

PHANGS: A MUSE & ALMA VIEW OF THE OUTFLOW IN NGC1672

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PHANGS

Physics at **H**igh **A**ngular resolution in **N**earby **G**alaxies

Bigiel, Blanc, Emsellem, Escala, Groves, Hughes, **Kreckel**, Kruijssen,
Leroy, Meidt, Pety, Rosolowsky, Sanchez-Plazquez,
Sandstrom, Schinnerer, Schrubba, Usero

Chevance, Faesi, Glover, Herrera, Ho, Hygate, Klessen, Lang, Liu, McElroy, Nofech,
Ostriker, Puschnig, Querejeta, Razza, Saito, Sun, Utreras, Utomo, Ward



PHANGS

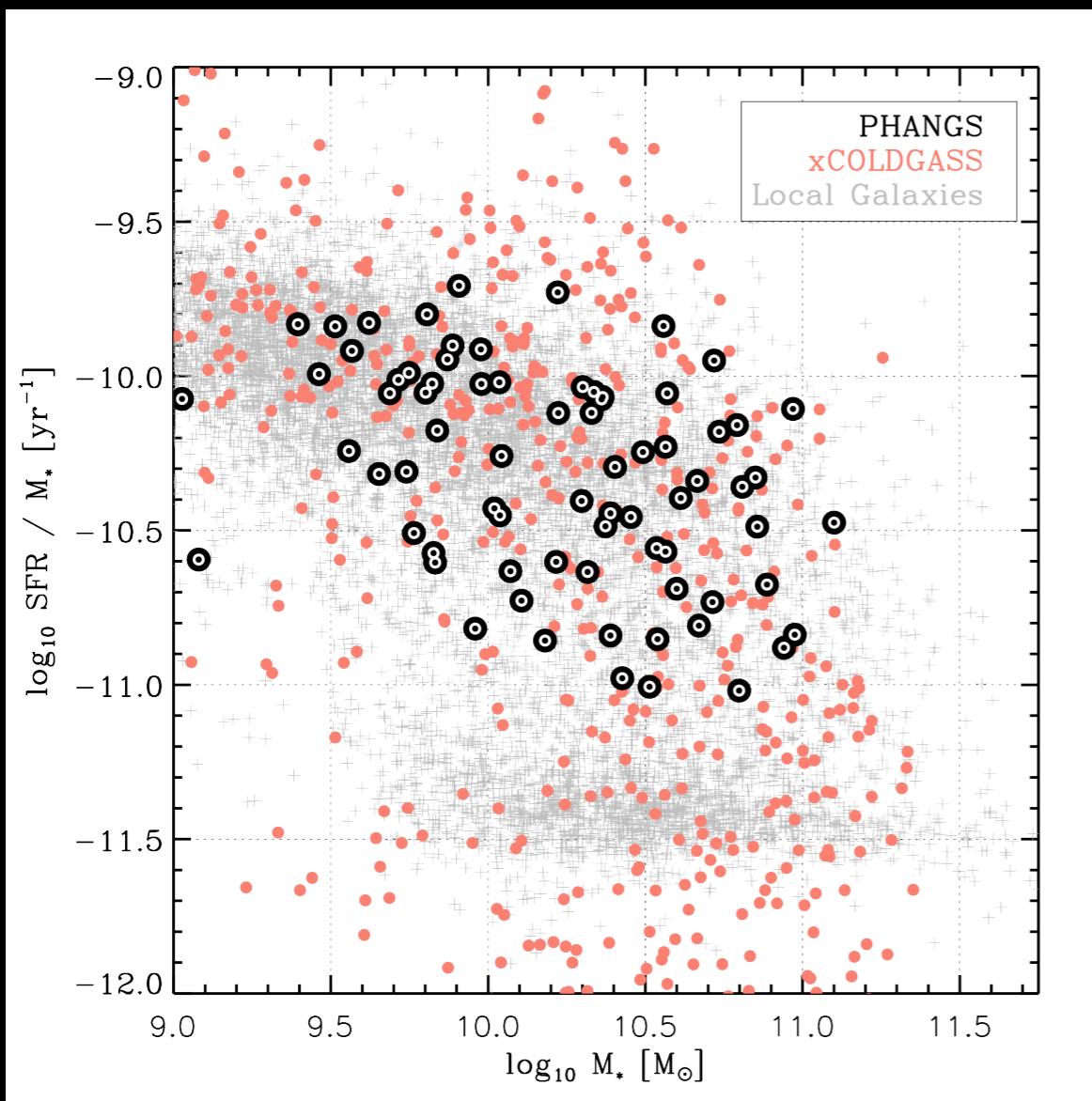
Physics at **H**igh **A**ngular resolution in **N**earby **G**alaxies

- ▶ **Aim is to understand the small-scale physics of gas and star formation in galaxies.**
- ▶ **Molecular Clouds:** How do the properties and population of molecular clouds depend on host galaxies, their environment, and their disk structure?
- ▶ **Star Formation:** How does the ability of gas to form stars depend on the cloud-scale structure and dynamics of the molecular gas?
- ▶ **Timescales:** What are the statistical timescales implied by cross-correlation of molecular gas, young stellar populations, and dynamical features in the galaxy?
- ▶ **Self-Regulation:** How does the self-regulation of star formation in galaxy disks emerge from the violent cloud-scale processes of star formation and feedback?

