A MULTIWAVELENGTH VIEW OF IC 860

WHAT IS IN ACTION INSIDE QUENCHING GALAXIES

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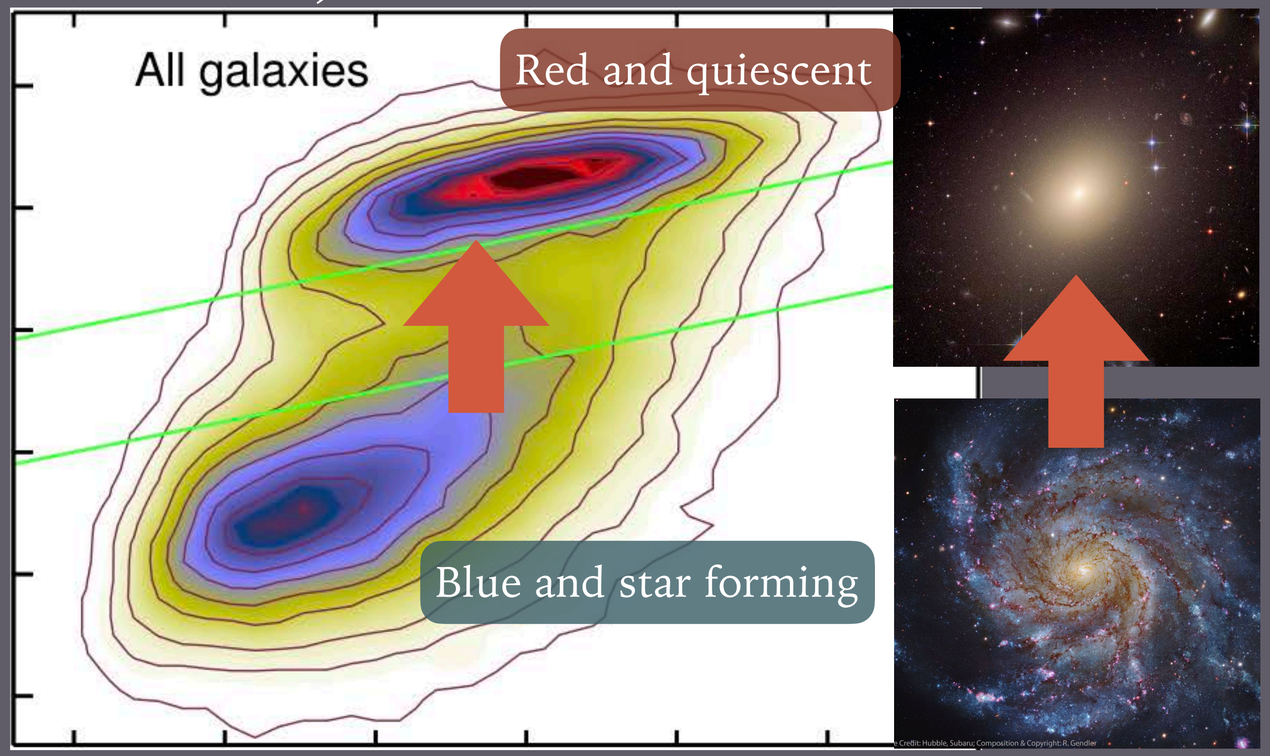
AAS 239th Press Conference, 1/10/2022

Quenching (transitioning) Galaxies

(Schawinski+2014)



(image credit: Hubble Space Telescope)

<u>Quenching</u>:

Decline in rate of star formation

"What's stopping the star formation?"

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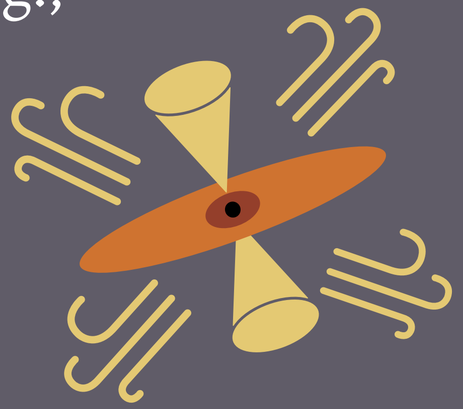
Galaxies need to lose gas…?

