CHARACTERIZING NEARBY STAR FORMING GALAXIES WITH THE SKA

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(ULTRA)LUMINOUS IR GALAXIES

LIRGs

$10^{11} L_{\odot} \leq L_{\mathrm{IR}} \leq 10^{12} L_{\odot}$

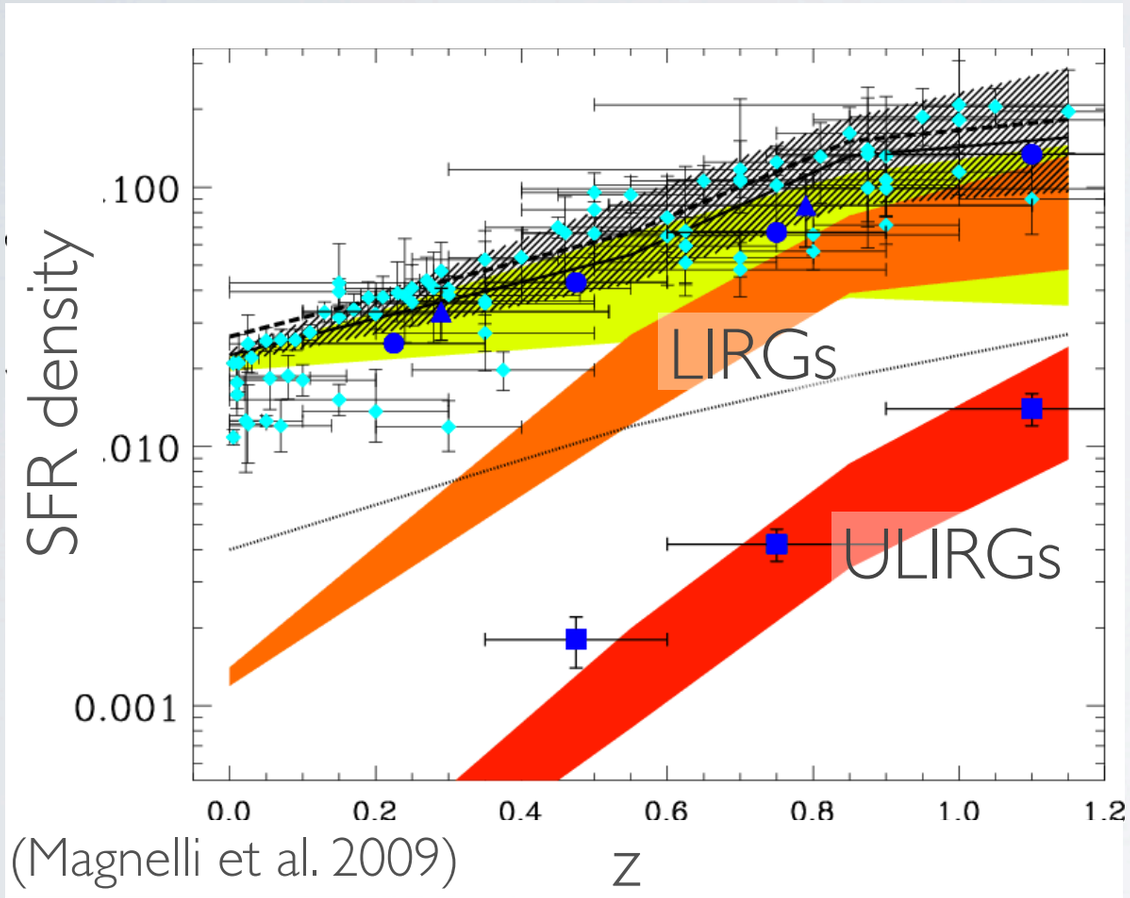
ULIRGs

$L_{\mathrm{IR}} \geq 10^{12} L_{\odot}$

- Morphological diversity
- Mostly mergers above $\sim 3 \times 10^{11} L_{\odot}$
- SFR up to 500$M_{\odot}$/yr
- Extreme CCSN rates

WHY (U)LIRGS?