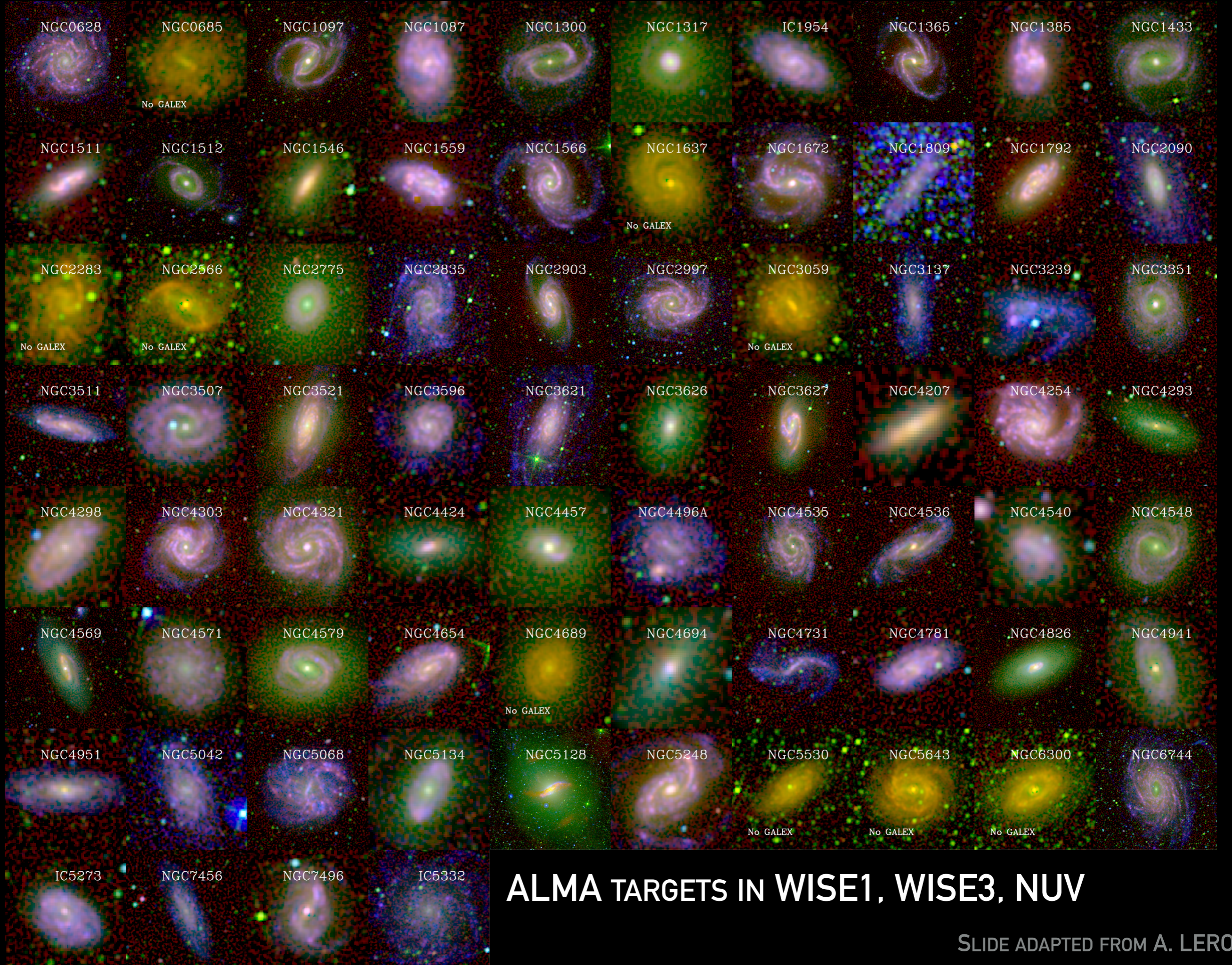
SLIDE ADAPTED FROM A. LEROY

PHANGS

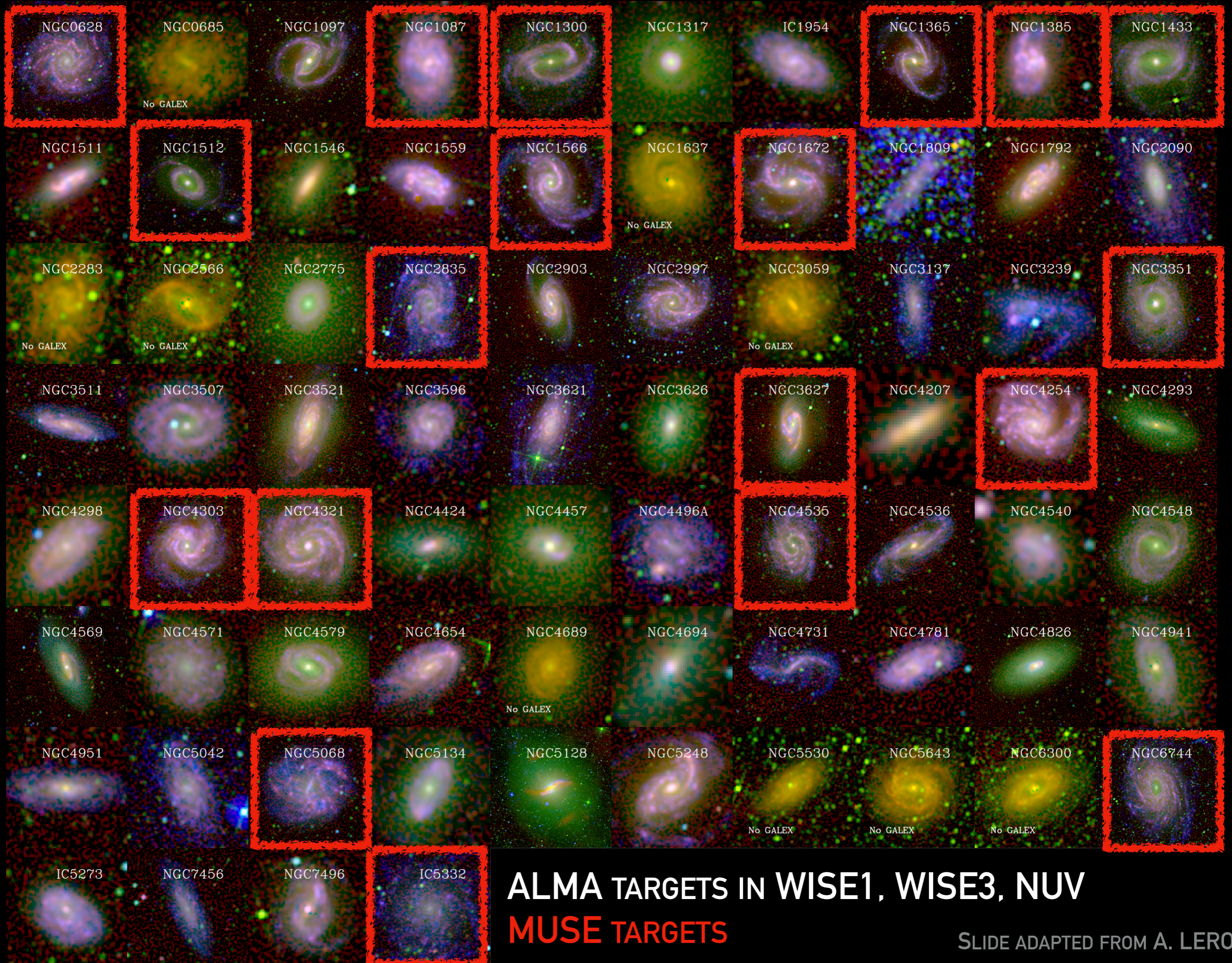
Physics at High Angular resolution in Nearby Galaxies



- 74 targets total, 19 with MUSE
- Selected to be visible by ALMA
- Relatively face-on ($i < 60^\circ$)
- $D < 17\text{Mpc}$
- All $< 1'' \sim 50\text{pc}$
- On the SF main-sequence