No gas, no fuel for star formation

e.g.,



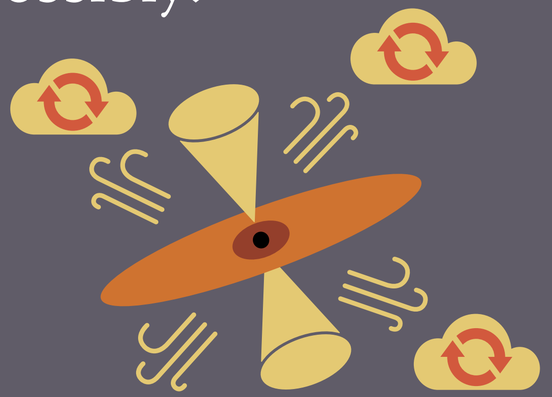
Black hole expels gas

BUT

Found large amounts of cold molecular gas in some quenching galaxies

(Rowlands+2015, French+2015)

Possibly:



Black hole disturbs gas

Let’s look into one of them: IC 860

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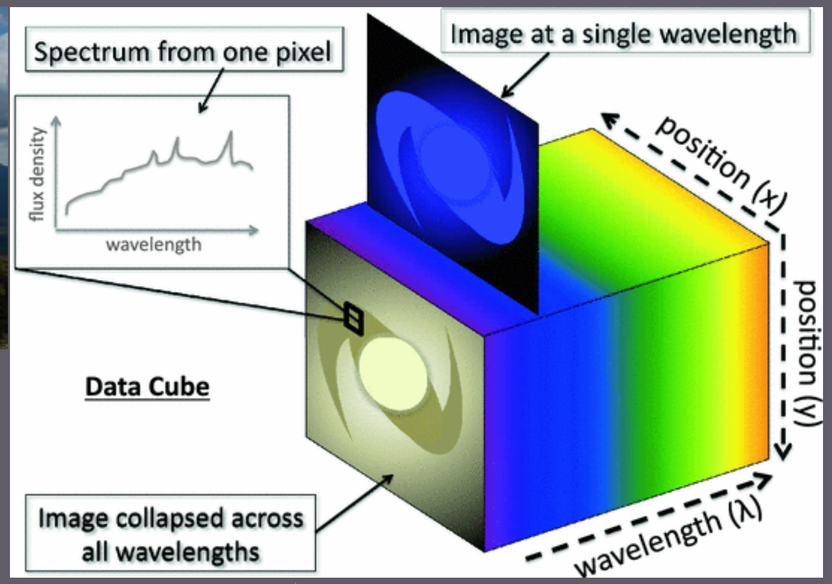
Multiwavelength data

Wide Field Spectrograph



Optical integral field spectroscopy: spatially resolved kinematics of stars and ionized gas