Fundamental at high-z



(Magnelli et al. 2009)

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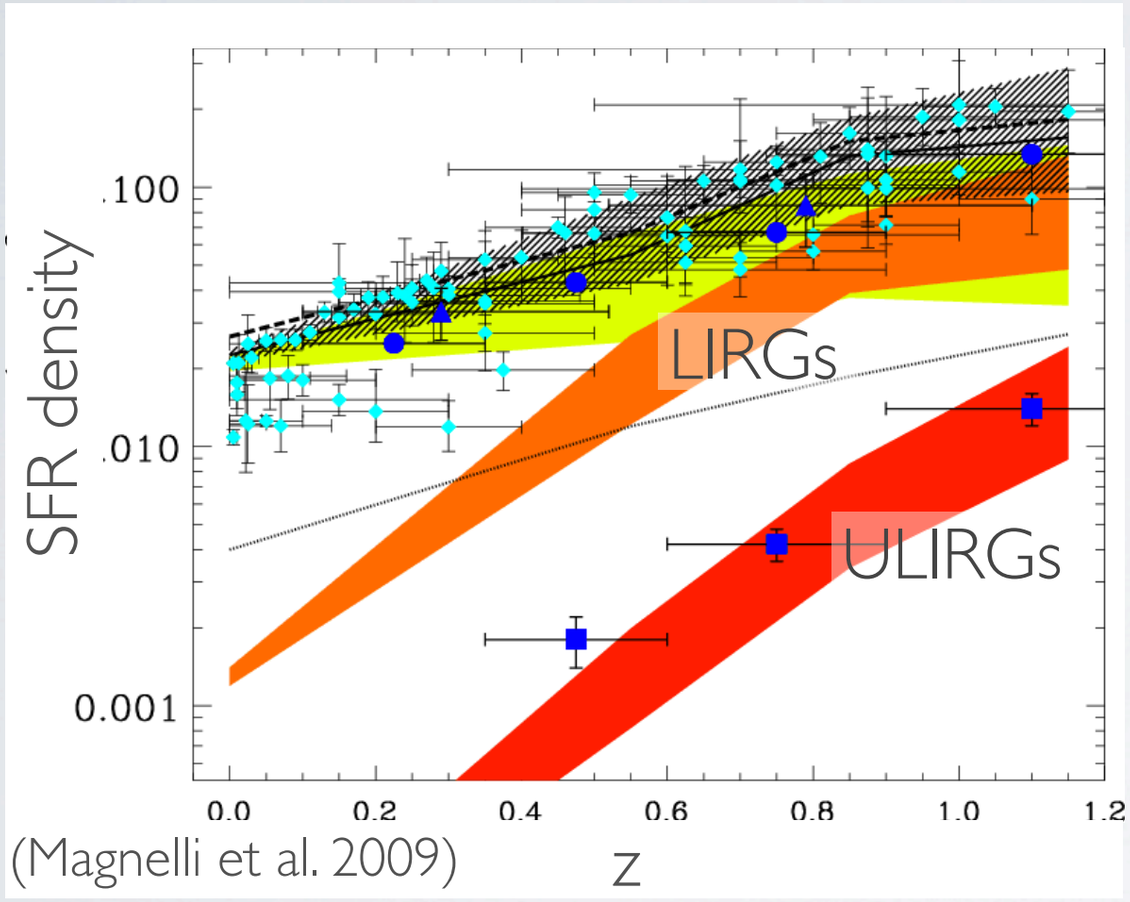
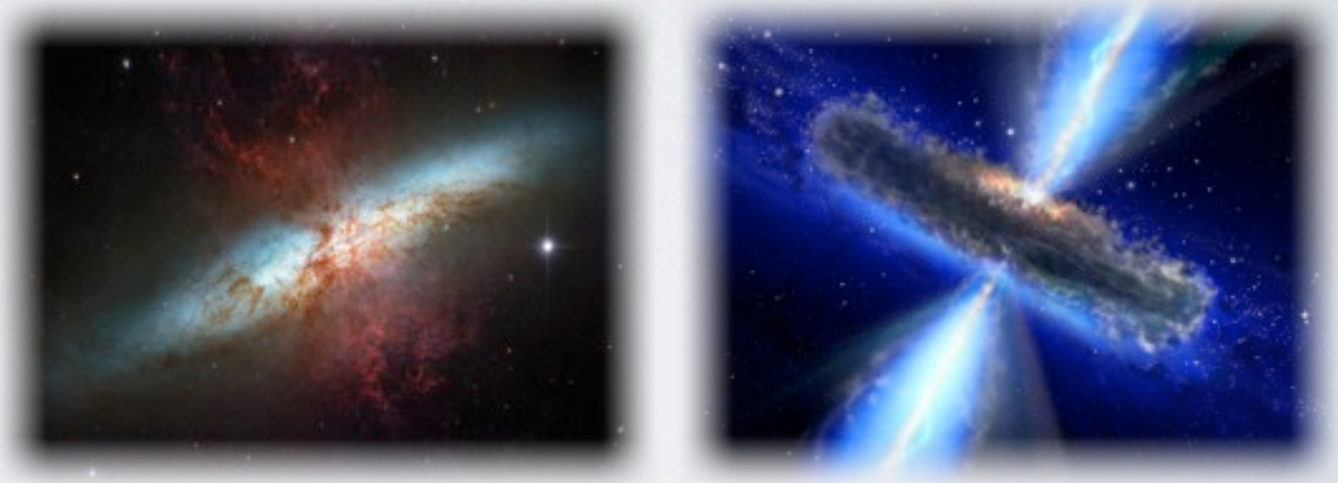