ALMA TARGETS IN WISE1, WISE3, NUV



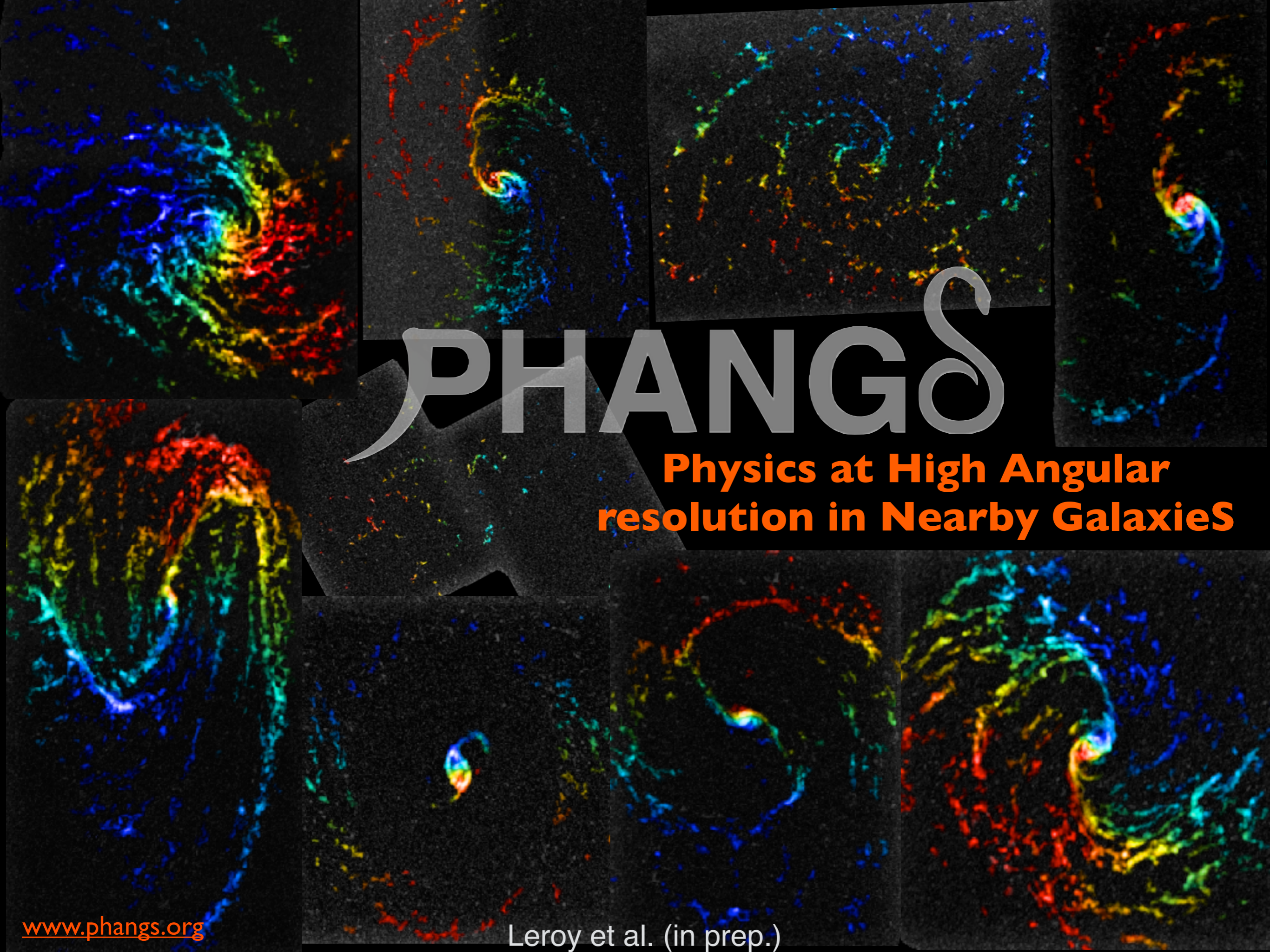
ALMA TARGETS IN WISE1, WISE3, NUV
MUSE TARGETS

A collection of eight spiral galaxies shown in a false-color ALMA image, where dust is highlighted in red and blue, and the central regions are yellow. The galaxies are arranged in two rows of four. The top row shows galaxies with various spiral patterns, including some with prominent central bars. The bottom row shows similar galaxies, some with more tightly wound spirals. The background is black.

*ALMA
gallery*

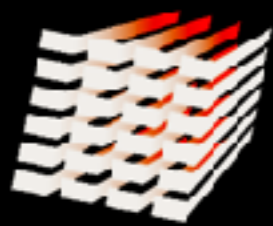
PHANGS

**Physics at High Angular
resolution in Nearby Galaxies**



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Physics at High Angular resolution in Nearby Galaxies



muse
multi unit spectroscopic explorer

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Archival

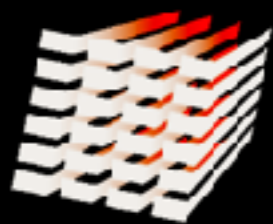


**White
Light
(MUSE)**



Emission
[OIII]
Halpha
[SII]

