

Star formation suppression by an AGN (in NGC 1266 and maybe more)

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NGC 1266

NGC 1266 appears to be a “quiescent” S0

NGC 1266 hosts a massive molecular disk ($>10^9 M_{\odot}$) and a massive ($>10^8 M_{\odot}$) molecular outflow that is multiphase being driven by an AGN

A young (1/2 Gyr) stellar population outside the nucleus is the most recent (obvious) SF event

Star formation is suppressed by at least a factor of 70 seen in the nucleus



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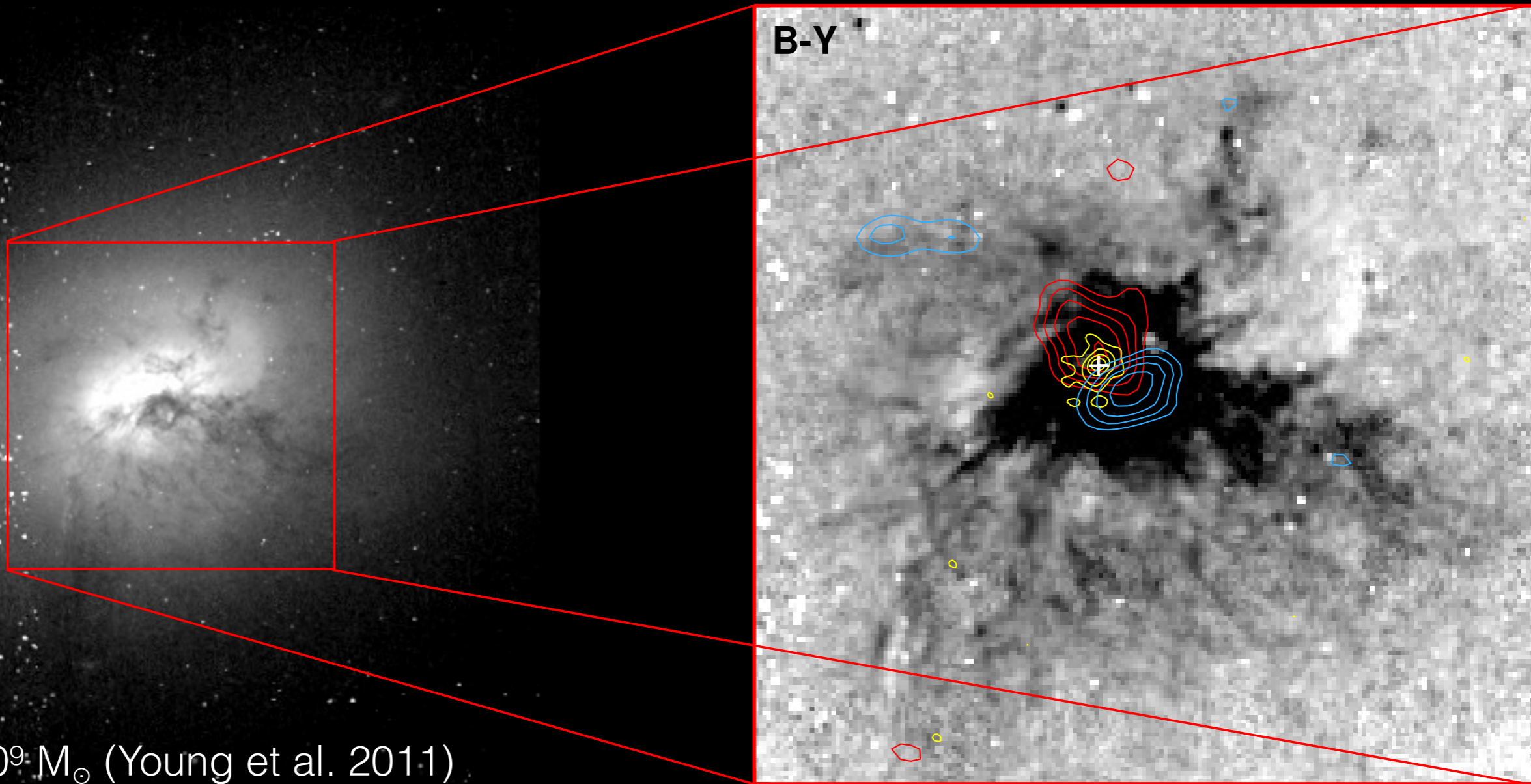
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NGC 1266 contains massive molecular outflow

B



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$M_{\text{outflow}} \sim \text{few} \times 10^8 M_{\odot}$

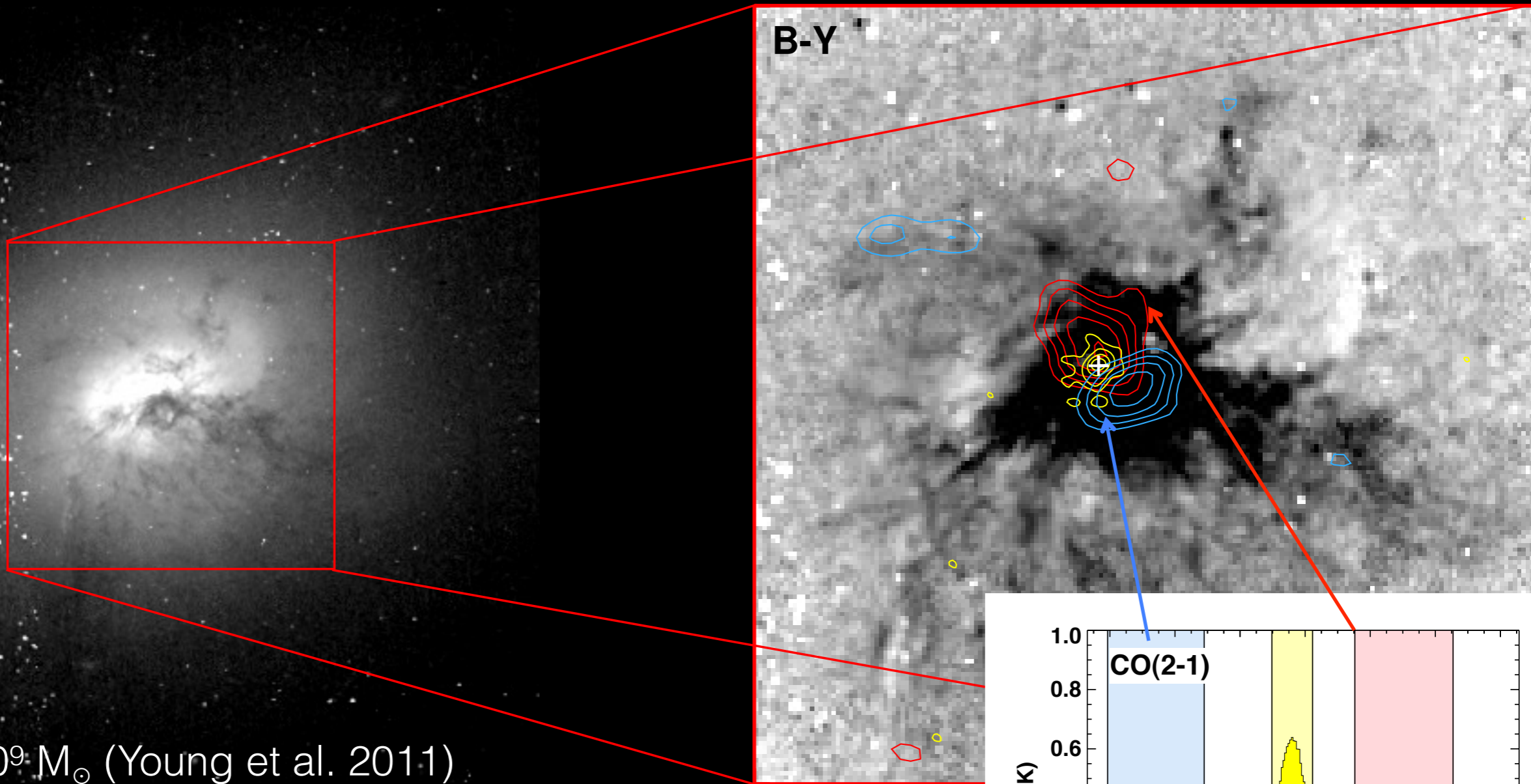
(Alatalo et al. 2011, new HCN and CS(2-1) have wings)