(Magnelli et al. 2009)

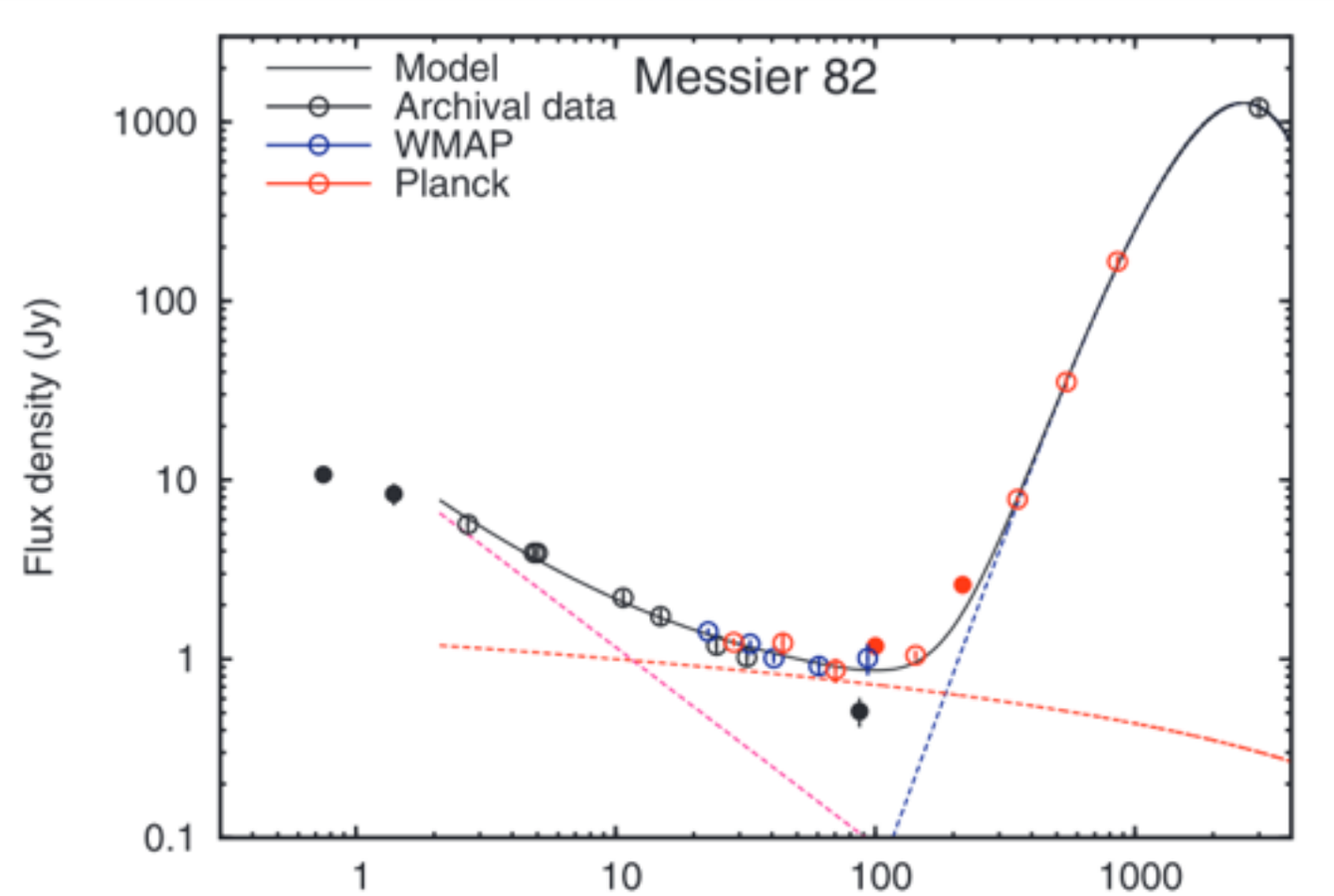
Dust heating



Star formation

