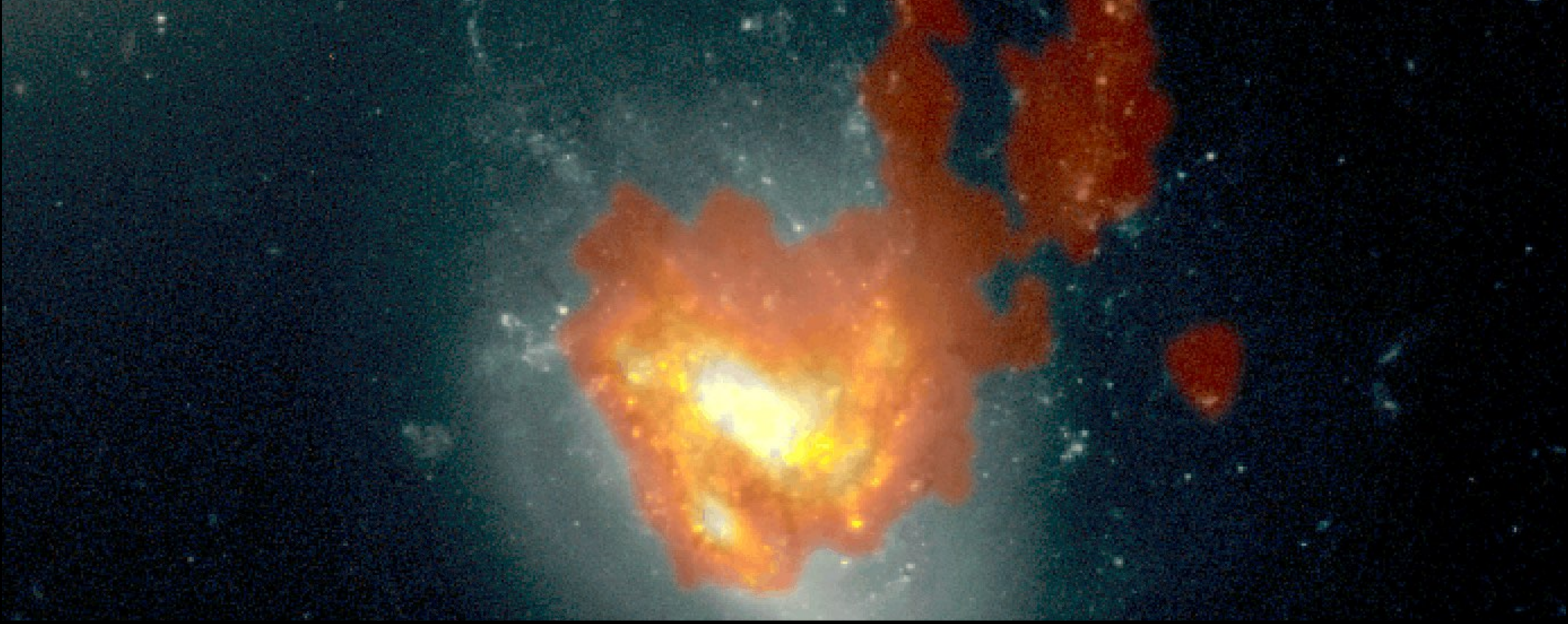


Inner Tail Gas Asymmetries and Fallback in a Jellyfish Galaxy

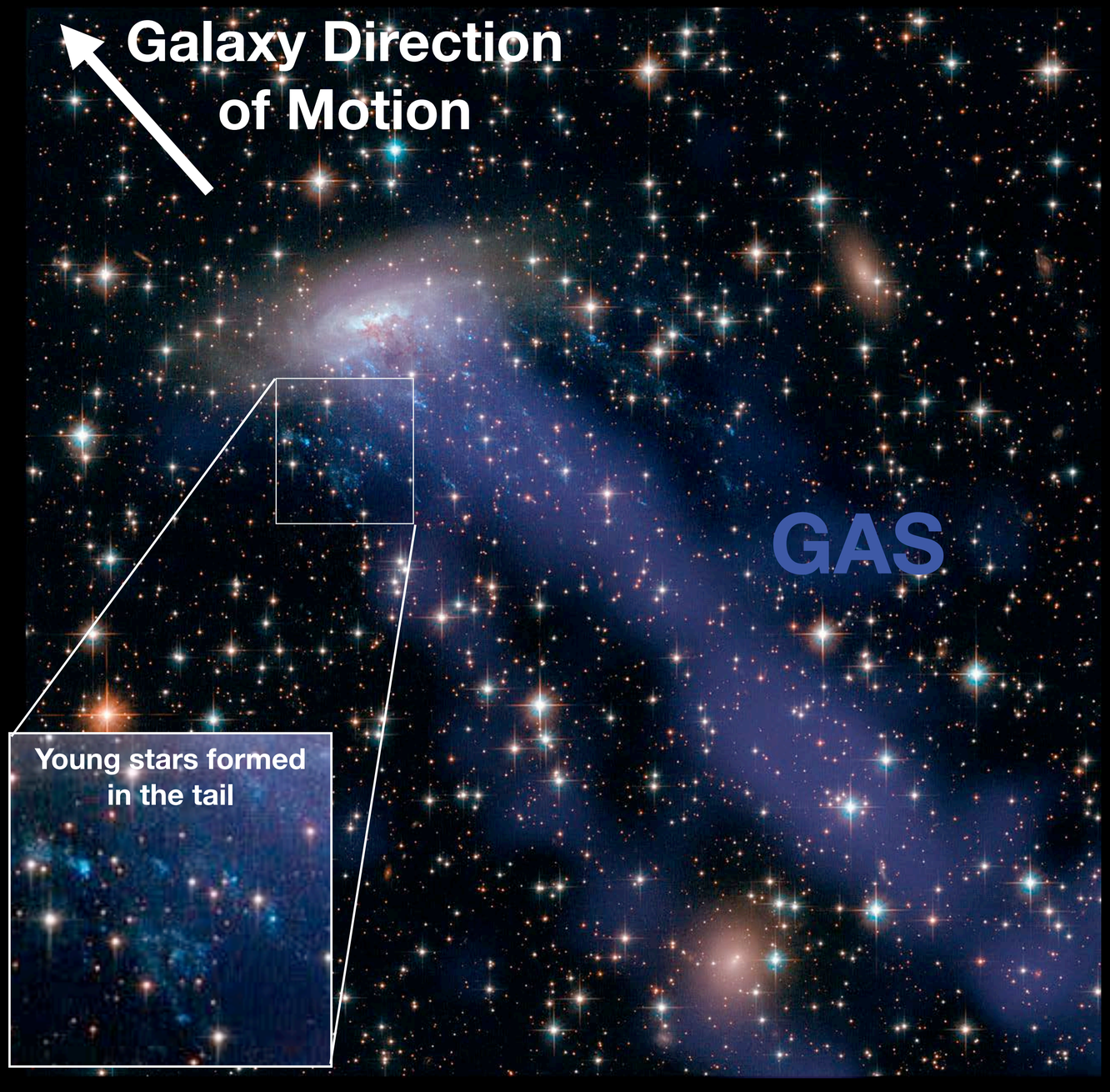
Harrison Souchereau, Yale University
with Jeffrey Kenney (Yale) and the ALMA-JELLY team
Contact: harrison.souchereau@yale.edu

Ram Pressure Stripping (RPS)

As a galaxy travels through a galaxy cluster, it moves through the hot gas of its environment, which the galaxy feels like a wind.

This can create dramatic gas tails in the opposite direction the galaxy is traveling in.

Ram pressure only affects the galaxy's gas, so any stars observed outside of the main body of the galaxy are being formed from gas in the RPS tail.



ESO 137-001: A jellyfish galaxy in the Norma Cluster. Composite image made using the Hubble Space Telescope and the Chandra X-Ray Observatory. Image credit: ESO

NGC 4858

A jellyfish galaxy swimming through a dense cluster with thousands of other galaxies.