Outflow mass flux $\sim 110 M_{\odot} \text{ yr}^{-1}$

Outflow dynamical time $< 3 \text{ Myr}$ (Alatalo et al. 2011)

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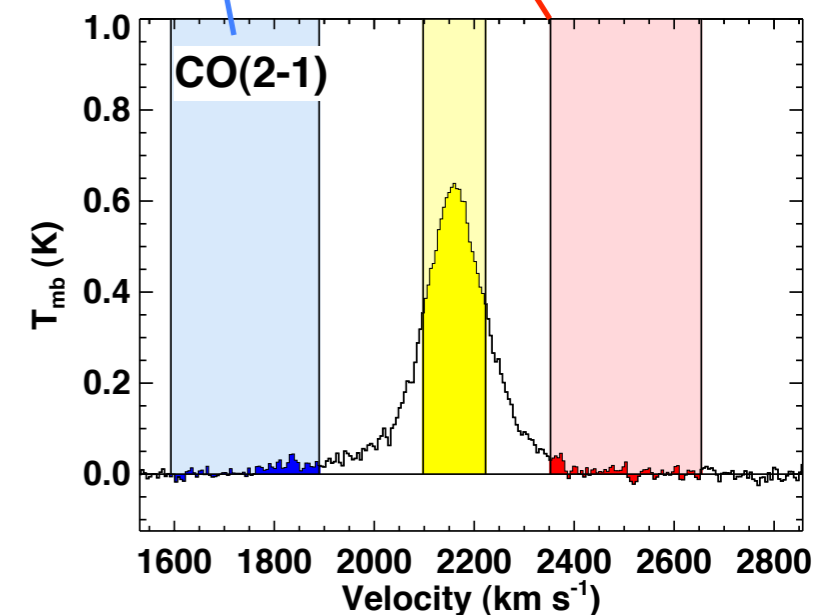
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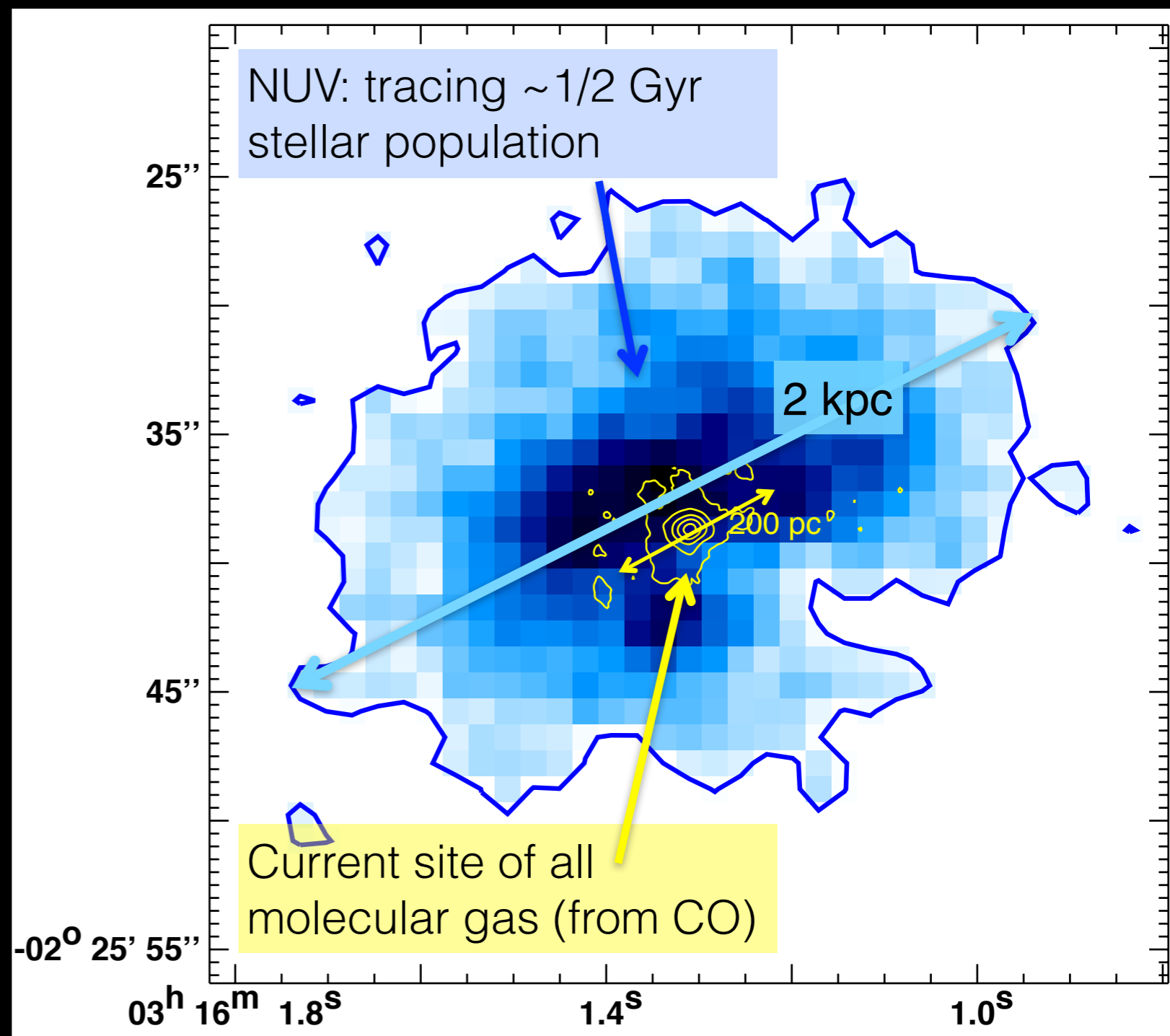


NGC 1266 is a poststarburst galaxy

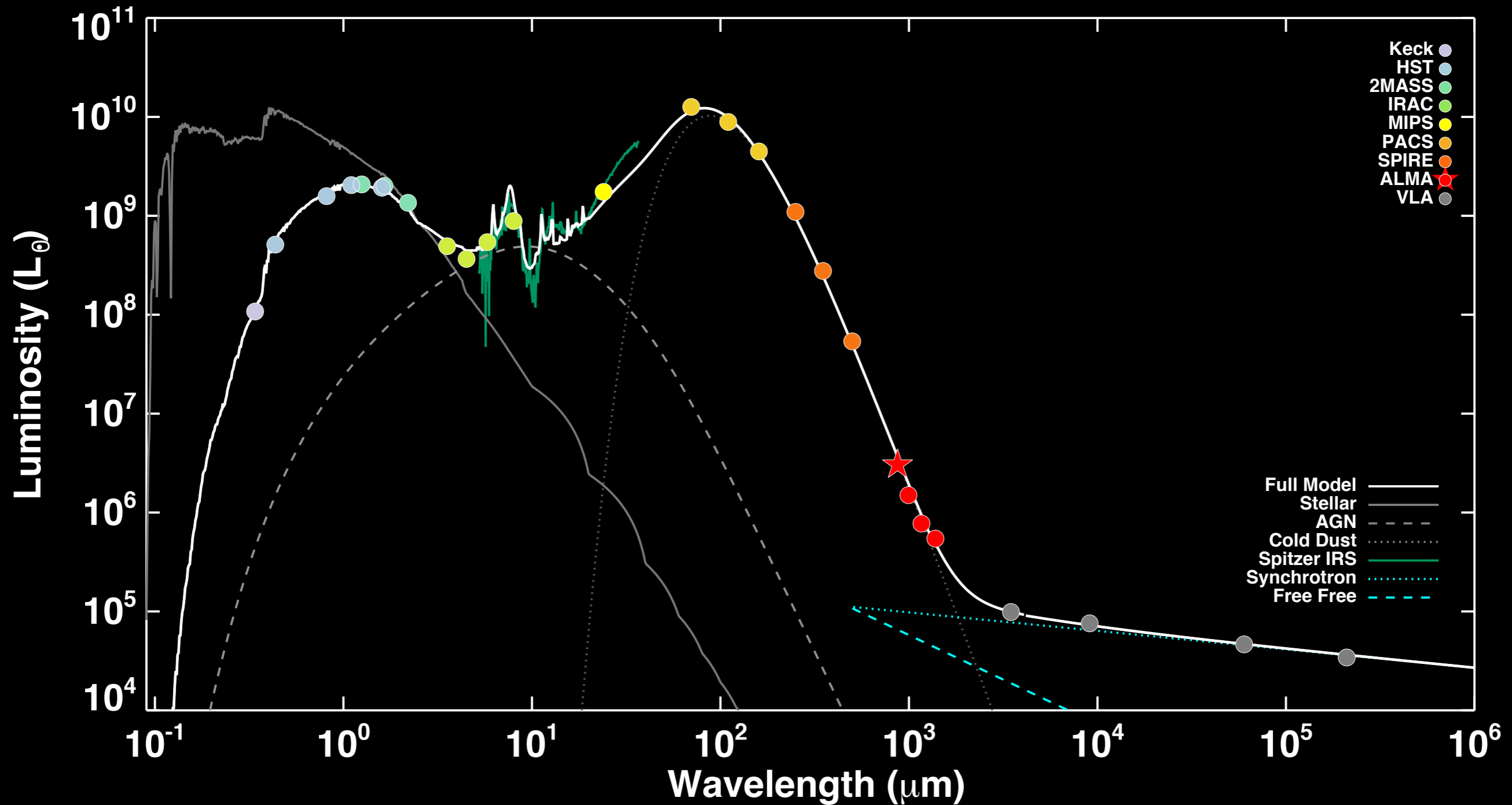
NUV imaging show a larger distribution of young stars than the current site of the molecular gas