Video:
I-Ting Ho



muse
multi unit spectroscopic explorer

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NGC1672

5-15 pointings per galaxy
172h on the VLT

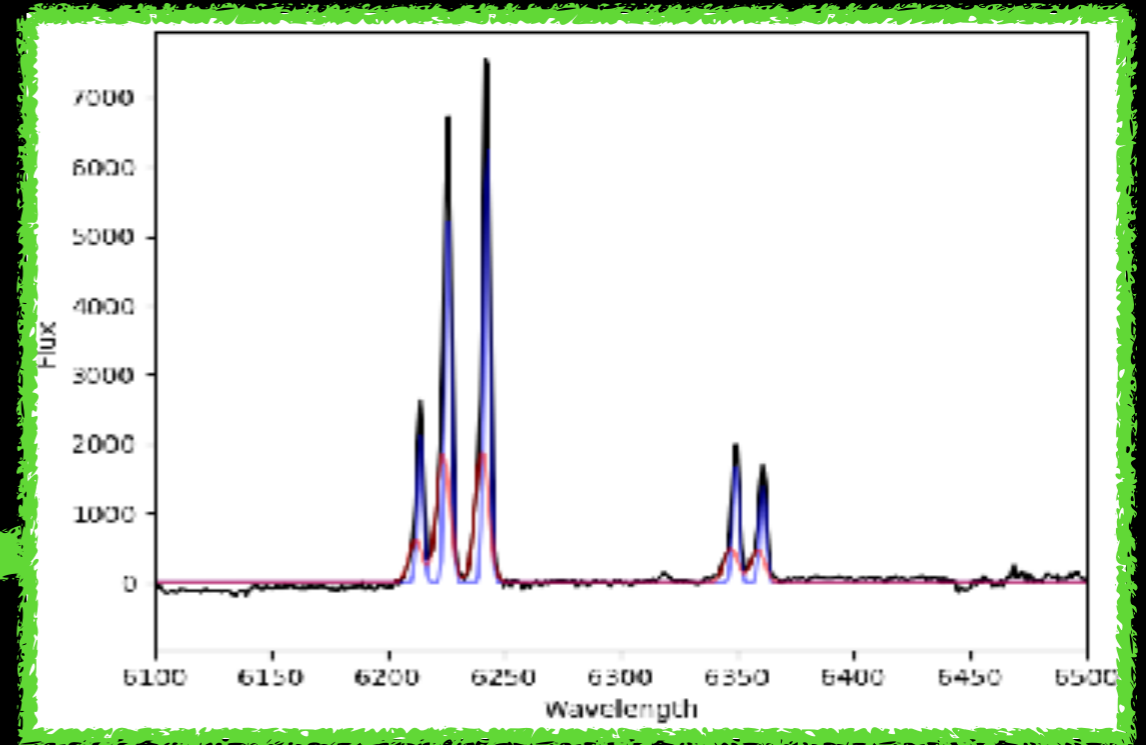
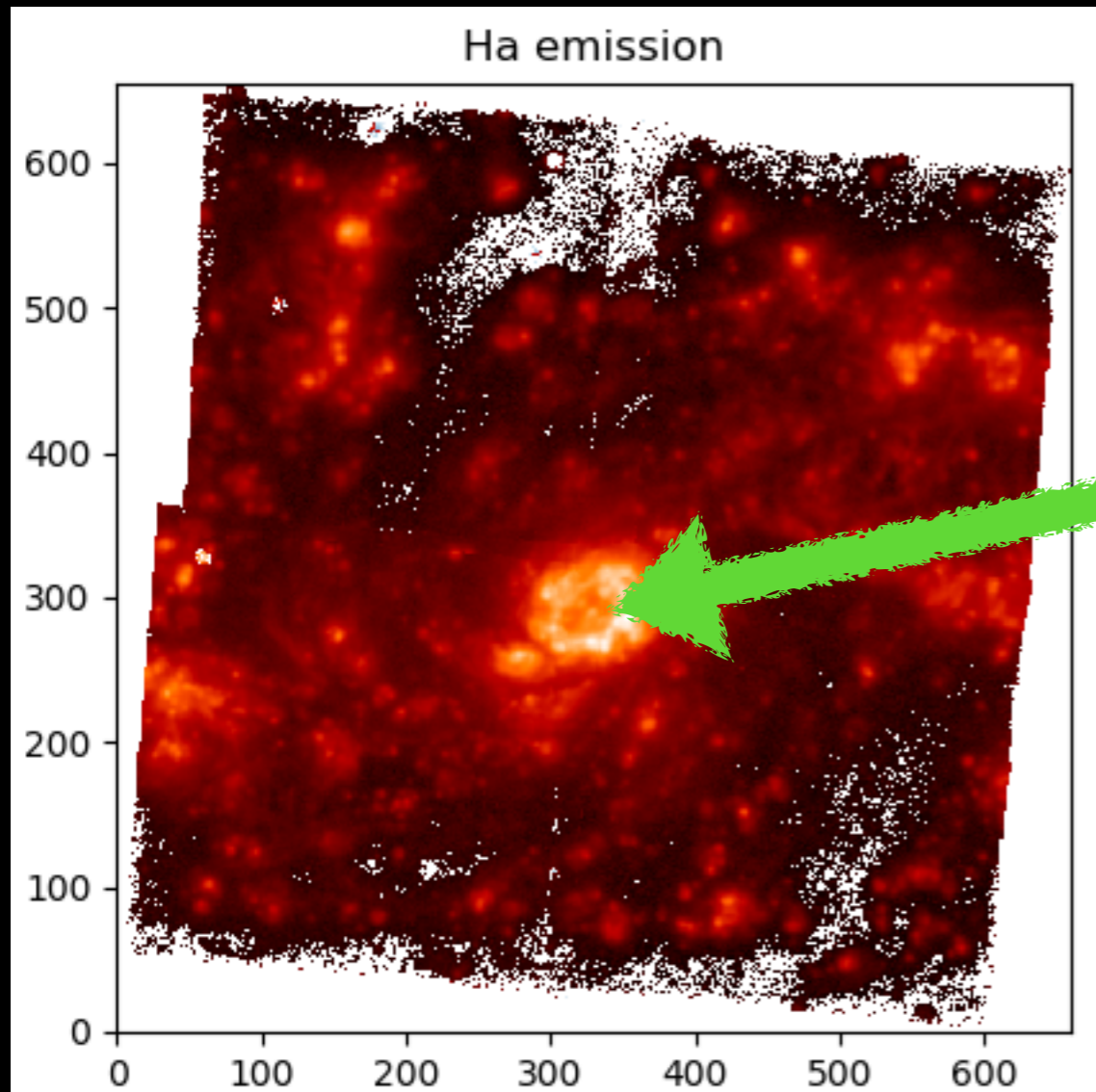
>>>> **A LOT of data**

[OIII]

Ha

[SII]