CARMA at mm: spatially resolved kinematics of CO gas

HST from NUV to NIR: exquisite multiband imaging

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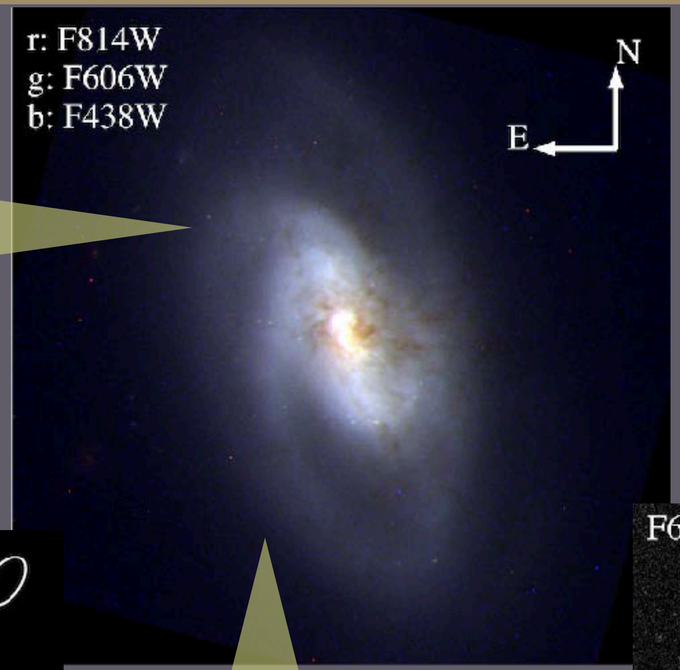
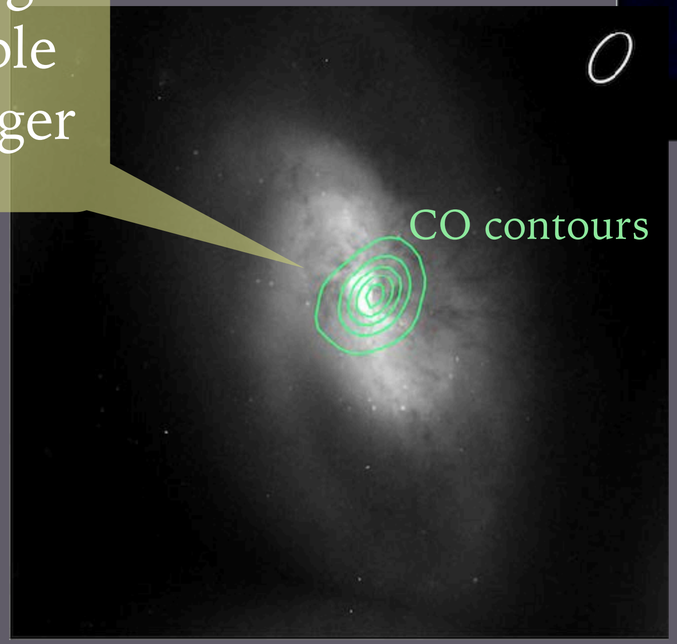
Dusty outflow + AGN + Recent merger