A stellar population analysis shows that the population is poststarburst of age (~ 500 Myr) with mass fraction $\sim 10\%$

Alatalo et al. 2014a



SF+AGN in the SED



Modeling the SED of 1266 results in SF $\sim 2.2 M_{\odot} \text{ yr}^{-1}$ is an upper limit, if all of this emission is from stars (it isn't) and the free-free fit say SF $< 0.9 M_{\odot} \text{ yr}^{-1}$.

$L_{\text{TIR}} \approx 3 \times 10^{10} L_{\odot}$ ($1.2 \times 10^{44} \text{ ergs s}^{-1}$)

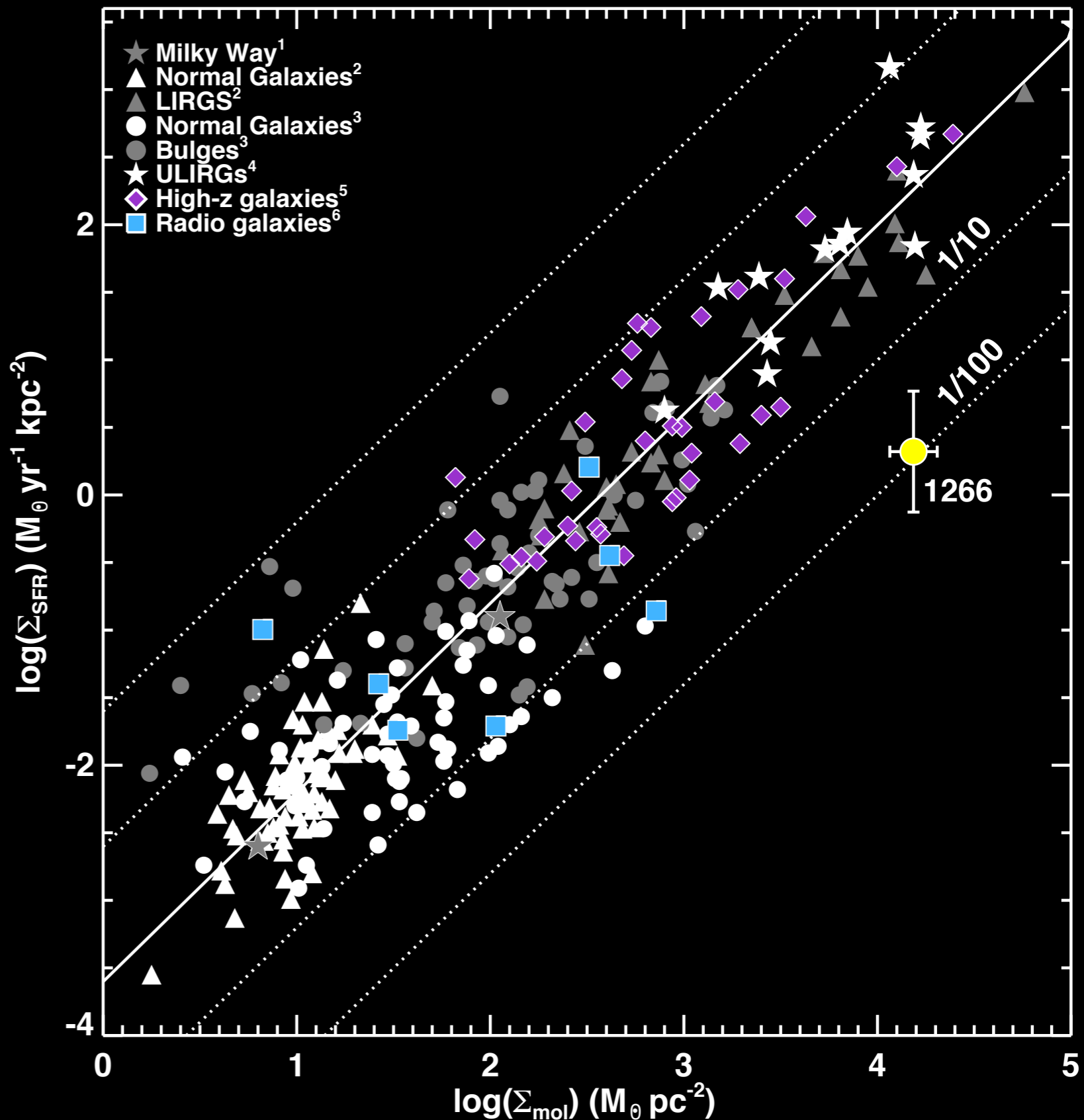
Extreme SF suppression

Last burst of SF happened
~500Myr ago and the nuclear
molecular gas has remained
since then

SFR calculated using the free-
free emission indicates a SFR
of $>0.9 M_{\odot} \text{ yr}^{-1}$ (the ALMA
decomposed data agree)

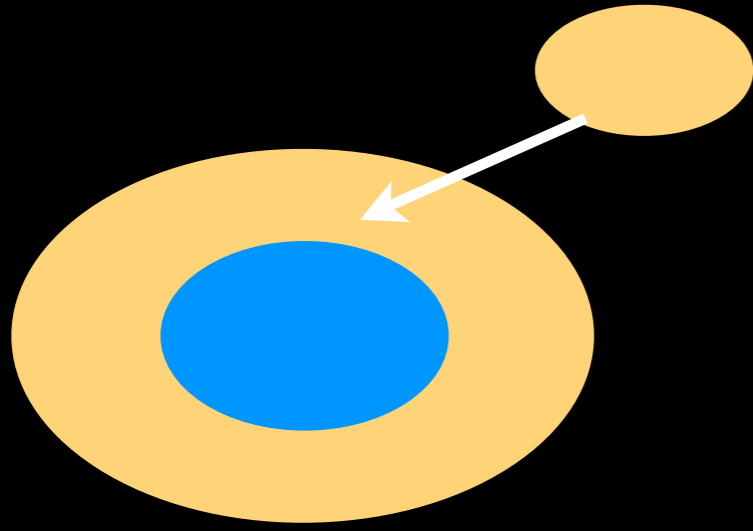
$\Sigma_{\text{gas}} \approx 10^4 M_{\odot} \text{ pc}^{-2}$
(from CO, CS and HCN)

Using dense gas (CS) size
and assuming SF/CS co-
spatiality, NGC 1266 is a factor
of ~70 off the K-S relation.