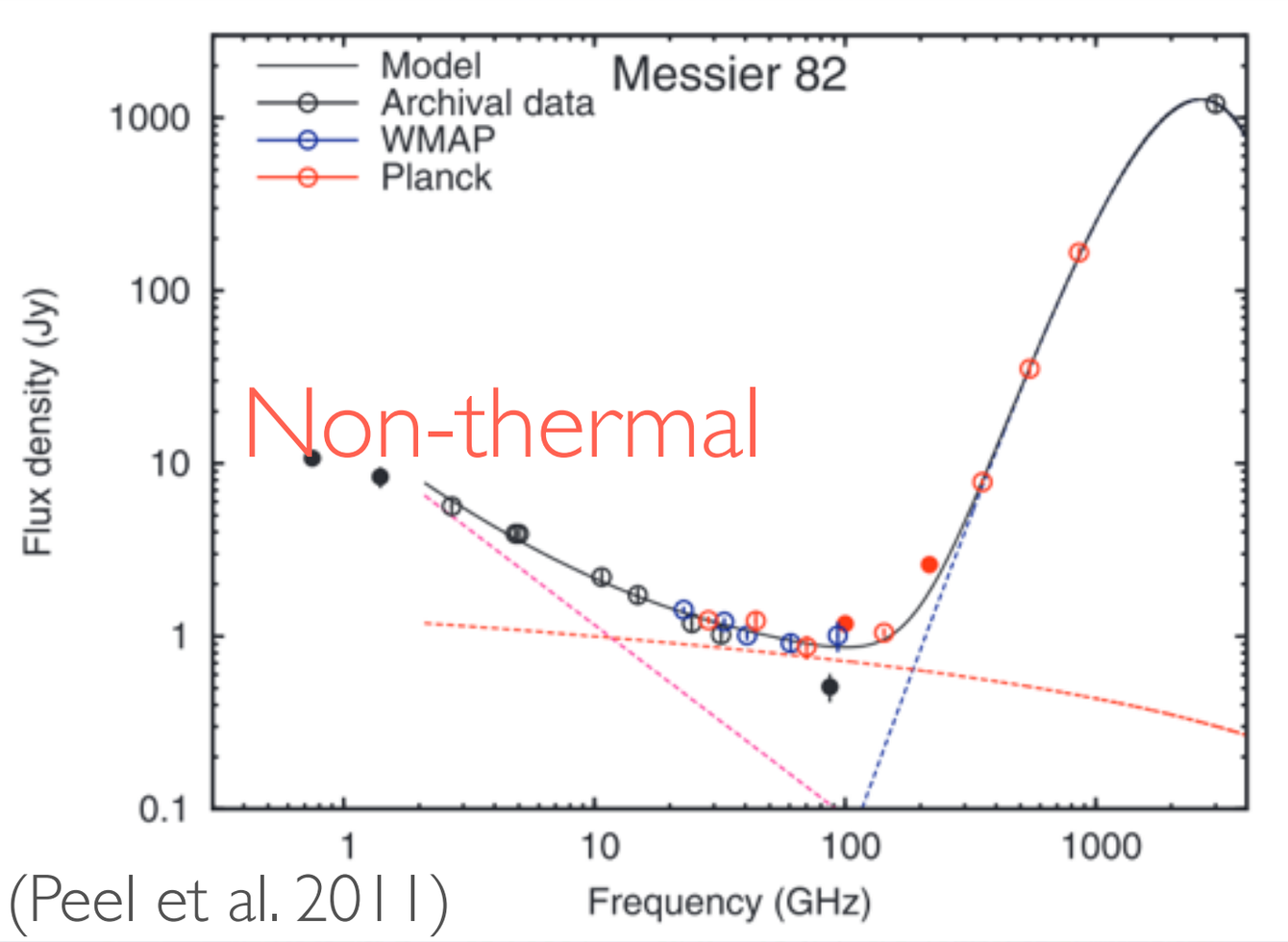
Accretion

RADIO EMISSION



(Peel et al. 2011)

