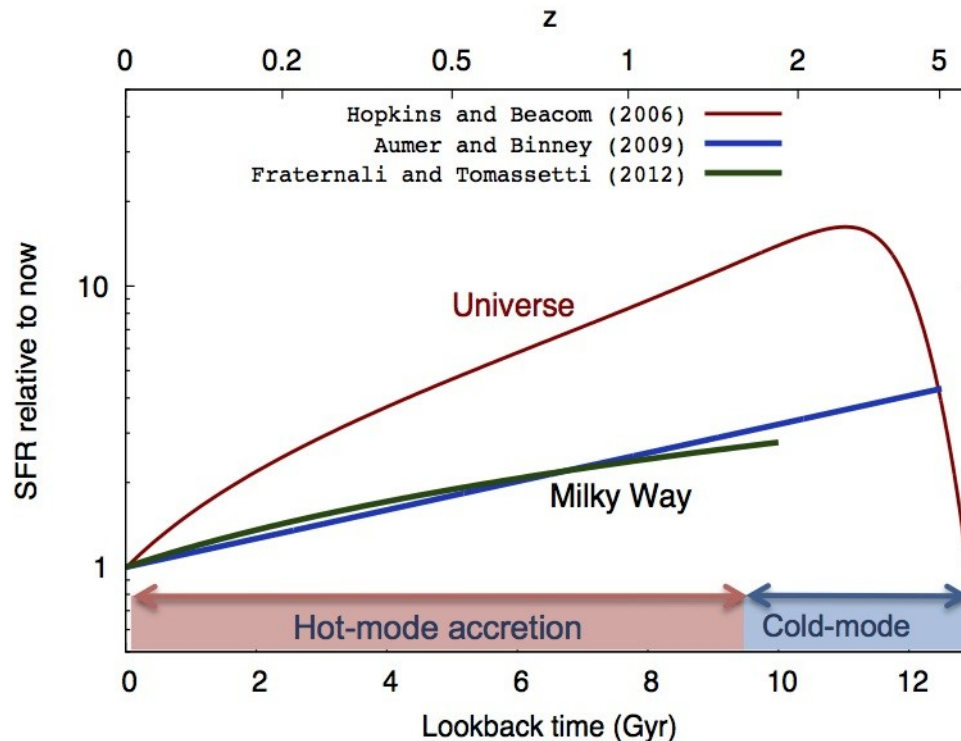
Merger events:
major and minor



How do galaxies accrete gas and form stars?

Cosmological models:

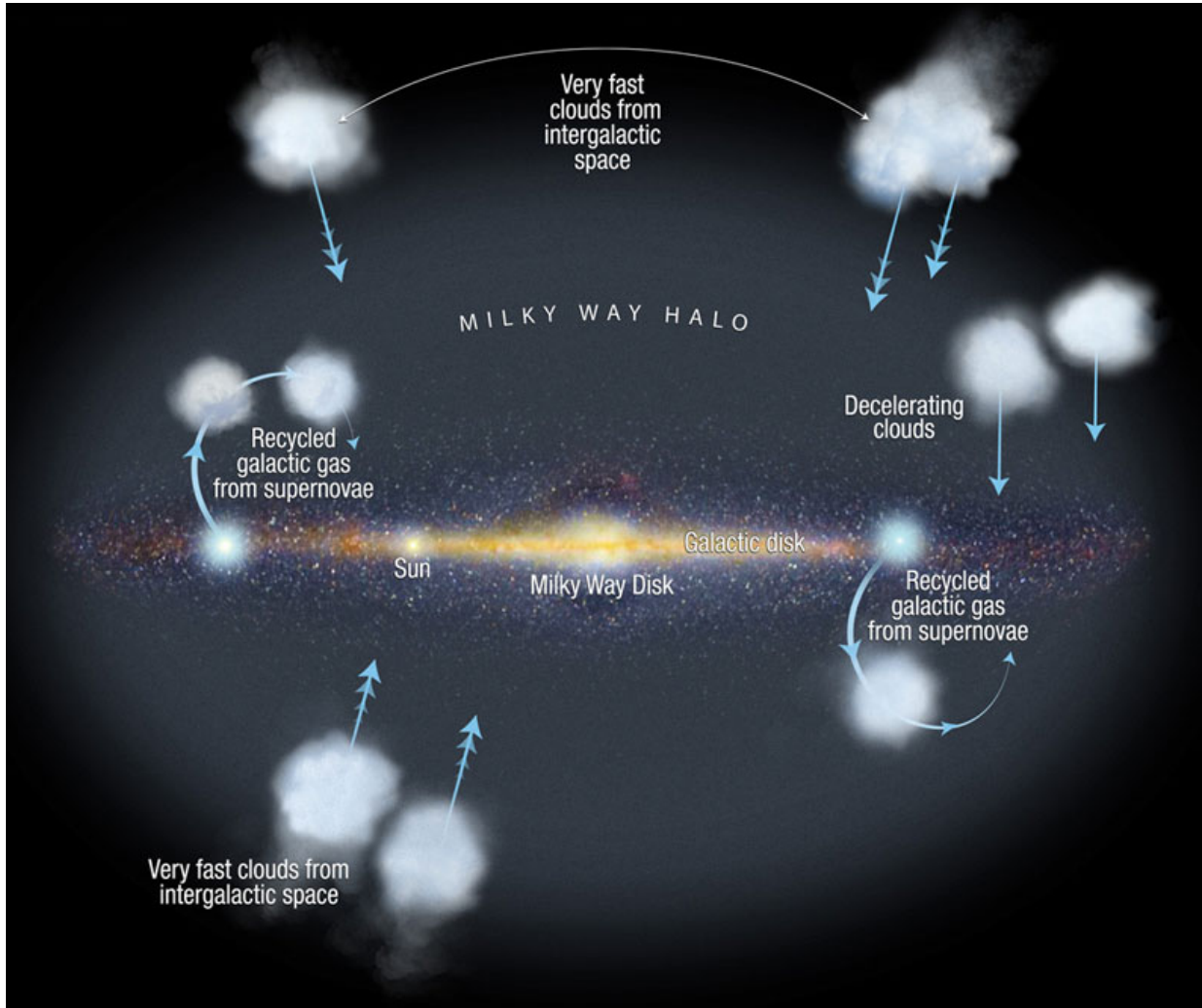
- **Hot mode**
 - gas cool within the halo, falls back to the center, massive halo (low z)
- **Cold mode**
 - gas tunneling in via filaments, low to intermediate mass halo (high z)



F. Fillipo
arXiv:1310.2956
[astro-ph.CO]



HI clouds



- **HVC**
- LVC
- Extraplanar gas
- Tidal debris
- etc

- **14 nearby disk galaxies (Schulman et al. 1994): 10 with high velocity wings, $6 \times 10^7 - 4 \times 10^9 M_{\text{sun}}$**