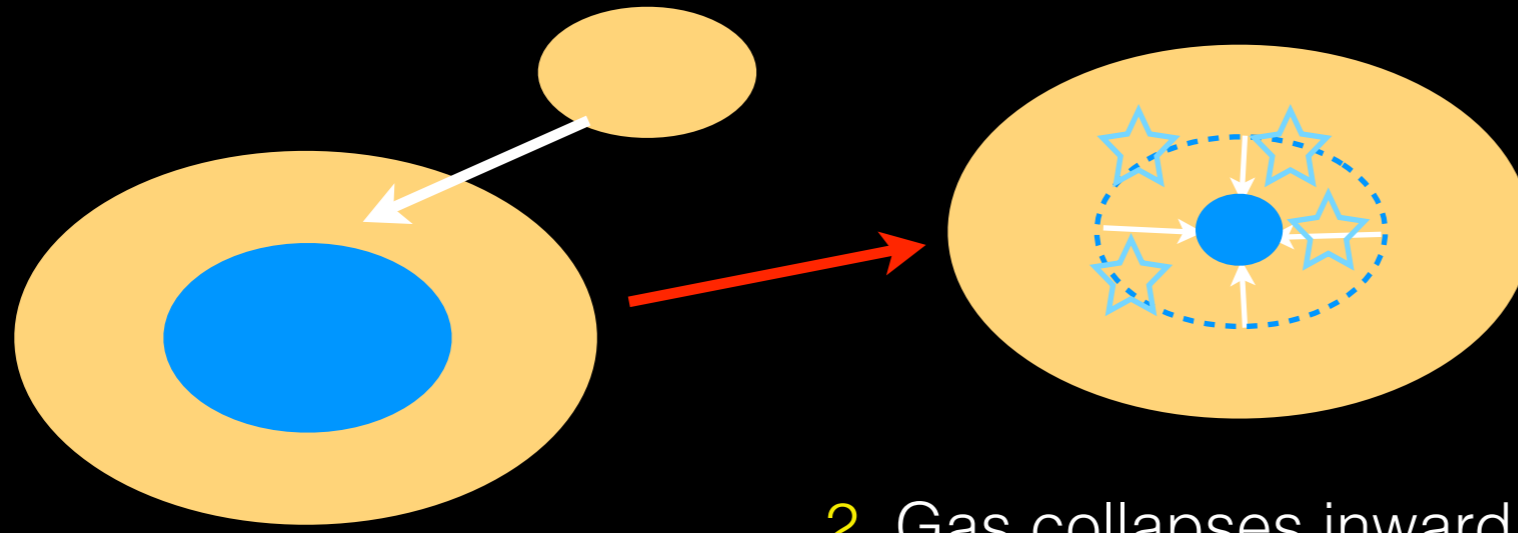
A scenario to explain NGC 1266

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1. Minor merger causes the collapse of a subcritical molecular disk in the already mostly old NGC 1266

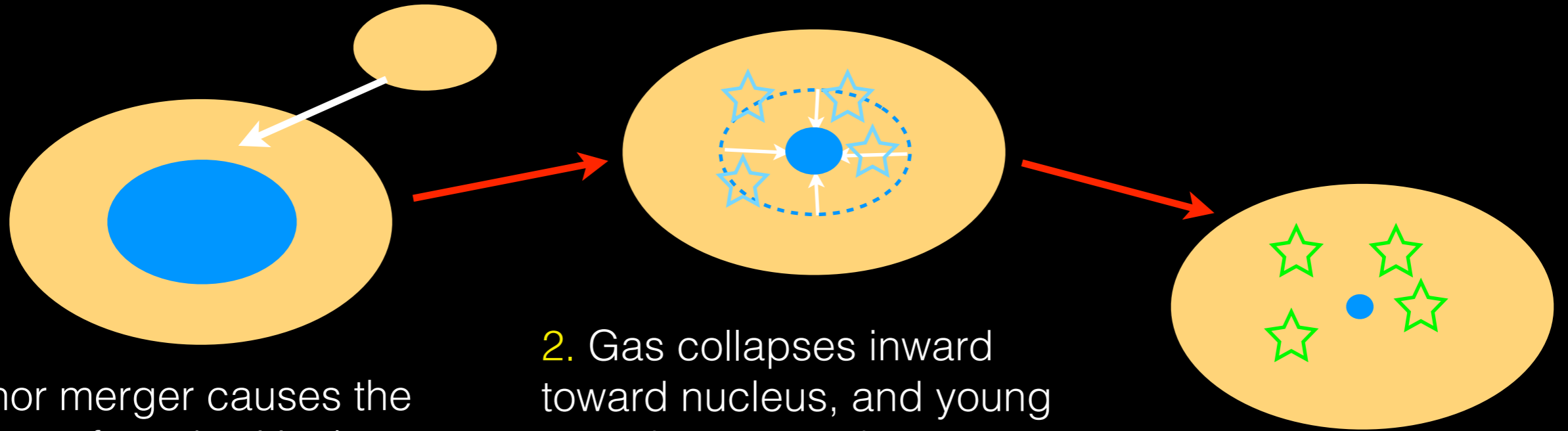
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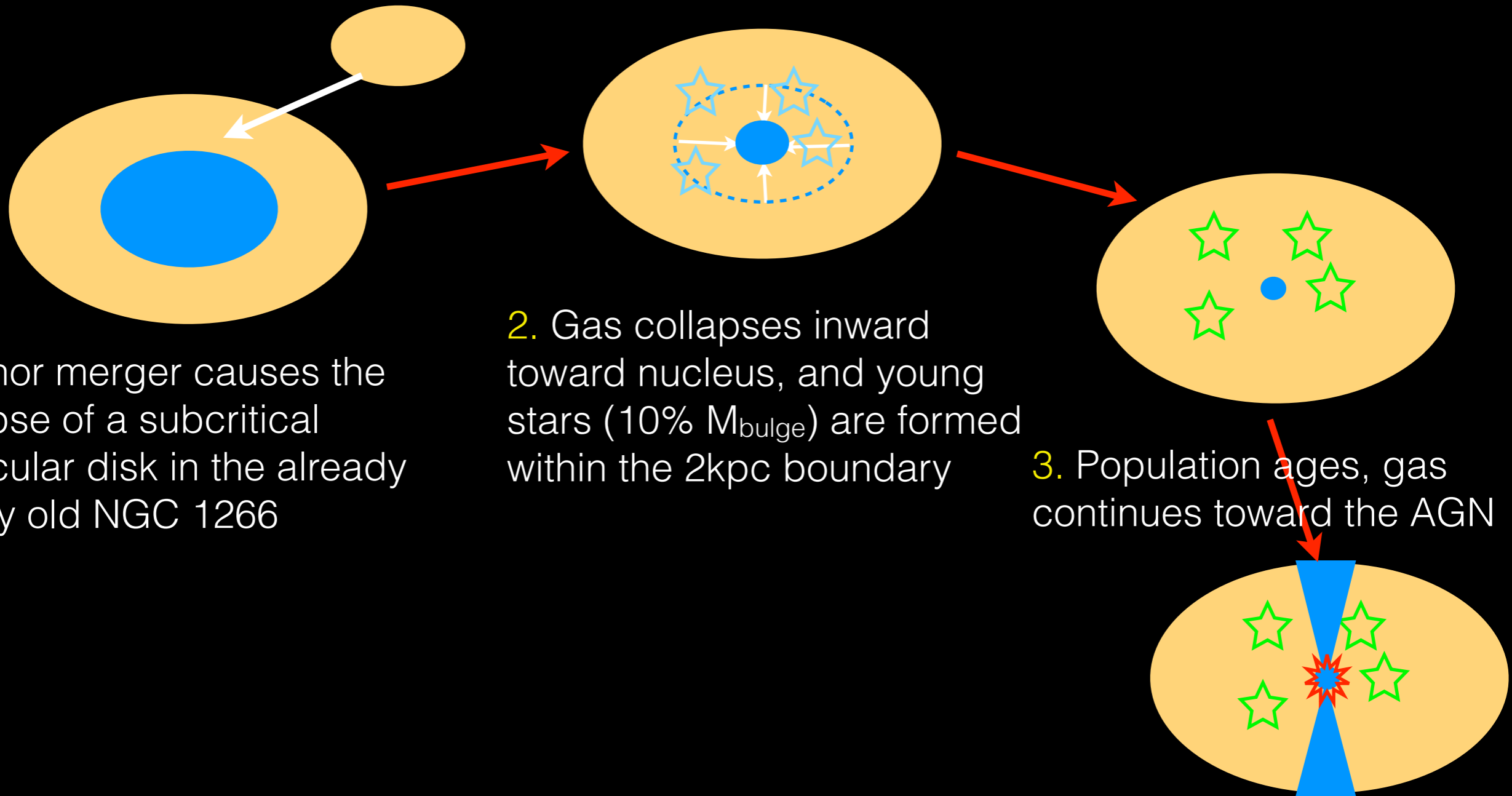