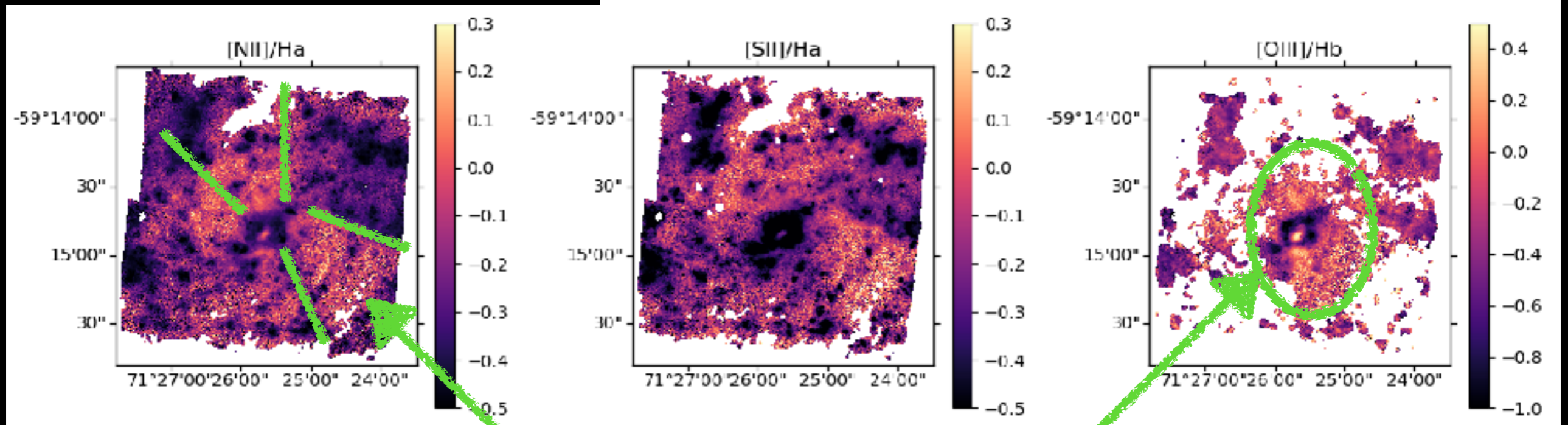
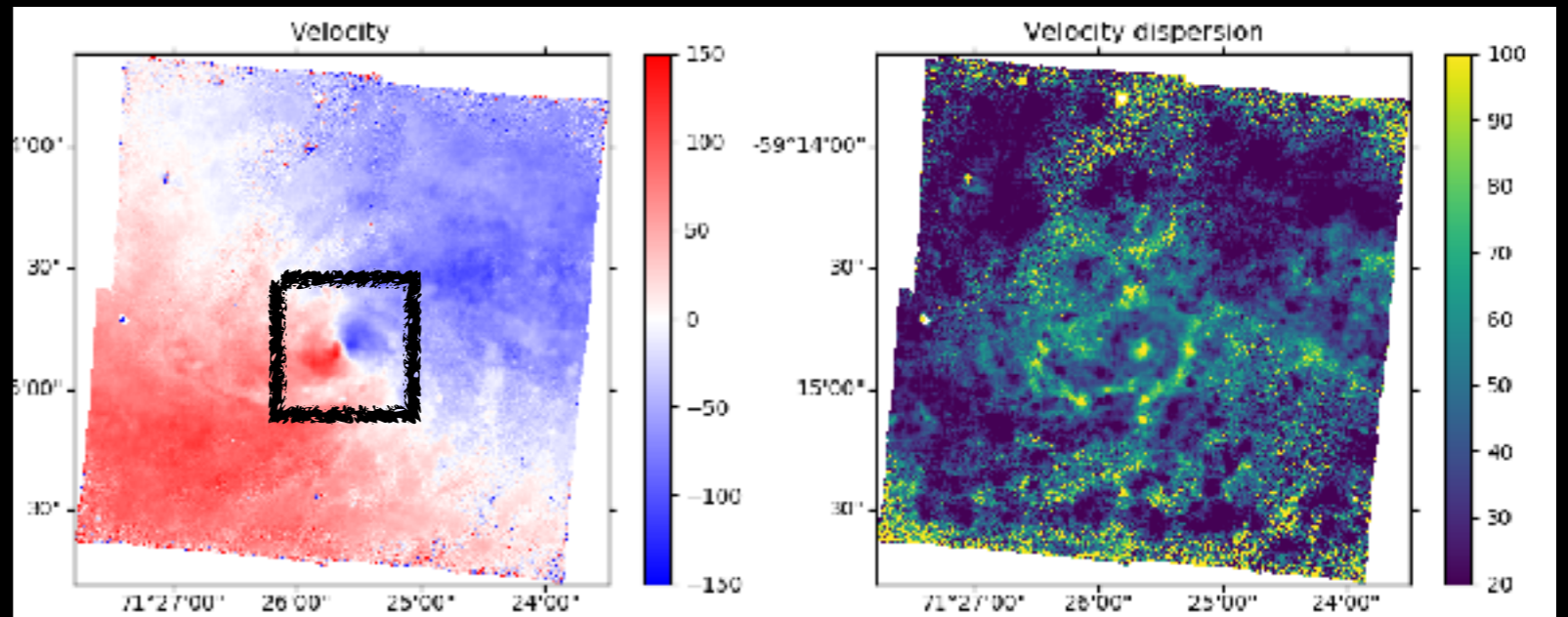
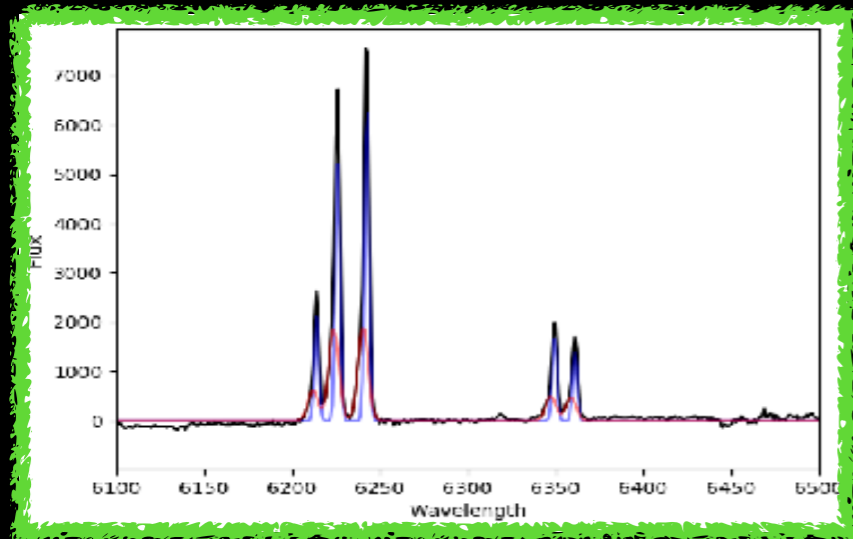
MUSE - NGC1672



We model the emission lines with LZIFU (Ho et al. 2016)

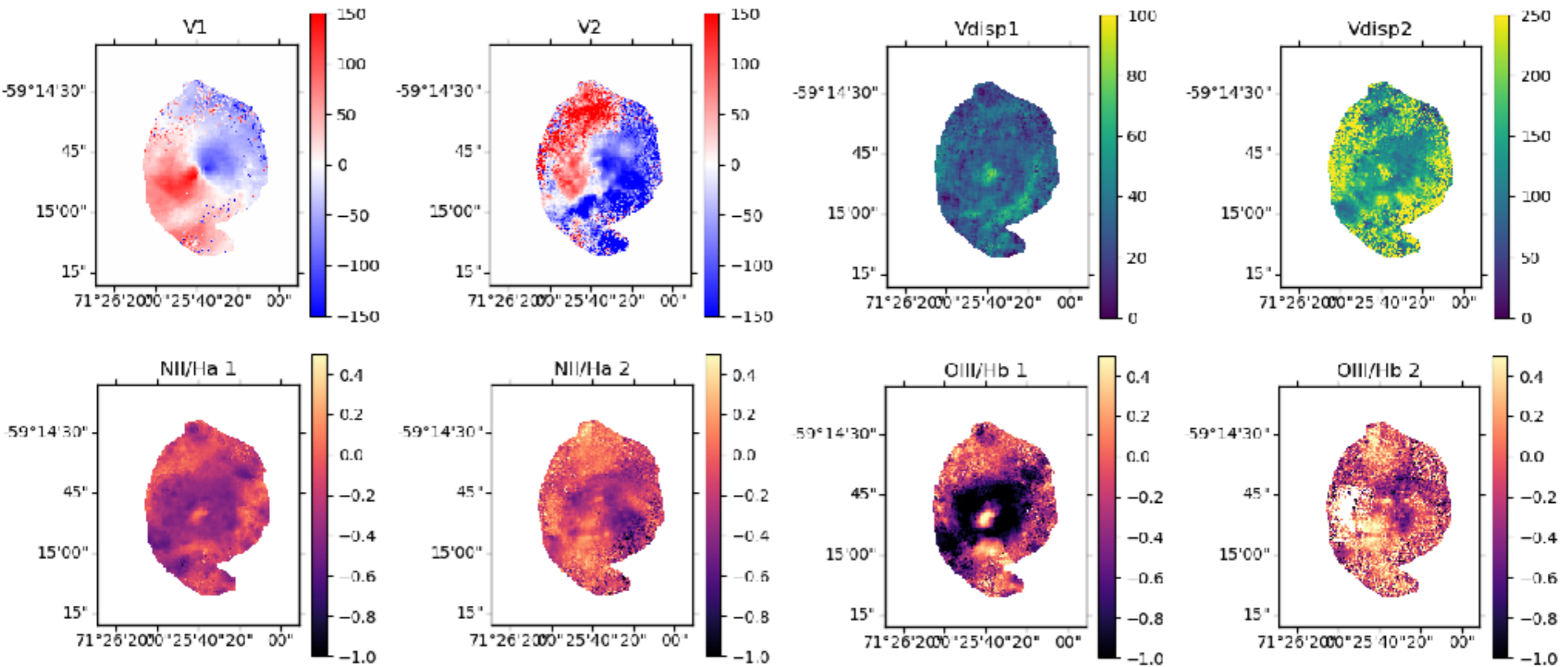
1 velocity component in the disk, 2 in the centre