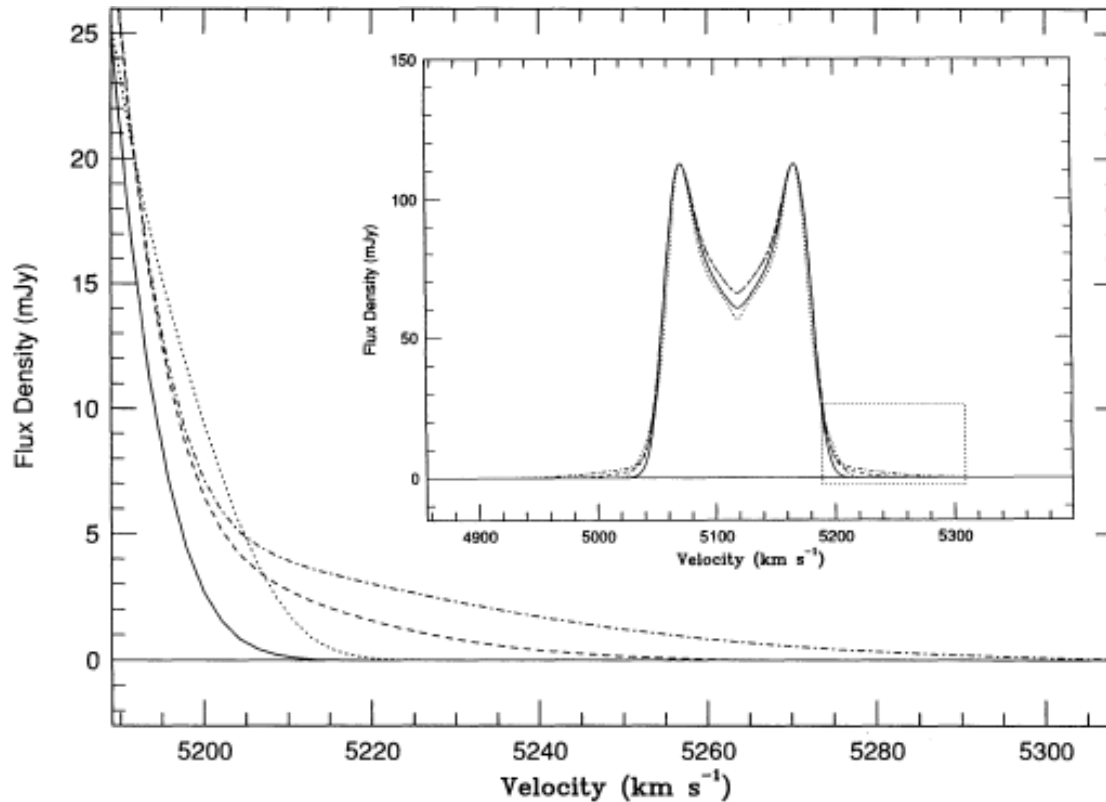
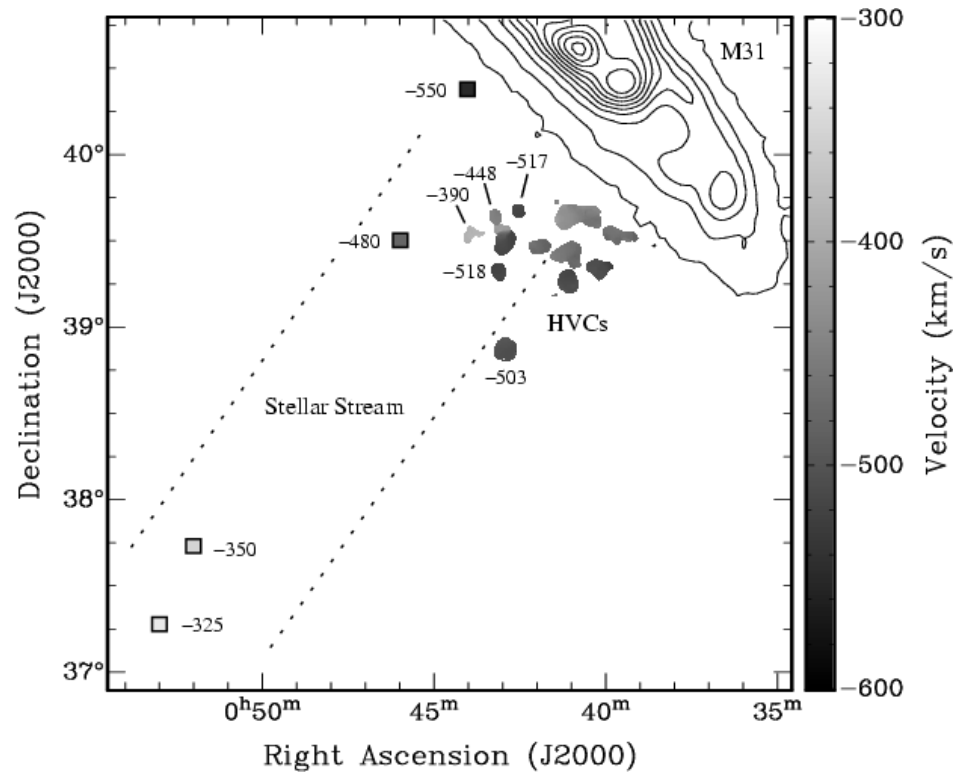
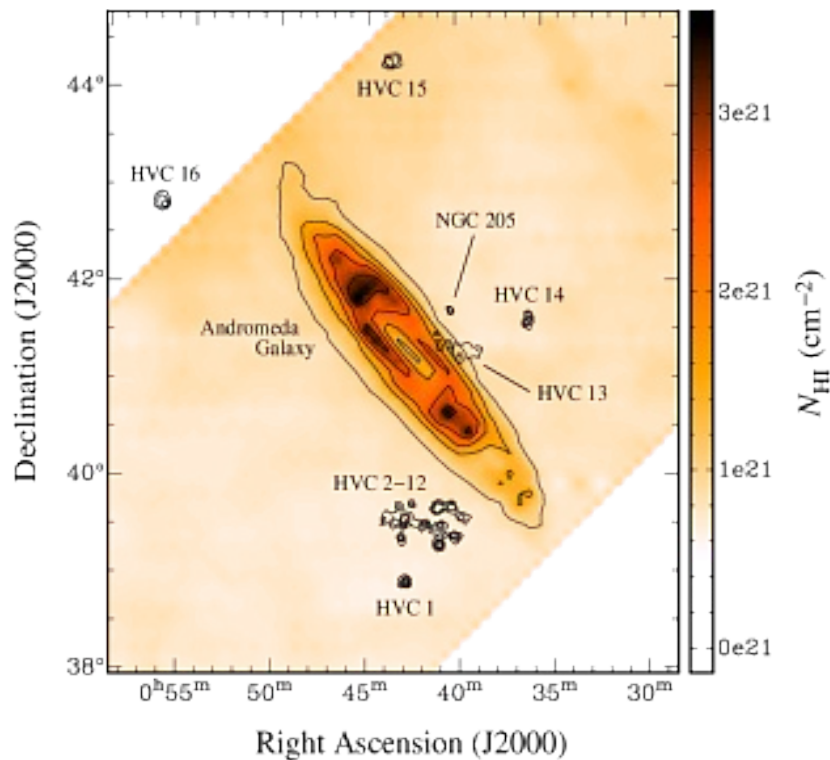