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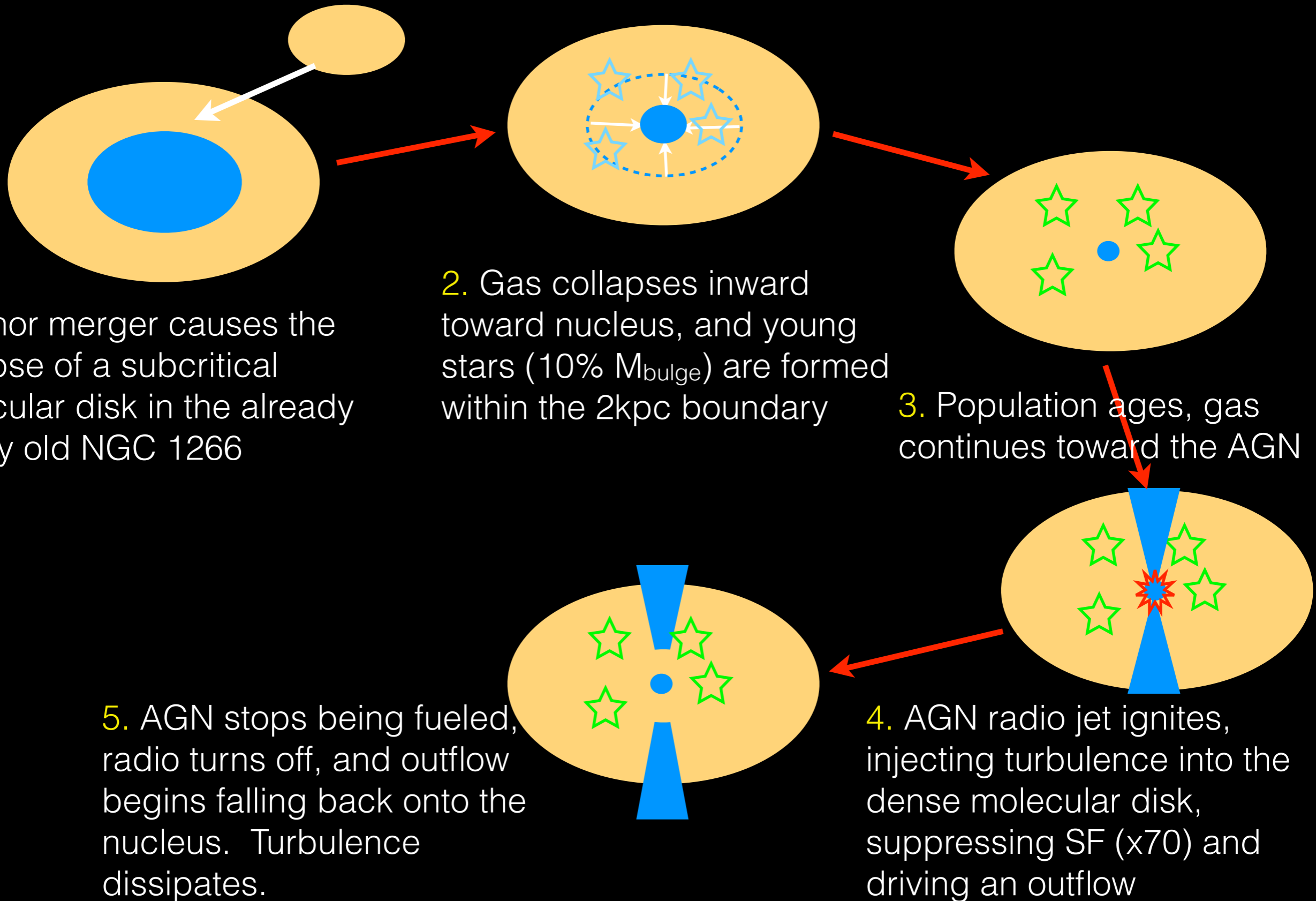
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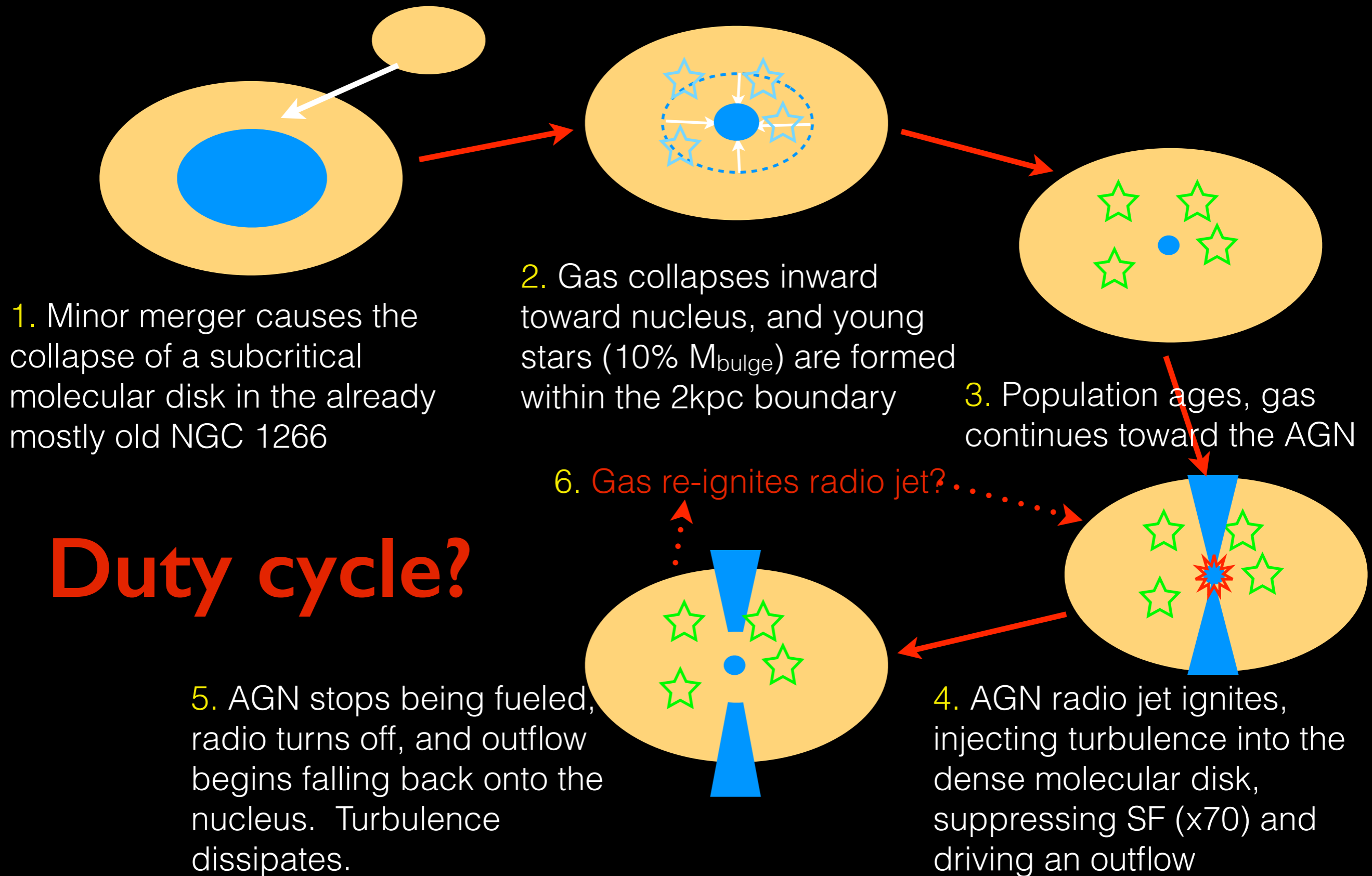
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4. AGN radio jet ignites, injecting turbulence into the dense molecular disk, suppressing SF (x70) and driving an outflow

A scenario to explain NGC 1266



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Duty cycle?

we need a systematic search for these sorts of objects.