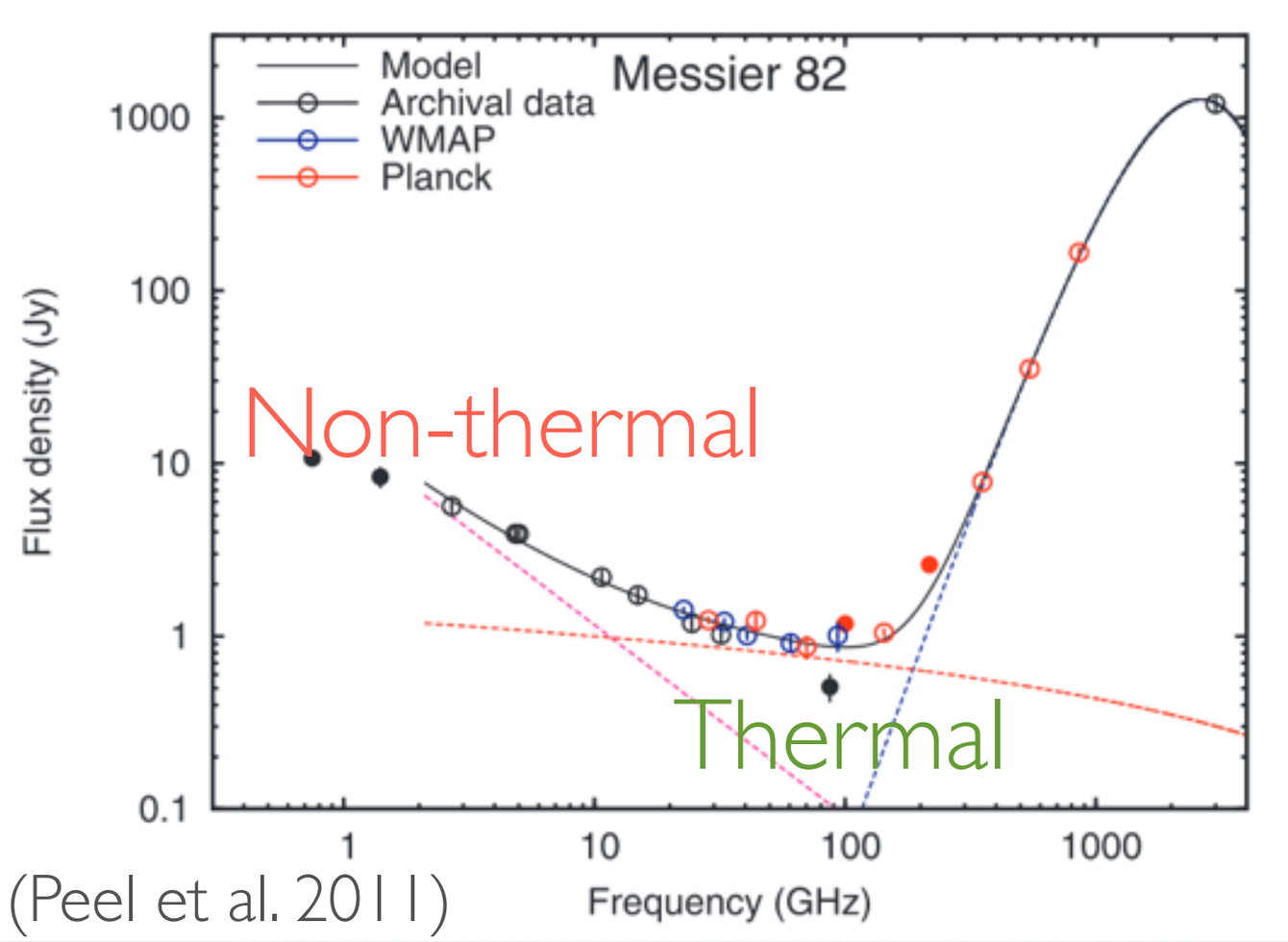
RADIO EMISSION



(Peel et al. 2011)