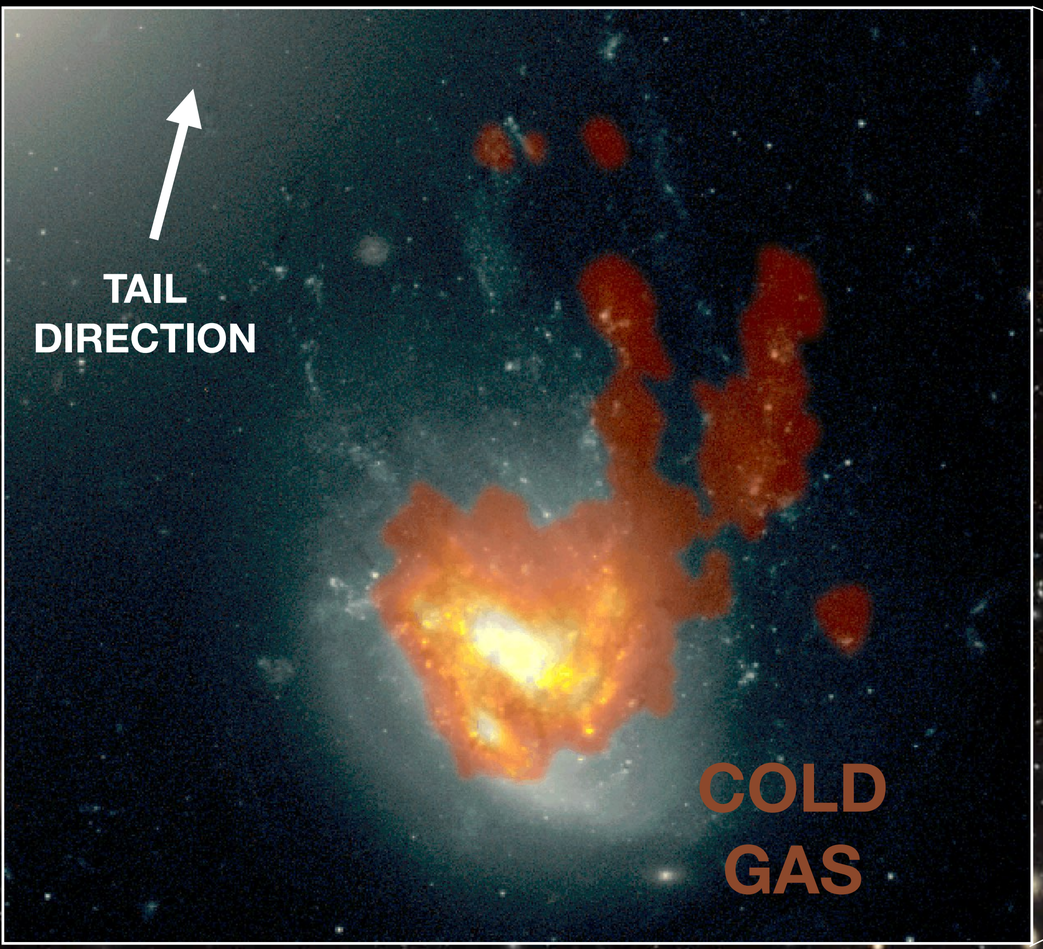


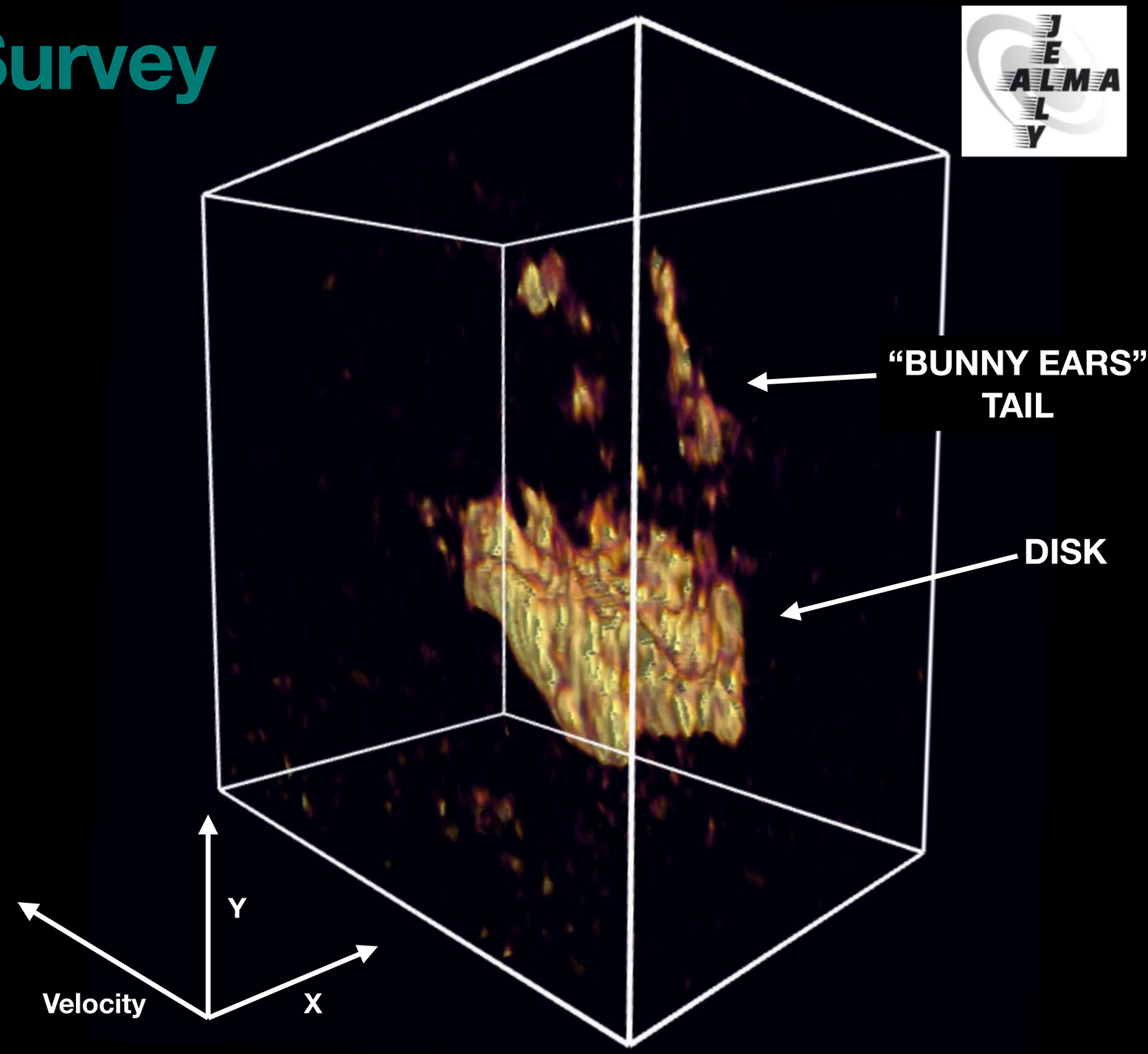
Image Credit: NOIRLab

The ALMA-JELLY Survey

Survey of the most extreme nearby examples of ram pressure stripping using the Atacama Large Millimeter Array (ALMA).

Data obtained using the ALMA radio telescope which shows not only where the cold gas in each galaxy is located, but how the cold gas is moving.

The sample covers 28 galaxies in 3 different clusters. (Most ALMA-JELLY galaxies are in the Coma cluster, located 320 million light years away)

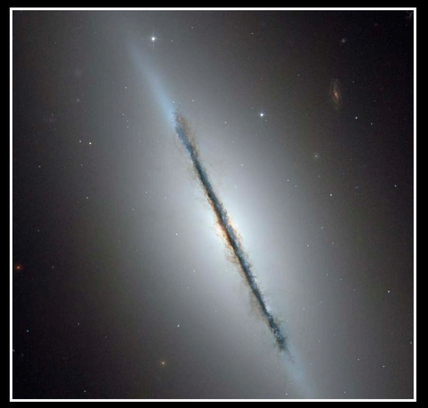


NGC 4858 has an asymmetric cold gas tail

The cold gas tail appears only on the western side of the galaxy.