Case studies are great, but can't tell us about a population.

What is the duty cycle of the SF quenching?

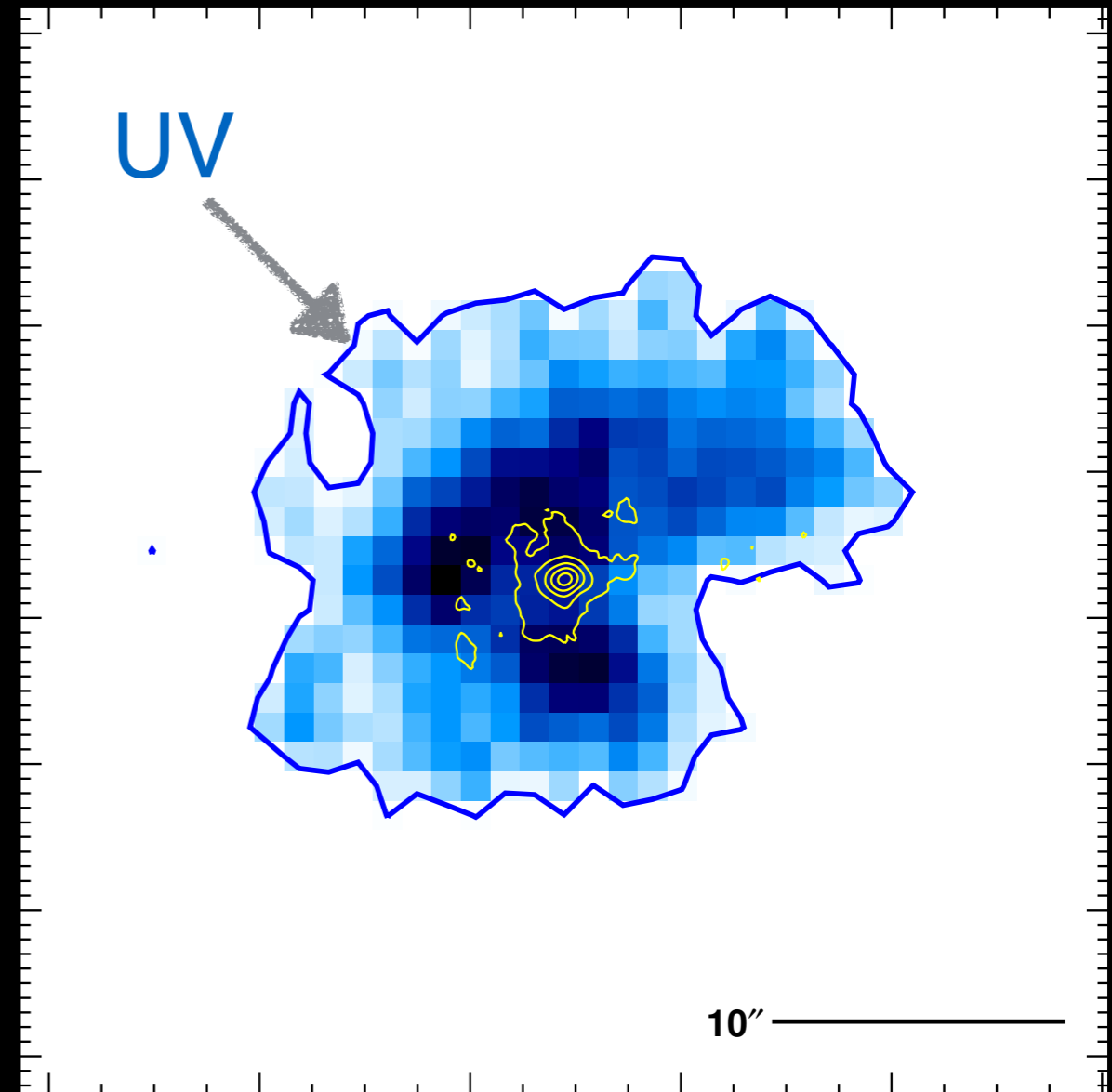
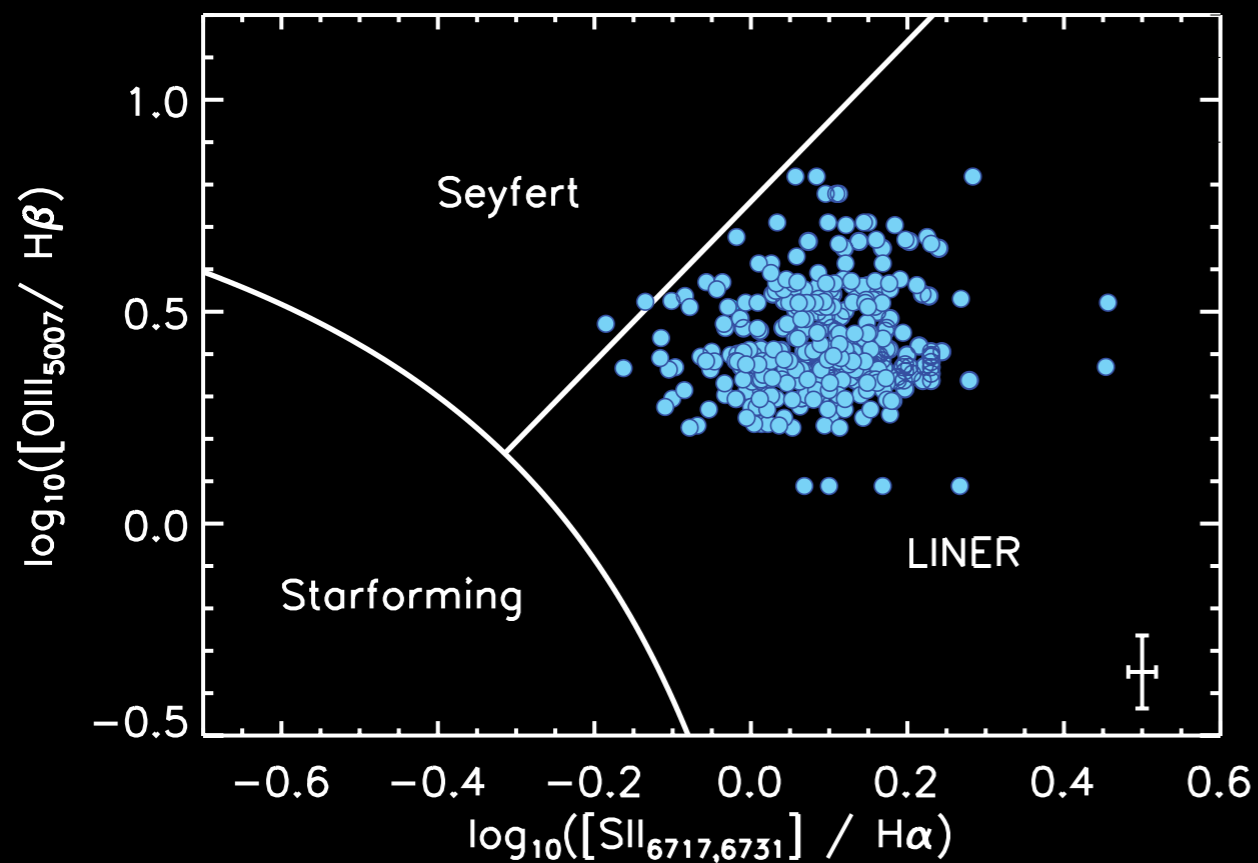
What evolutionary pictures lead to an AGN expulsion of molecular gas?

Can we begin to understand NGC 1266-like objects?

What is the redshift evolution of these objects?