e- accelerated in SNe and SNR

RADIO EMISSION



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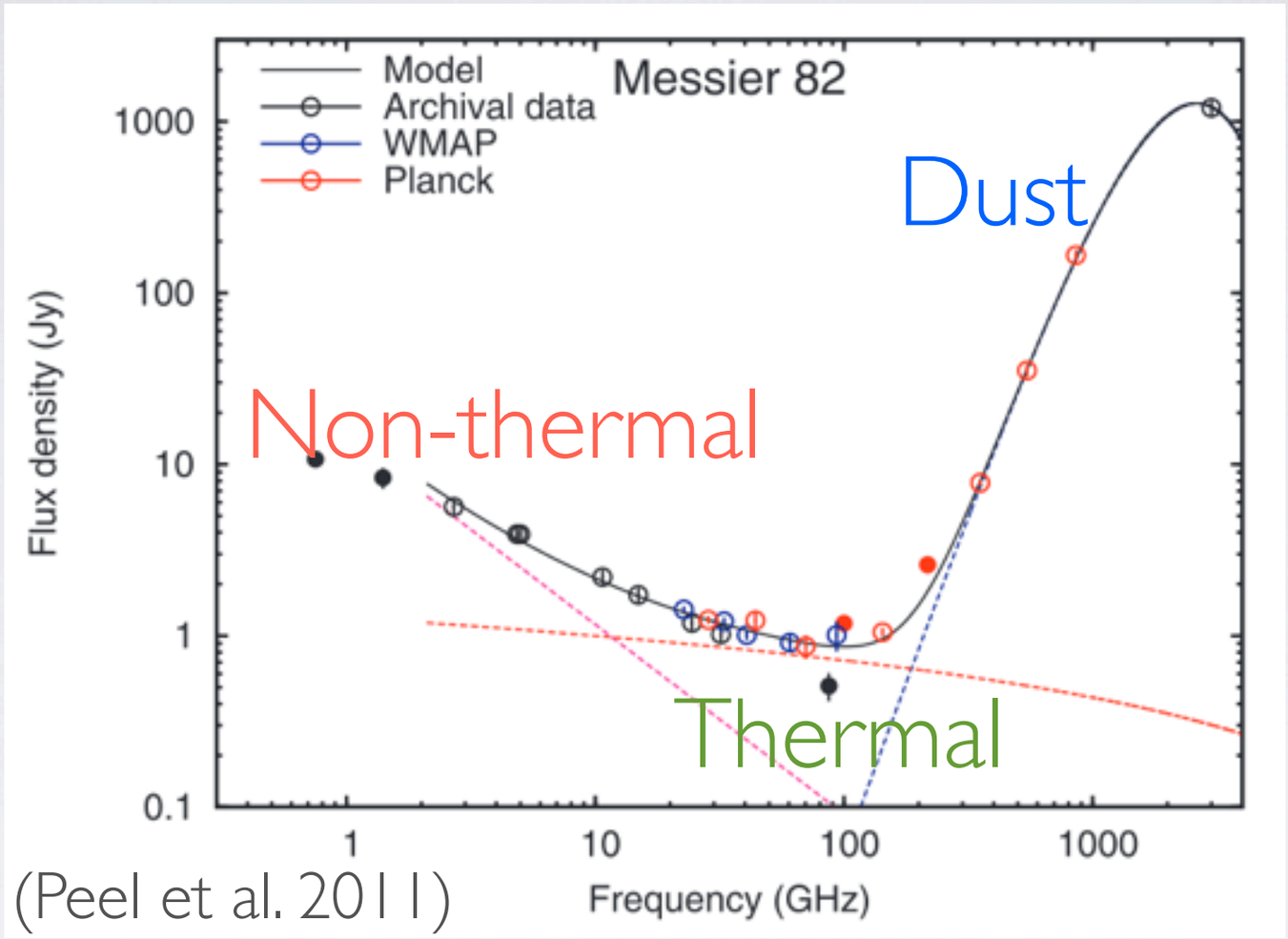
HII regions ionized by massive stars

RADIO EMISSION



(Peel et al. 2011)