MUSE - NGC1672

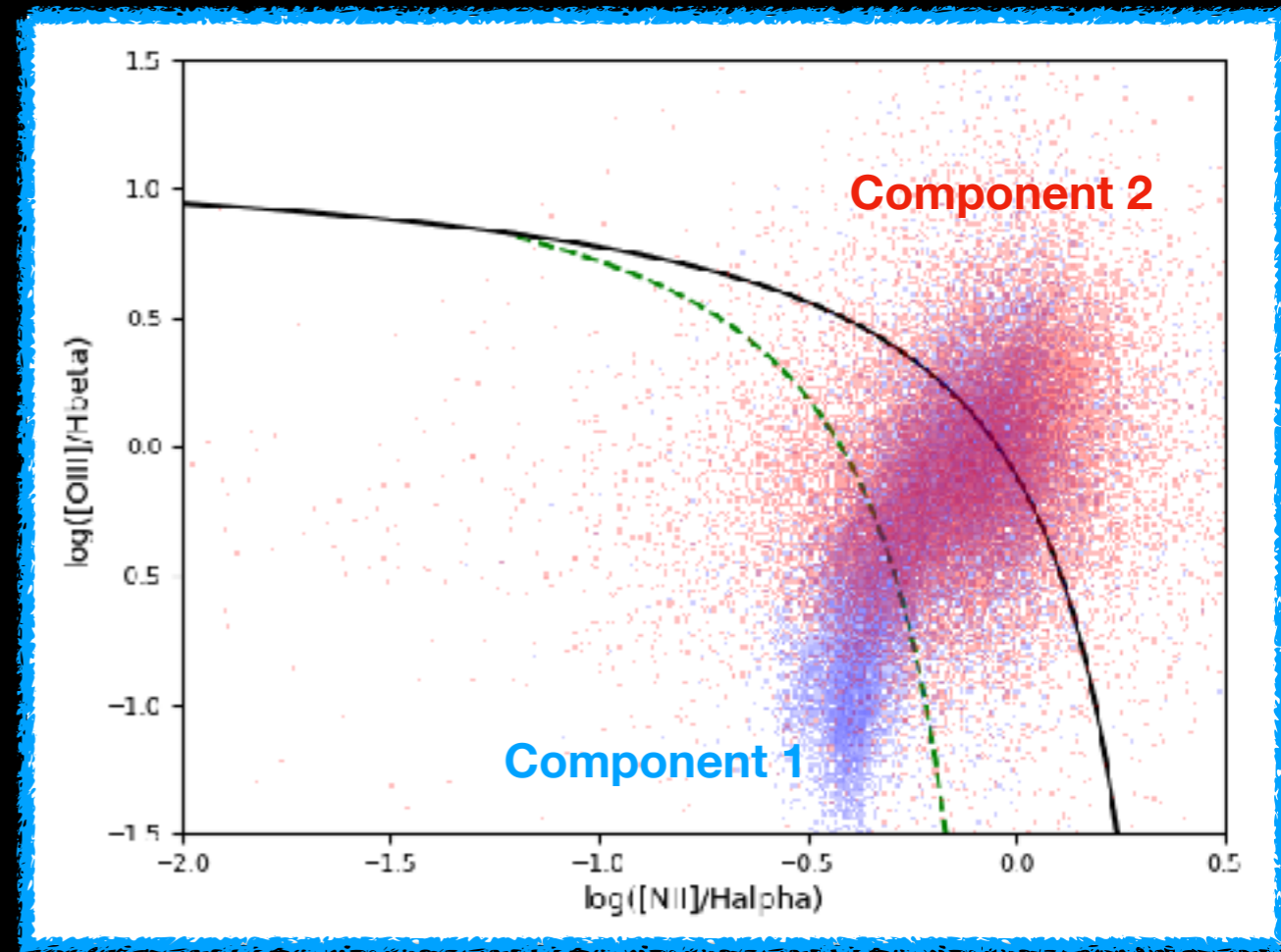
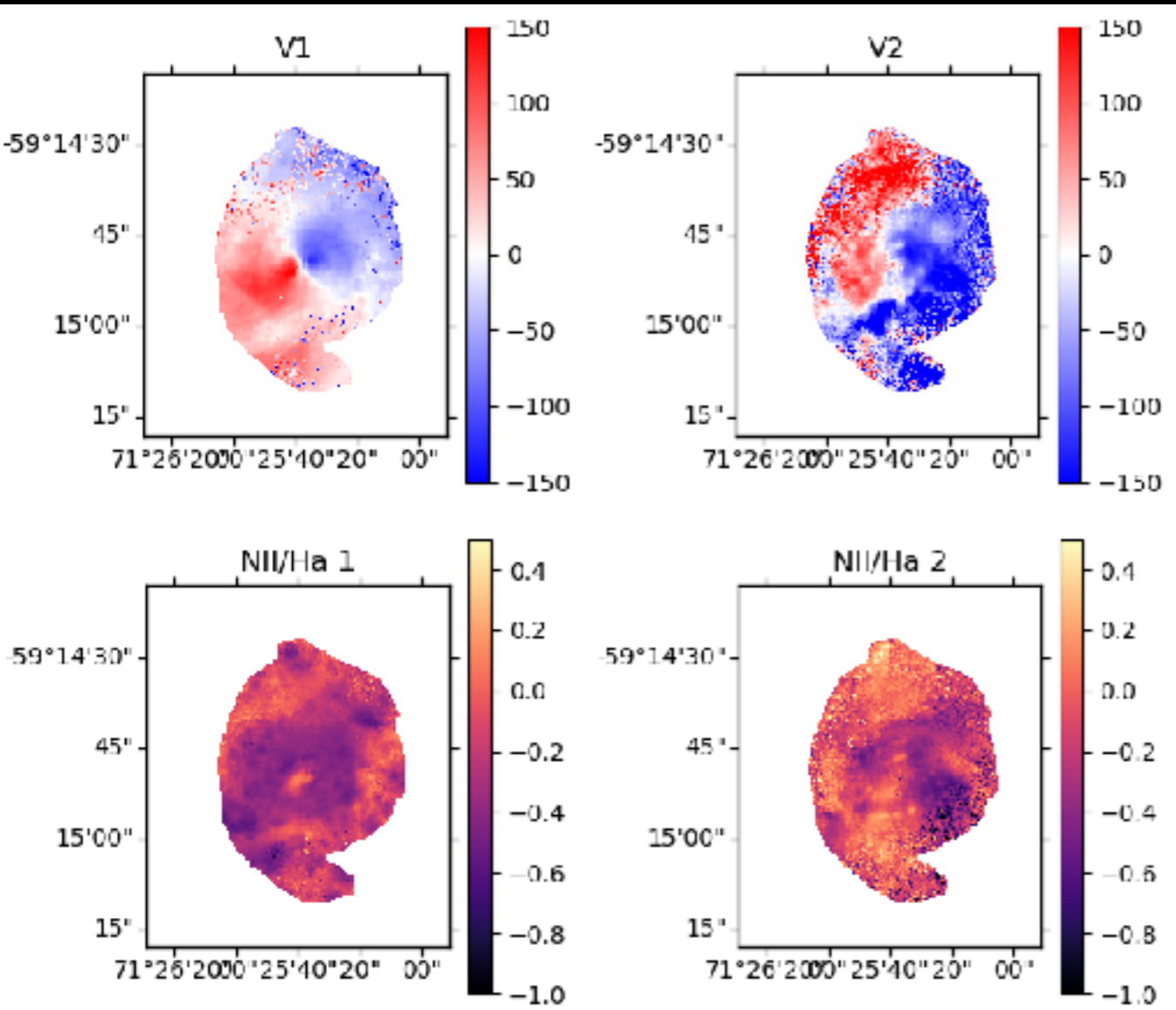