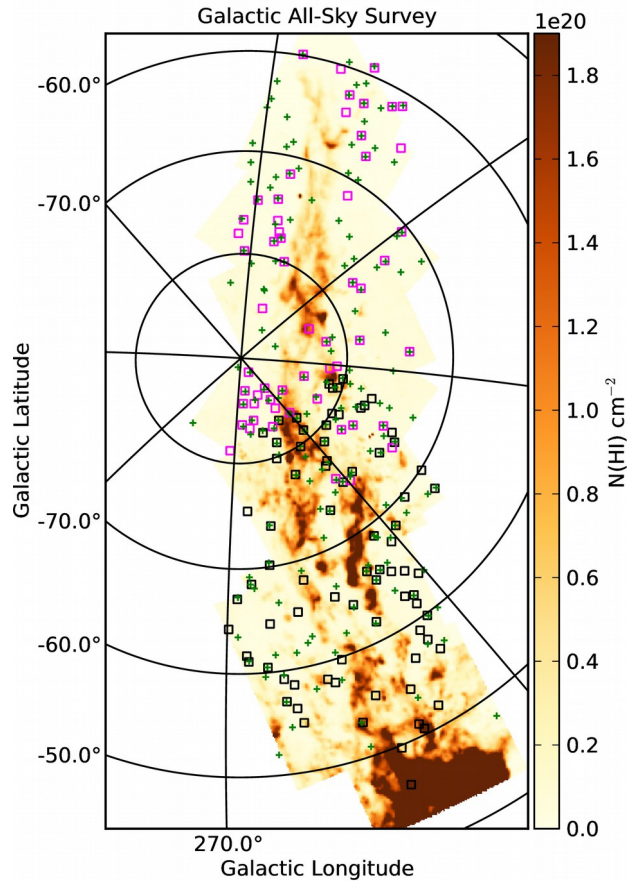
FIG. 1.—Wings of four H I profiles produced by different disk galaxy models of NGC 765: a model with no high-velocity material (*solid line*); a model with a warp along the major axis (*dotted line*); a model with high-velocity clouds having a velocity dispersion of 50 km s^{-1} (*dashed line*); and a model with high-velocity clouds having a velocity dispersion of 30 km s^{-1} (*dash-dot line*). The inset shows the entire H I profiles, and the dotted box indicates the magnified region.