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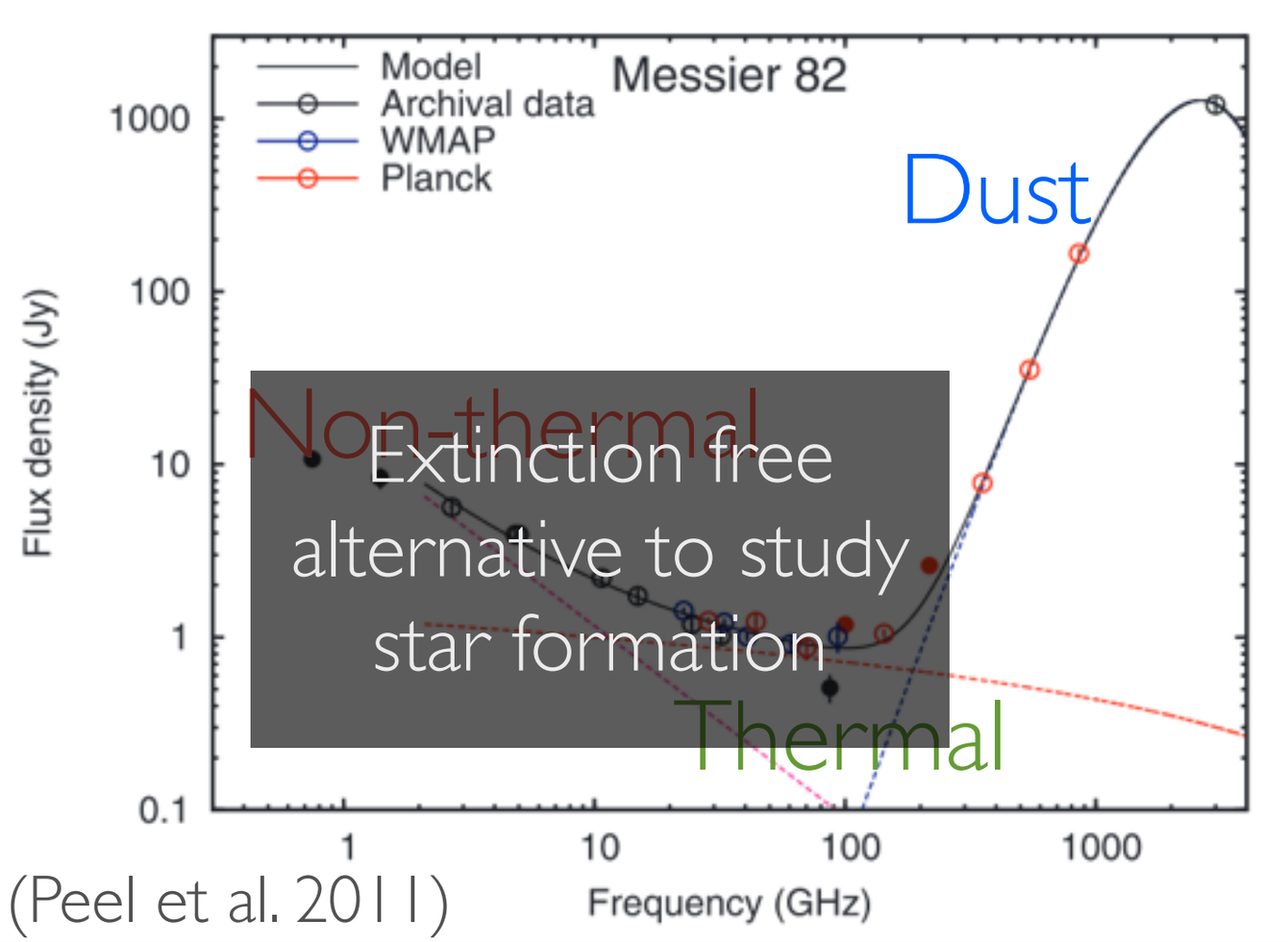
Reprocessing