A 3rd spiral arm? Possible tidal feature after merger

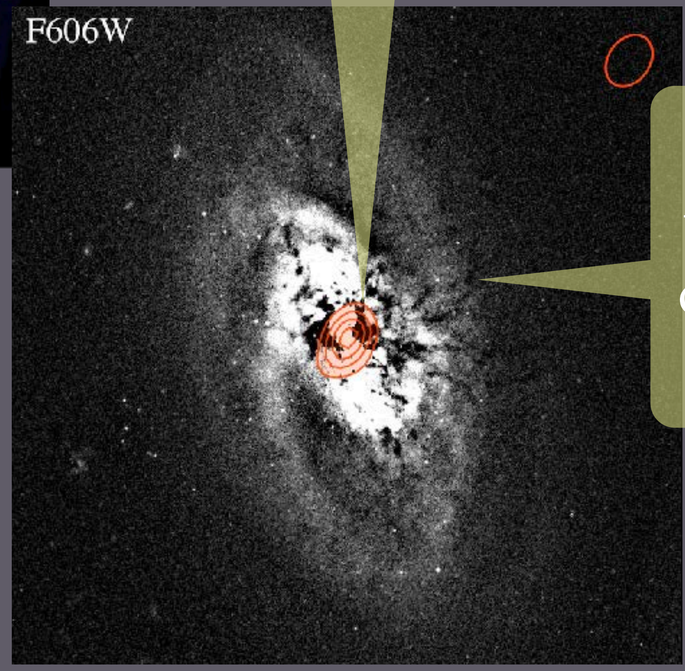


Centrally concentrated molecular gas: external origin and possible recent merger



Blue optical color: early stage of transitioning

Compact radio emission at center >> evidence of AGN



Dust tracing the cone of the outflow

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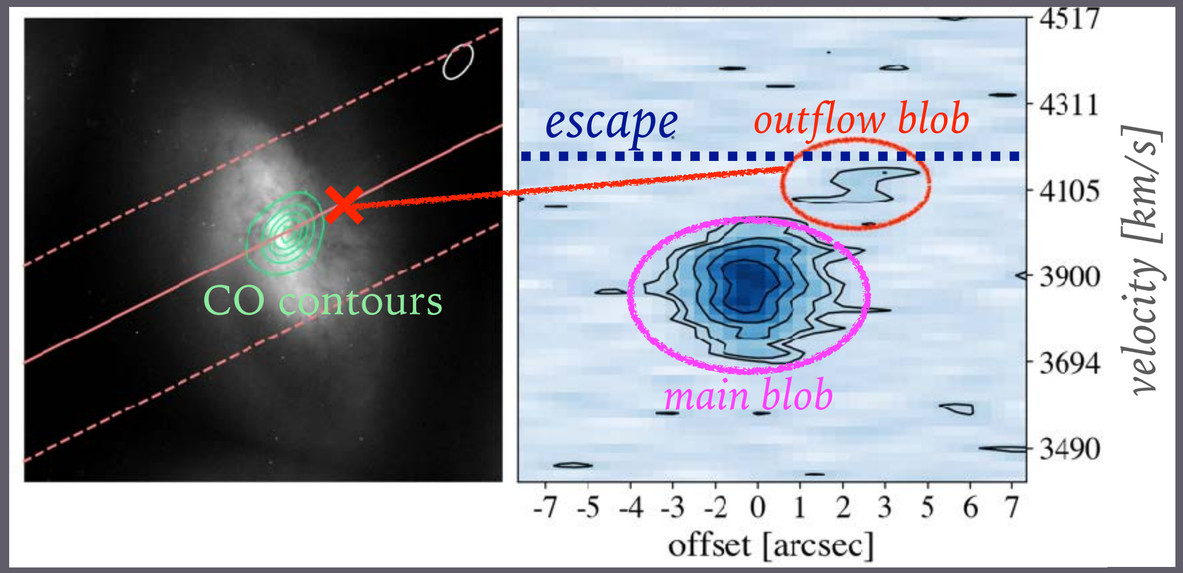
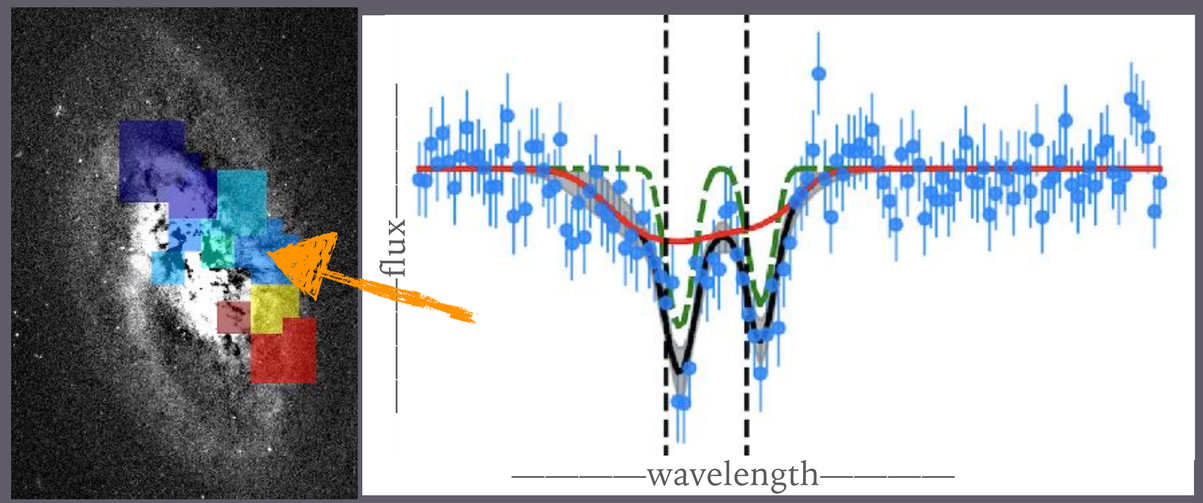
Multiphase outflows

NaD doublet absorption >> neutral gas outflow

Relatively small mass outflow rate; cannot escape





molecular gas outflow >> CO gas cloud deviating from bulk motion

Only 4% of total molecular gas mass; cannot escape

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Star formation ends not with a bang but a whimper

(inspired by Eliot's poem)

RESULTS

- Evidence of merger history and AGN activity
- Presence of multiphase outflows (molecular + neutral)
- The outflows are not powerful enough to expel gas out of the galaxy

IMPLICATIONS

- Outflows disturb the gas to prevent star formation, not expel the gas
- AGN plays a role in galaxy quenching, but more investigation is desirable

(Luo+in prep)

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