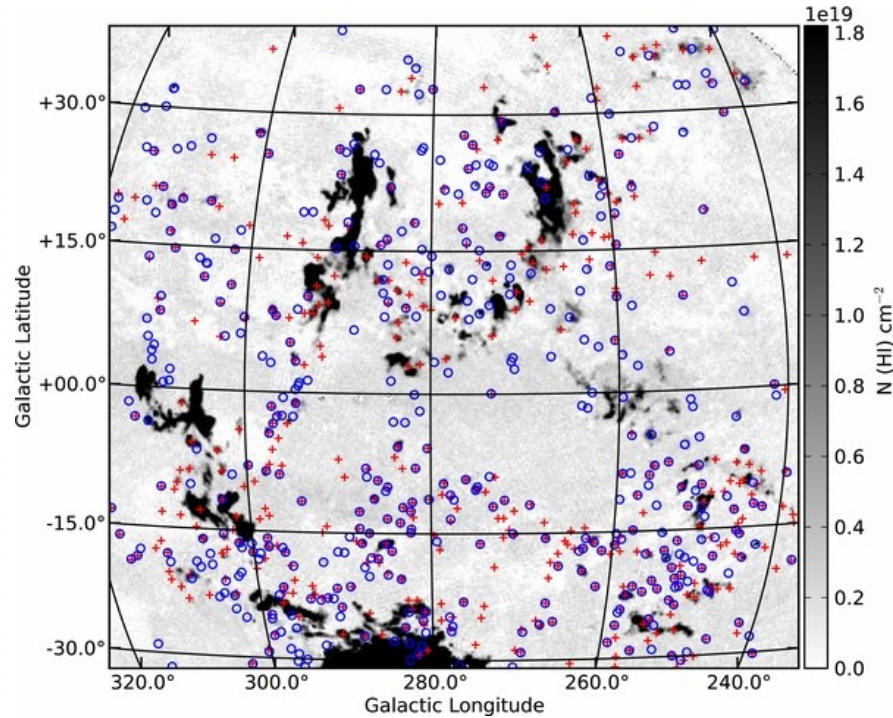
Previous Studies

- **11 dwarf galaxies in loose groups (Pisano et al. 2004): no detection ($< 10^8$ Msun)**
- **M31 and M33 (Westmeier et al. 2005): 16 + 1 (10^5 Msun), tidal origin**





For et al. (2014)



For et al. (2013)

The Magellanic Stream and Leading Arm(s) HVCs:
tidal origin



HVC studies

1. How common are HVCs around galaxies?
2. Are HVCs more common in galaxy group environments?
3. Are they tidal debris?
4. Do they have stellar counterpart? If not, are they dark galaxies?
5. Do HVCs contribute significantly to the SFR of galaxies?