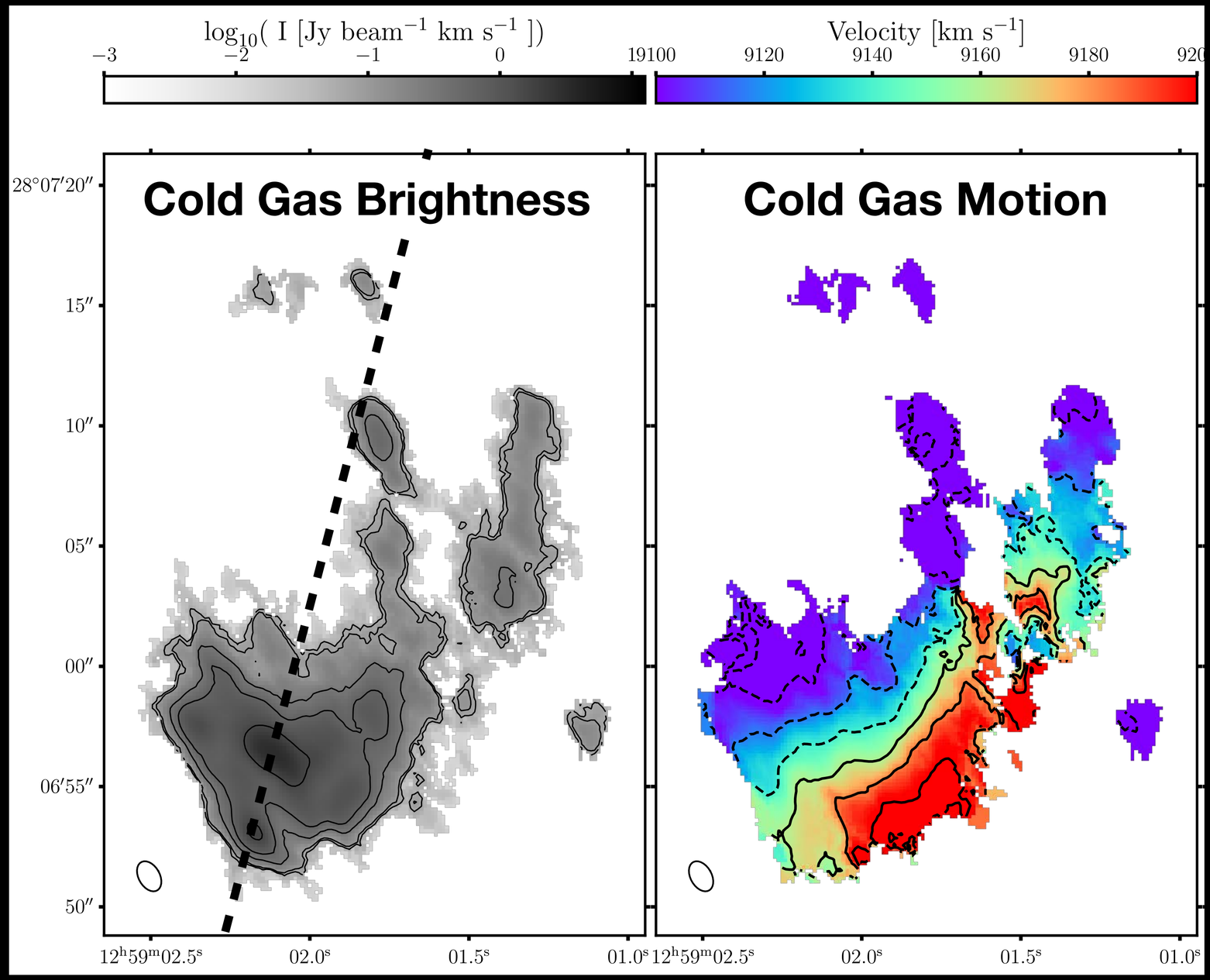
Likely an effect of the wind striking the galaxy being close to edge-on, and the galaxy's rotation.