Finding the needle in the haystack

NGC 1266 hosts an AGN-driven outflow, but also contains a unique set of **optical** features



shocked ionized gas (Davis et al 2012)

young(ish) stellar population
Alatalo et al. 2014a

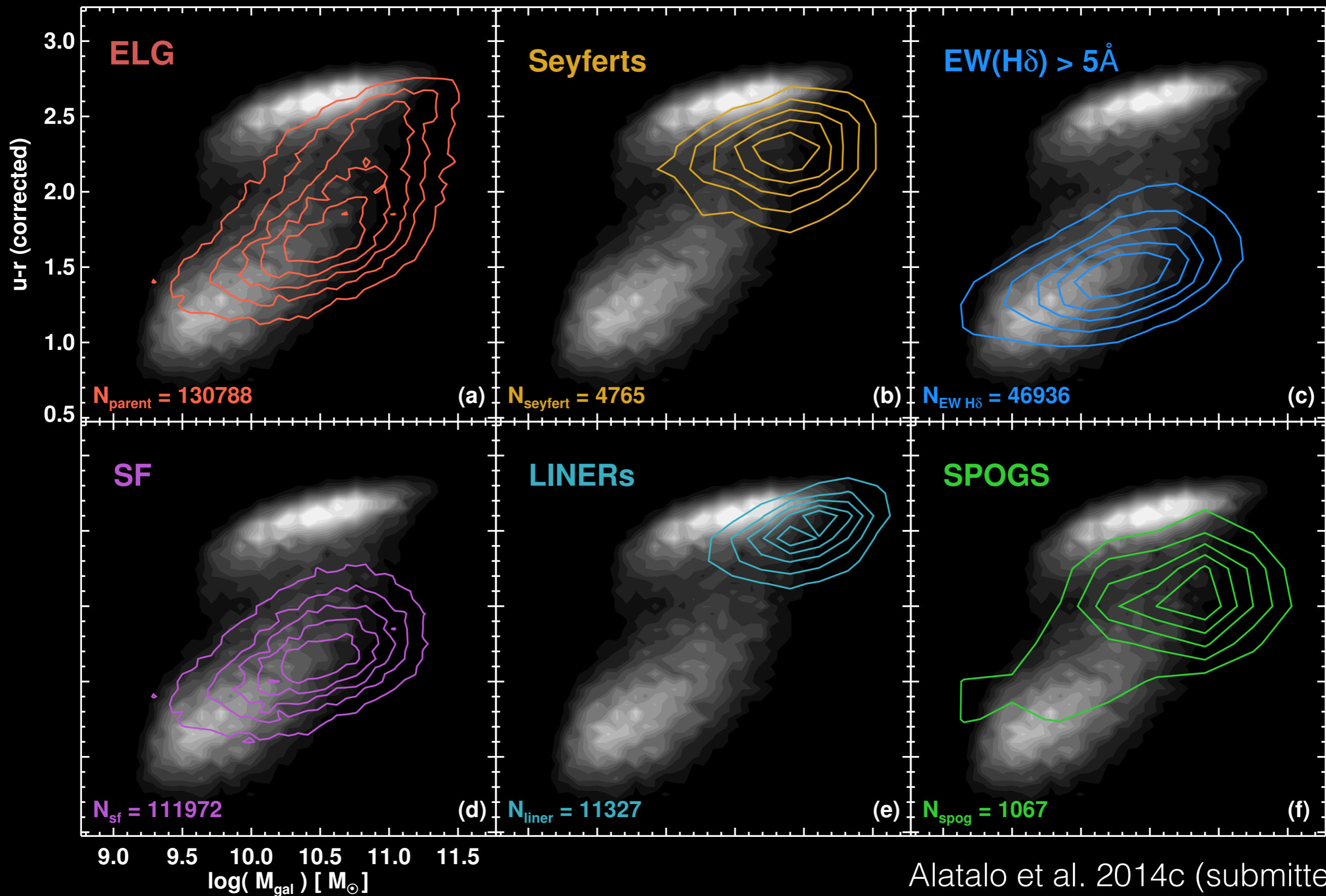
shocked ionized gas ratios + poststarburst stellar population

=

a Shocked Poststarburst Galaxy (spog)

NGC 1266 is a spog.

SPOGS: First results



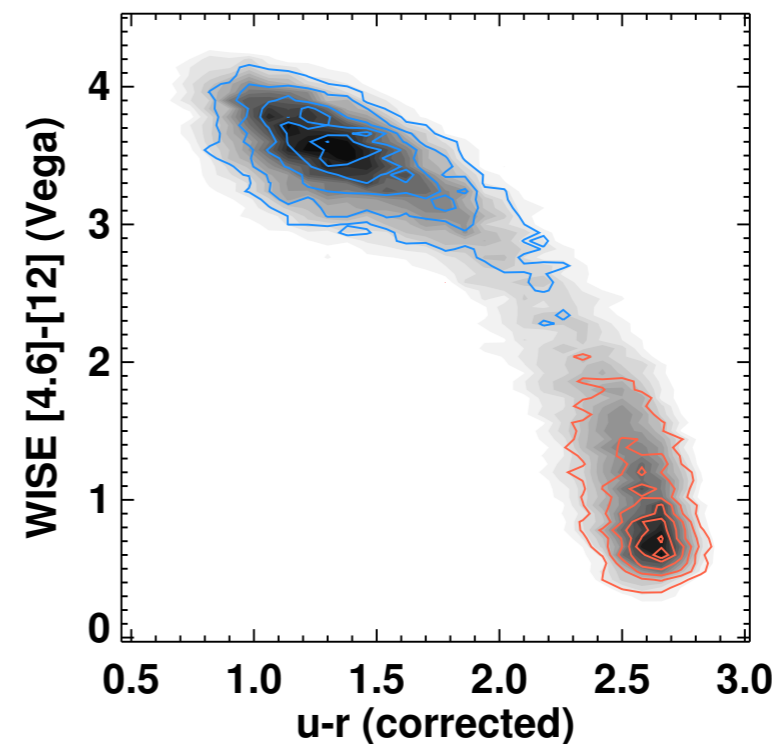
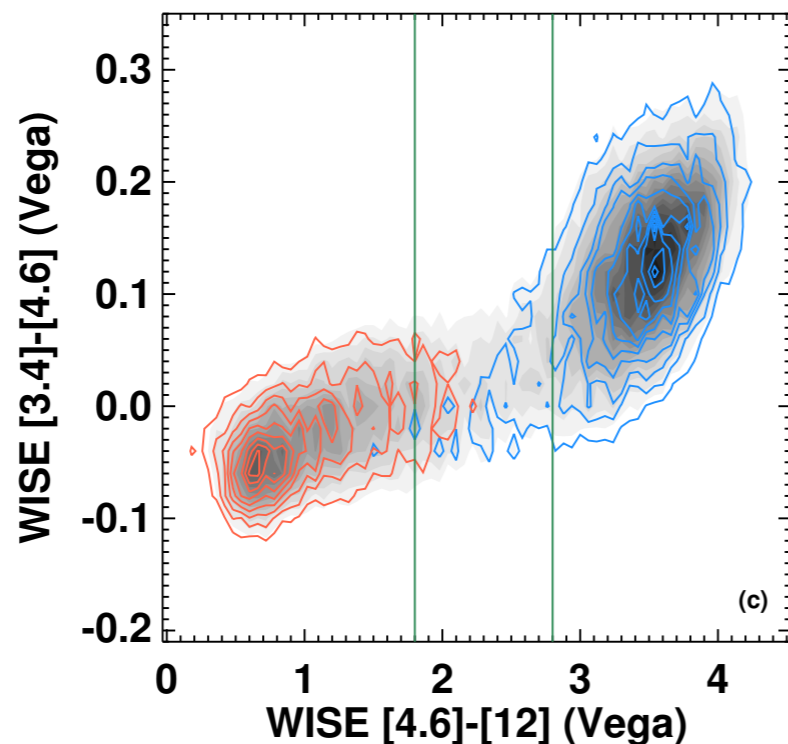
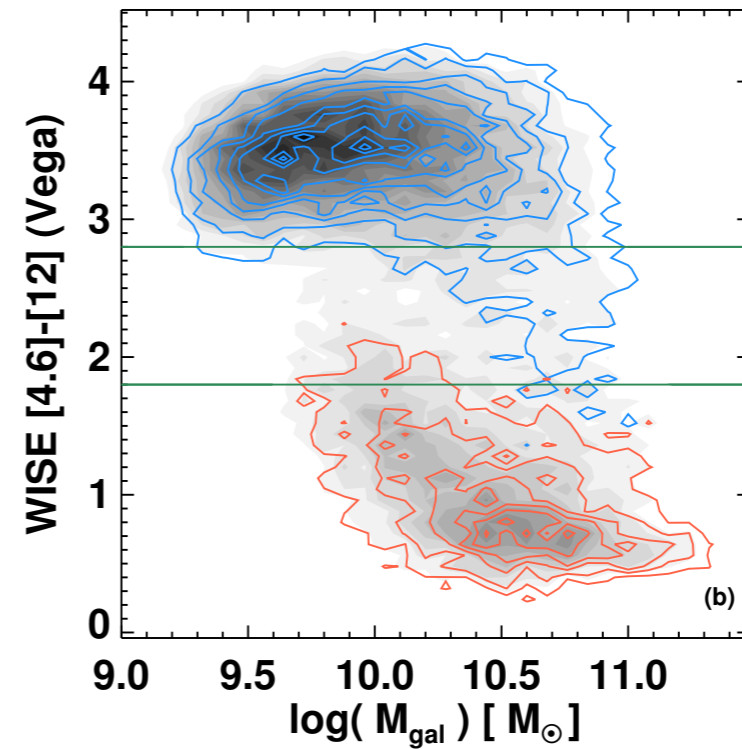
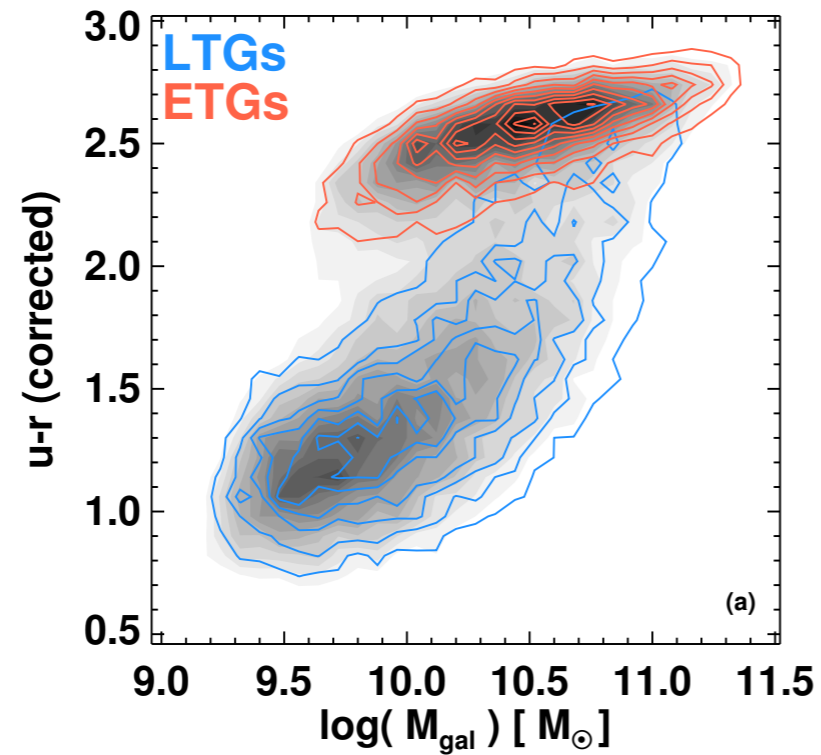
SPOGS result: a surprise