Cone-like ionisation structure
Extended region of high [OIII]/Hb ratio

MUSE - NGC1672



MUSE - NGC1672



Different velocity field

High velocity dispersion

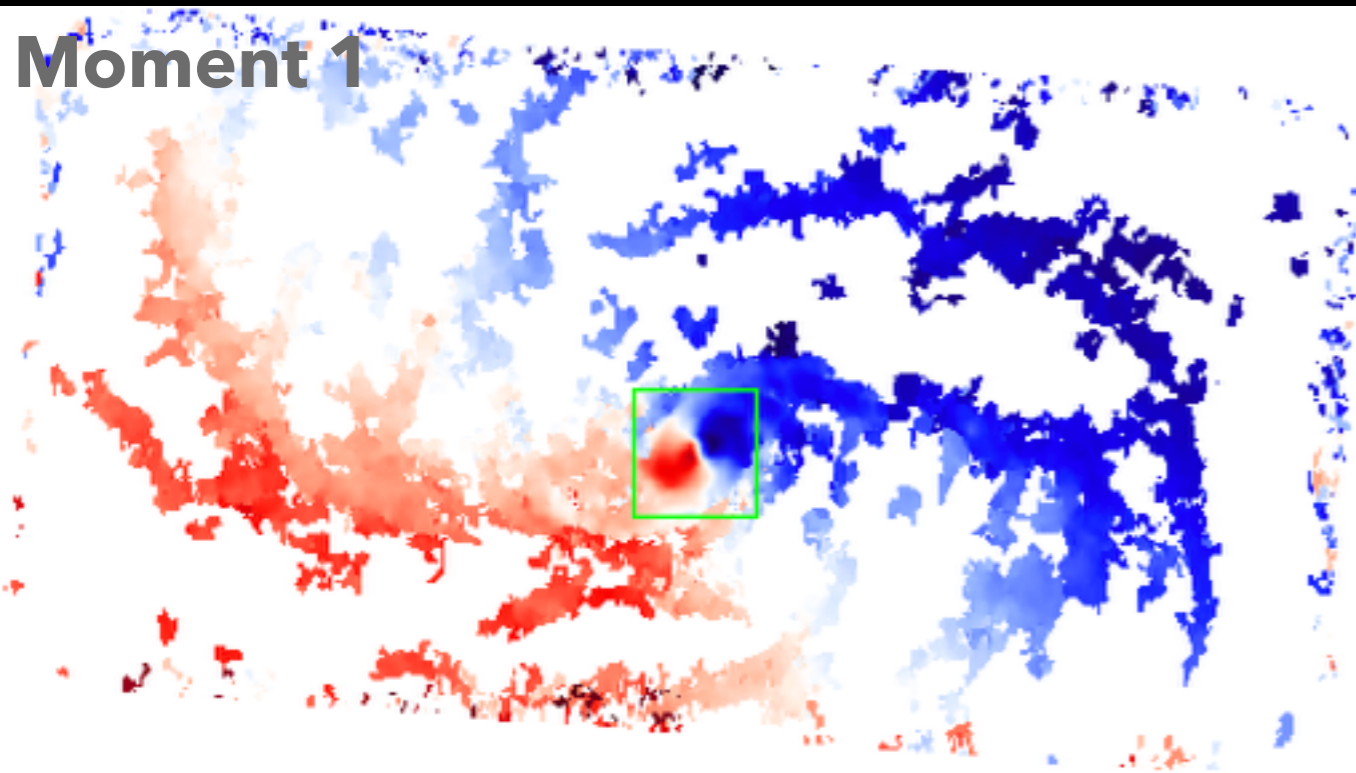
High [NII] and [OIII] emission

Separate on BPT

Wind / outflow?