EDGE-ON



FACE-ON

Images Credit: ESA, NASA, and the Hubble Heritage Team (STSci/AURA)

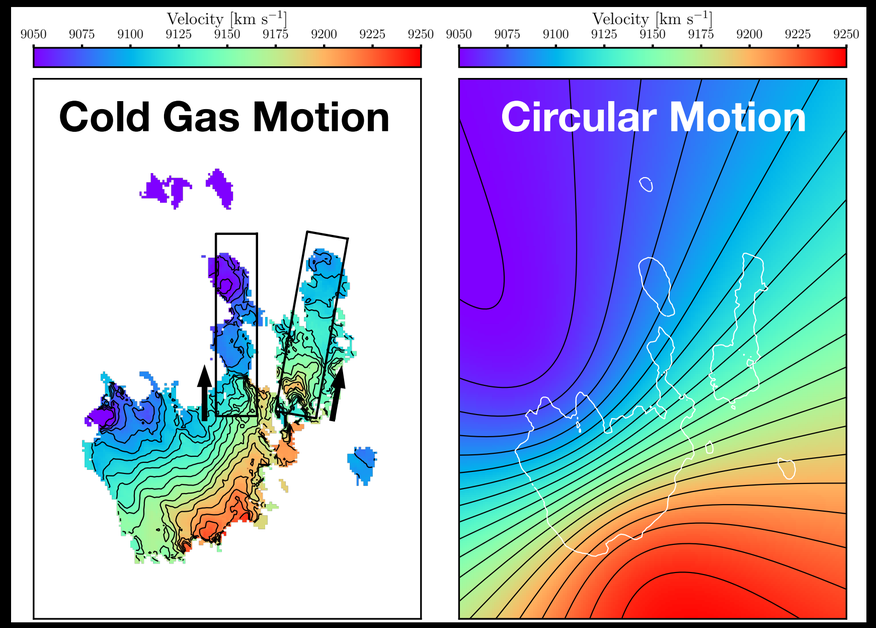


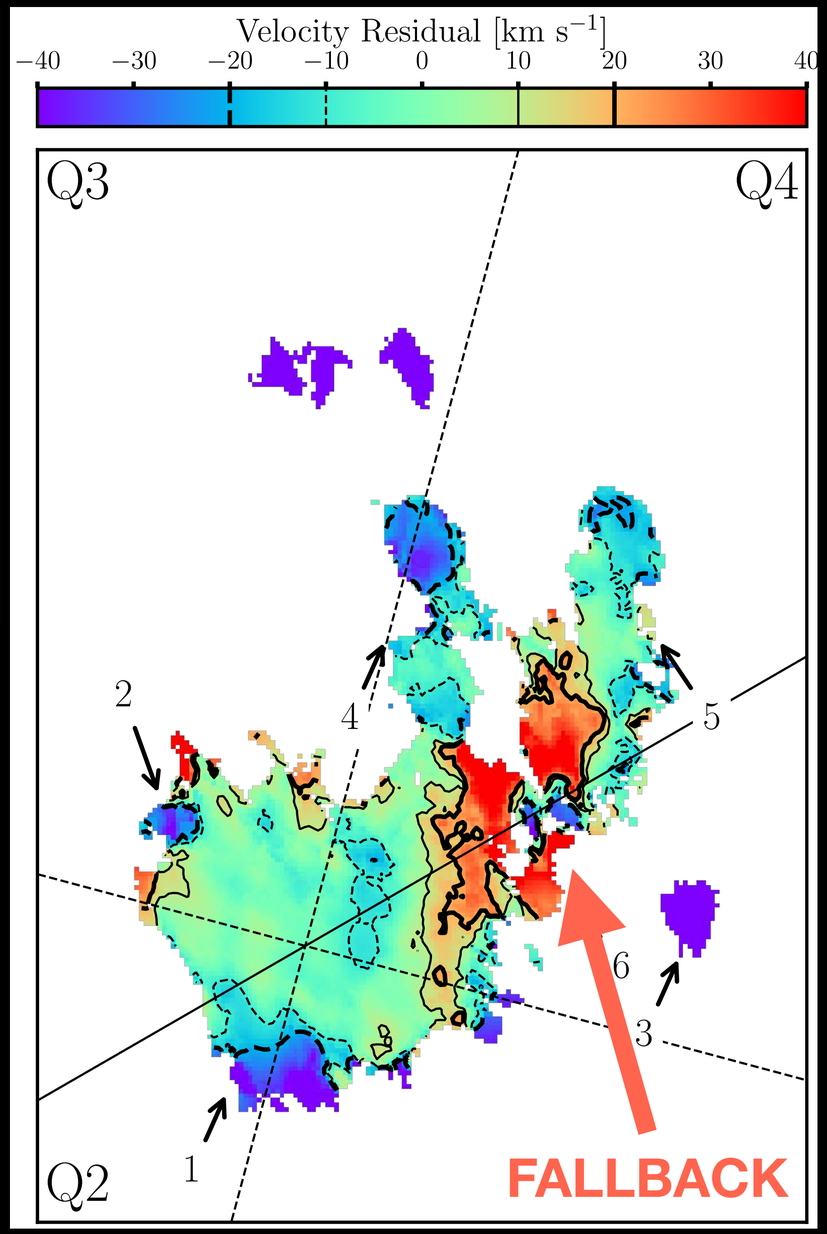
NGC 4858 has an unusually moving cold gas tail