1, 2 → gas accretion

3 → environmental effect

4, 5 → multiwavelength studies

ALL → impact on galaxy evolution and formation



WALLABY + (Early Science ASKAP-12)

- **PI:** Baerbel Korbalski (CASS) & Lister Staveley-Smith (UWA/ICRAR)
- Large, unbiased samples, large FOV
- WALLABY early science: 10^6 Msun HVCs, nearby galaxies





Update (on behalf of WALLABY team)

- Early science observation began in **Oct 2016**
- ~500hr to date, 36 beams (FOV 30deg)
- 48 MHz → 192 MHz → 304 MHz?
- **Fields :**
 - NGC 7232 & Fornax cluster (**completed**)
 - Dorado & M83 group (**ongoing**)
- **Source finding WG:** SoFiA (Serra et al. 2015)
- **Kinematics WG:** 2DBAT (Oh et al. submitted), FAT (Kamphuis et al. 2015) etc
- **Data processing WG (ASKAP team):** includes data validation (weekly meeting)
- **Science papers:** WALLABY team

No observations since Jan 2017 due to firmware/software problem



The screenshot displays the SoFiA software interface. The main window is titled "SoFiA - SoFiA.par" and shows a menu bar (File, Pipeline, Analysis, Settings, Help) and a toolbar. Below the toolbar is a "Pipeline Messages" area. The main workspace is currently empty, showing a progress bar at 0%. The "Input" tab is selected, and the "Smooth + Clip Finder" is enabled. The "Reliability" help window is open, providing information about the reliability calculation method and user-controllable parameters. The "Source Catalogue" window is also open, displaying a table of source parameters.

Reliability

SoFiA can automatically estimate the reliability of individual sources and discard unreliable sources in certain circumstances, using the method introduced by [Serra, Jurek & Flöer \(2012\)](#). The method works by not only detecting and parameterising sources with positive Flux, but also 'pseudo-sources' with negative flux. Under the assumption that all negative sources are artefacts (e.g. noise peaks), one can then estimate the reliability of positive sources by comparing the regions of parameter space occupied by positive and negative sources. Simply speaking, a positive source located in a region of parameter space that is occupied by numerous negative sources is less likely to be genuine than a positive source located in a region of parameter space that is free of negative detections.

In order for the reliability calculation to work and be accurate, a few conditions must be met. Firstly, all noise and artefacts in the data cube must be centred on zero and negative artefacts exist at a ratio of approximately 1:1. Secondly, all good sources in the data cube must have positive Flux (e.g., no absorption signals). Finally, the detection threshold must be set to a fairly low value to ensure that a substantial number of positive noise peaks and artefacts get detected. This is to ensure that the number of detections in parameter space is sufficiently high to be accurately measured.

Several aspects of reliability calculation can be controlled by the user, including the kernel to be used in logarithmic parameter space (`reliability.kernel`) and the threshold (`reliability.threshold`) to be used to discard all sources whose reliability is below that threshold.

ID	ID_oid	Xg (pix)	Yg (pix)	Zg (chan)	Xm (pix)	Ym (pix)	Zm (chan)	Xmin (pix)	Xmax (pix)	Ymin (pix)	Ymax (pix)
1	1	142.903	96.808	61.258	142.932	96.913	60.803	136	151	91	104
2	2	169.434	22.492	40.238	169.421	22.463	40.244	167	173	20	26
3	3	29.457	63.958	66.991	29.45	63.802	70.576	21	39	57	71
4	4	156.364	69.925	54.325	156.362	69.87	54.465	152	161	66	75
5	5	27.509	131.5	75.059	27.621	131.248	80.683	16	38	125	140
6	6	83.29	103.441	55.373	83.272	103.432	55.361	81	87	101	107
7	7	125.381	105.043	45.716	125.386	104.994	45.663	122	129	102	109
8	8	42.637	110.573	68.895	42.68	110.612	68.821	40	46	108	114

Parameter: steps.doReliability
Type: bool
Values: true, false
Default: false
Description: If set to true, use negative detections to determine the reliability of each source based on the algorithm of [Serra, Jurek & Flöer \(2012\)](#).

Parameter: reliability.threshold
Type: float
Values: 0.0 - 1.0
Default: 0.9
Description: Discard all sources whose reliability is below this threshold.