a WISE infrared transition zone

when in doubt, cross-correlate with WISE

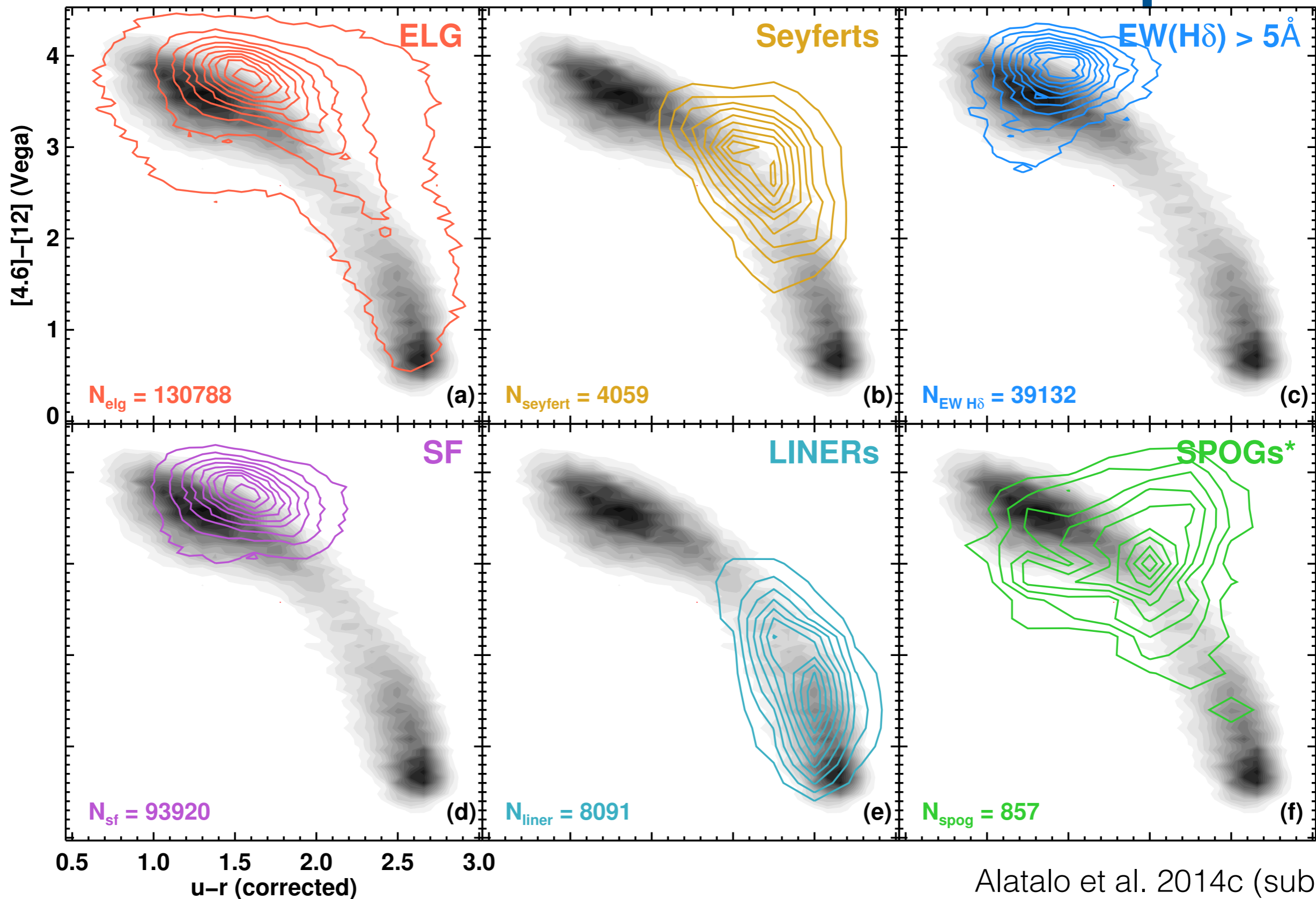
SPOGS result: a surprise

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SPOGS* colors

u-r and W2-W3 transformation sequence





The end.

The molecular outflow seen in NGC 1266 is about $110 M_{\odot} \text{ yr}^{-1}$, far too large to drive with its star formation rate ($dM/dt/SFR \sim 100$)

ALMA observations have shown that star formation is suppressed currently by a factor of 70

A radio duty cycle might explain how NGC 1266 has come to be (and provide a look at how AGNs are able to remain obscured.)

NGC 1266 is a shocked poststarburst galaxy (spog)

WISE+SDSS is a great tracer of transitioning galaxies

The SPOGs survey seems to have found what it was looking for (transitioning objects)...

questions?