Removing circular motion from the cold gas velocity map reveals features with perturbed motions.

Because of how the galaxy is moving through the cluster, ram pressure is expected to create blue features.

There is one large red feature at the base of the tail. This feature must be due to gas that has been pushed out of NGC 4858's gas disk, and is now falling back in.



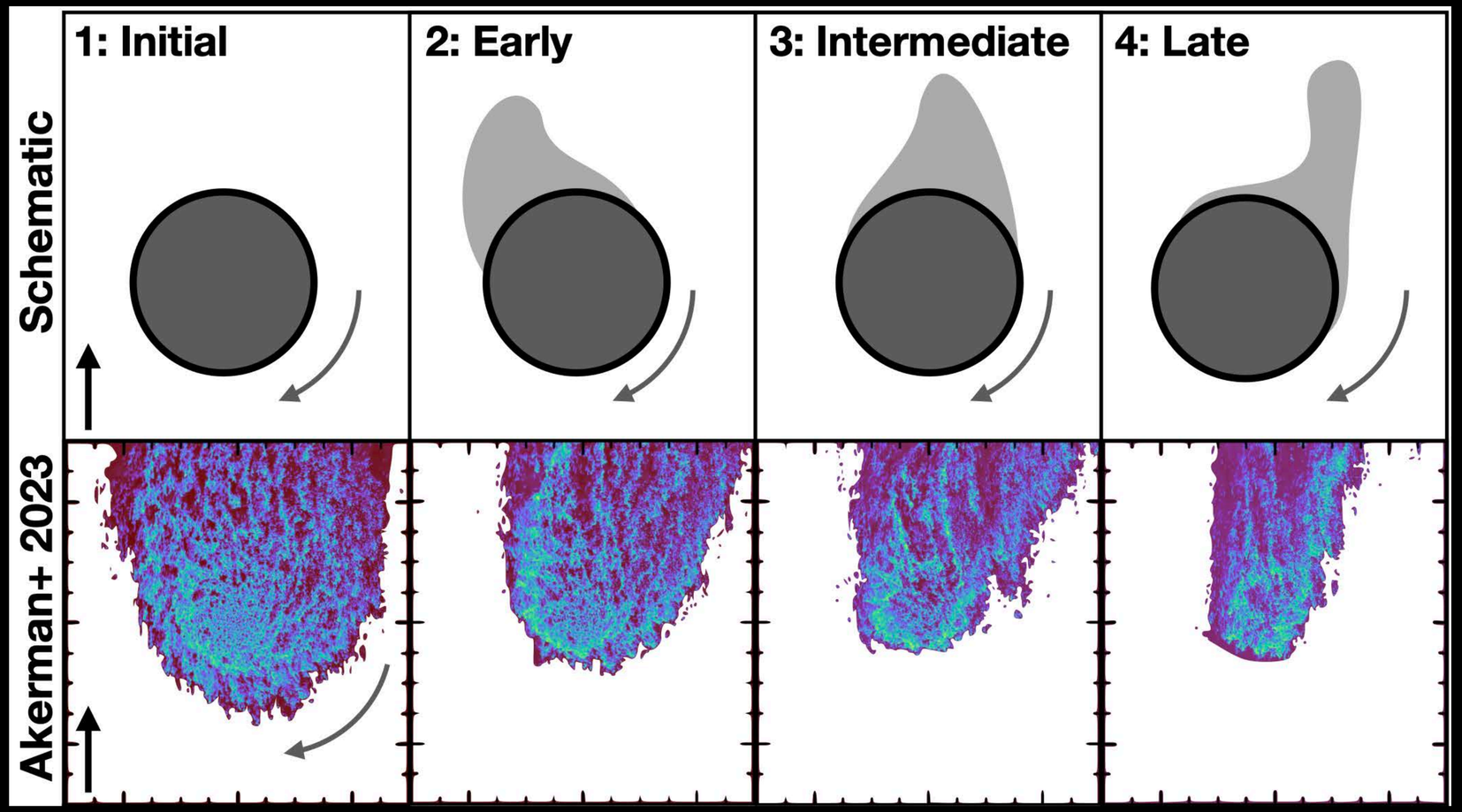


We developed a model for “inner tail” evolution of gas

- Gas is pushed out preferentially on the side rotating with the wind.
- Orbital motion carries the gas across to the other side, where it collects and can fall back into the disk.

“Bunny ears” are probably entire spiral arm components stripped at different times.

“Wind tunnel” simulations of edge-on ram pressure show this evolution in action.