2DBAT

seheonoh / 2dbat Watch 0 Star 0 Fork 0

[Code](#) [Issues 1](#) [Pull requests 0](#) [Projects 0](#) [Pulse](#) [Graphs](#)

2dbat v1.0

23 commits | 1 branch | 0 releases | 1 contributor

Branch: master [New pull request](#) [Find file](#) [Clone or download](#)

seheonoh filtering option updated Latest commit 4d698c2 on 22 Jan

docker_2dbat	filtering option updated	3 months ago
include	filtering option updated	3 months ago
pyplots	2dbat v1.0	4 months ago
shared_libs	2dbat v1.0	4 months ago
src	filtering option updated	3 months ago
2dbat	filtering option updated	3 months ago
Makefile	2dbat v1.0	4 months ago
README	updated	4 months ago

README

```
# -----+
# 2D Bayesian Automated Tilted-ring fitter (2DBAT) +
# by SE-HEON OH (KASI/ICRAR) + WALLABY KINEMATICS WORKING GROUP +
# -----+
# 2dbat README by Se-Heon Oh
# version 1.0 (8 Dec 2016)

# DEPENDENCIES
-----
```

<https://github.com/seheonoh/2dbat>



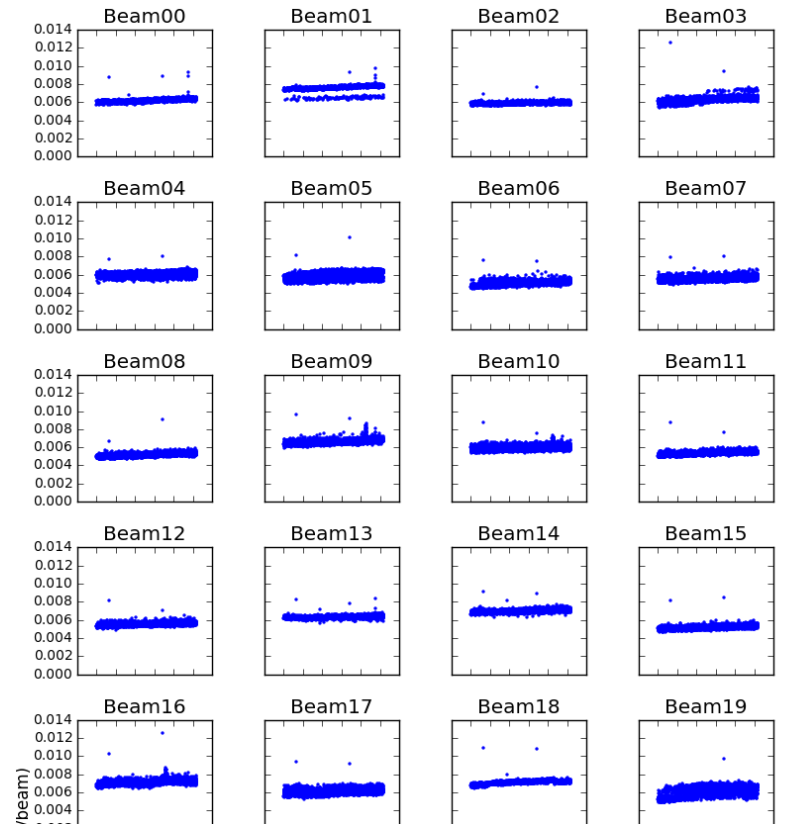
Data processing WG



ASKAP WALLABY Spectral Line Validation Page

NGC 7232 group

Filename	RMS
image.i.N7232.cube.SB2338.NGC7232_A_T0-0A.beam00.restored	LINK
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image.i.N7232.cube.SB2338.NGC7232_A_T0-0A.beam02.restored	LINK
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image.i.N7232.cube.SB2338.NGC7232_A_T0-0A.beam04.restored	LINK
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image.i.N7232.cube.SB2338.NGC7232_A_T0-0A.beam08.restored	LINK
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image.i.N7232.cube.SB2338.NGC7232_A_T0-0A.beam11.restored	LINK
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image.i.N7232.cube.SB2338.NGC7232_A_T0-0A.beam13.restored	LINK



Work in progress....

<http://ict.icrar.org/store/staff/biqing/WALLABY/html/validation.php>



Thank you