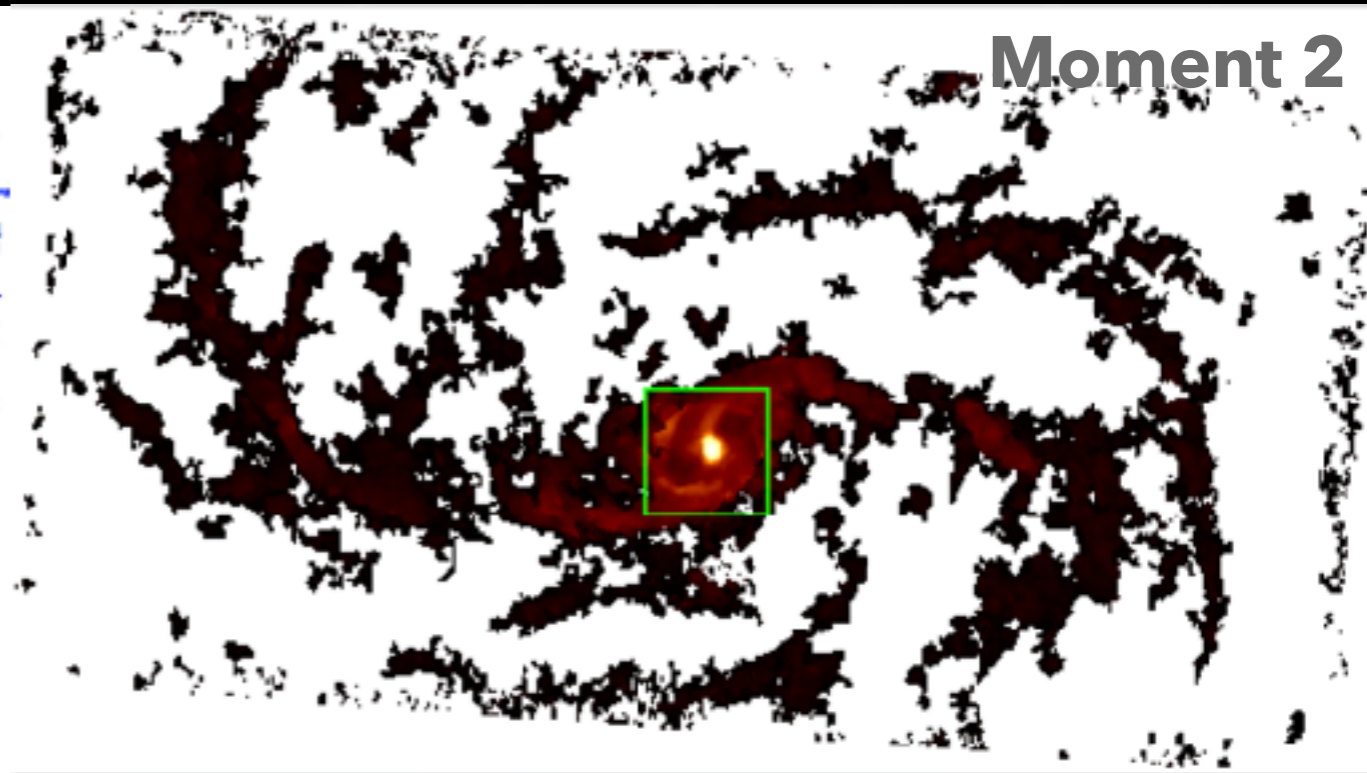
ALMA - NGC1672

Moment 1



122e+03 125e+03 128e+03 131e+03 134e+03 137e+03 14e+03 143e+03 146e+03

Moment 2

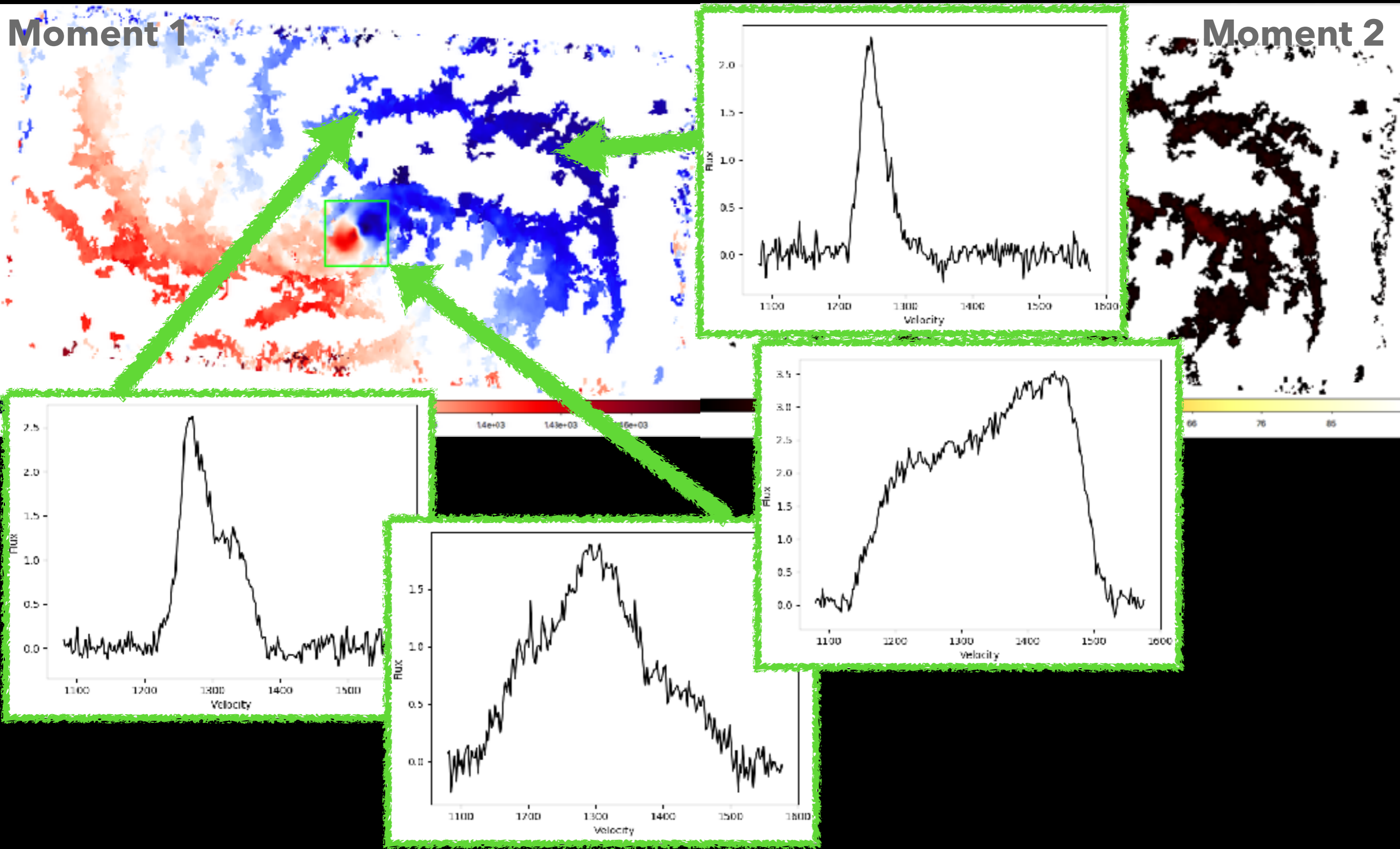


9.5 19 28 38 47 57 66 76 85

ALMA - NGC1672

Moment 1

Moment 2



PHANGS: A MUSE & ALMA VIEW OF THE OUTFLOW IN NGC1672

- ▶ **Clear signatures** of a wind in our MUSE data
 - ▶ High [OIII] and [NII] emission
 - ▶ Distinct coherent velocity field and high velocity dispersion
- ▶ Less clear signatures of complex kinematics in the ALMA data
 - ▶ Does not correlate with the optical outflow
 - ▶ Counter-rotating?
- ▶ Just a small preview of all the awesome science to come from PHANGS!