Link to Akerman et al, 2023: https://iopscience.iop.org/article/10.3847/1538-4357/acbf4d

Take Home Messages

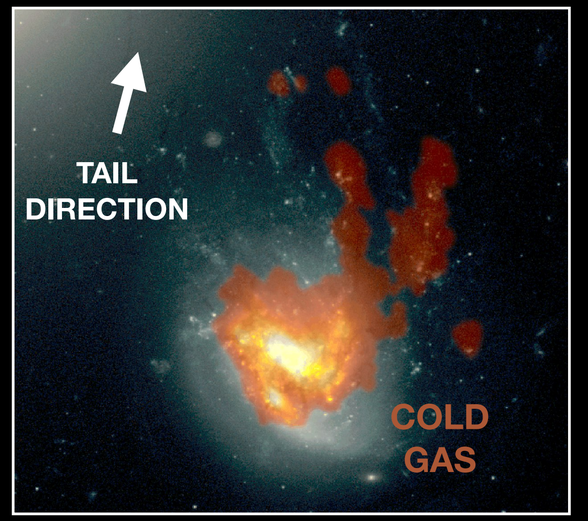
- The cold gas structure and motion in NGC 4858 is due to a combination of a nearly edge-on wind and the rotation of the galaxy creating complex effects.

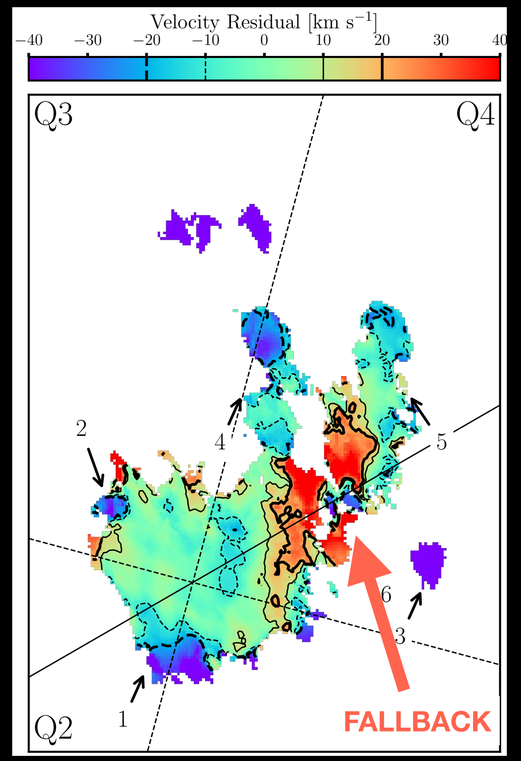
- Cold gas fallback has never been observed before in such a clear and unambiguous way.

- Understanding these extreme events will give us insight into how ram pressure works for galaxies where directly observing the effects are more difficult.

Personal Website
https://souchereau.com

Link to paper!
https://arxiv.org/abs/2506.07262





For more information, please contact: harrison.souchereau@yale.edu