RADIO EMISSION



(Peel et al. 2011)

e- accelerated in SNe and SNR

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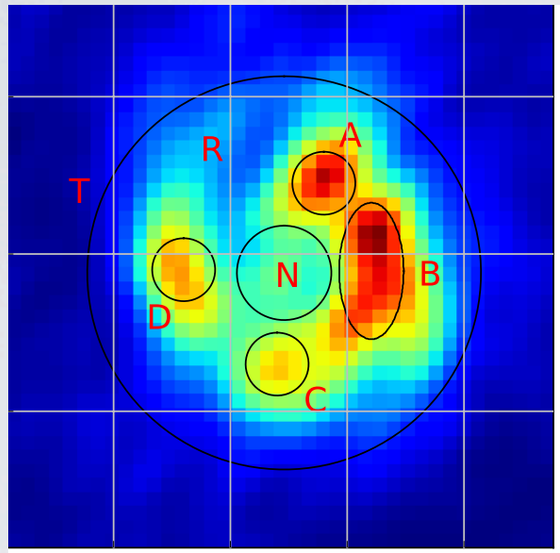
Reprocessing

RADIO DECOMPOSITION

Both thermal free-free and radio synchrotron emission are SF tracers, but arise from different processes.

RADIO DECOMPOSITION

NGC1614 (3.6cm)



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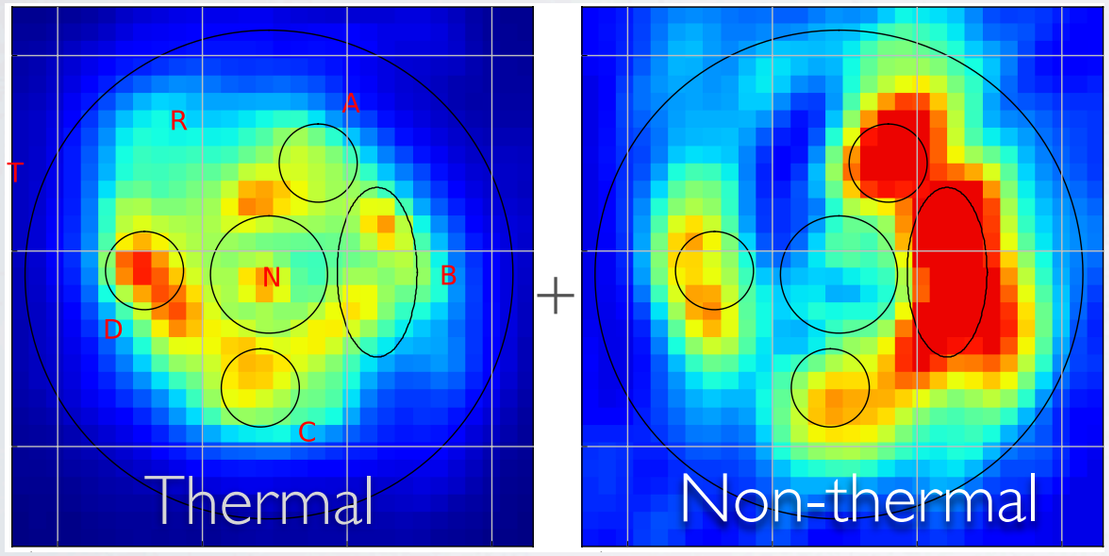

Unabsorbed Paschen- α

$$S_{\mathrm{thermal}} = 1.076 \times 10^{13} \times F(\mathrm{Pa}\alpha)\, \nu^{-0.1}$$

(Herrero-Illana et al. 2014)
(Xu et al. 2015)

RADIO DECOMPOSITION

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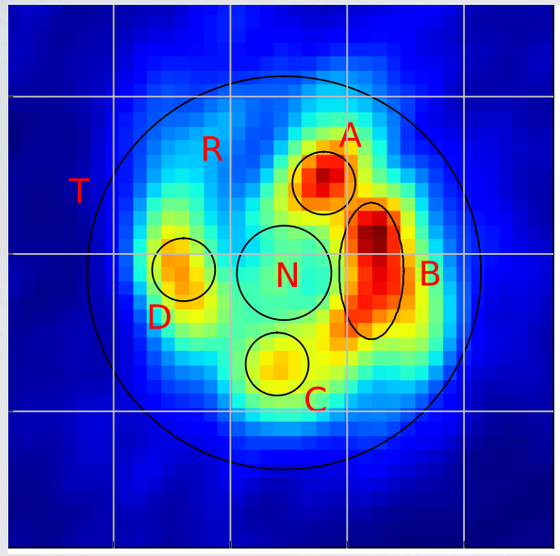

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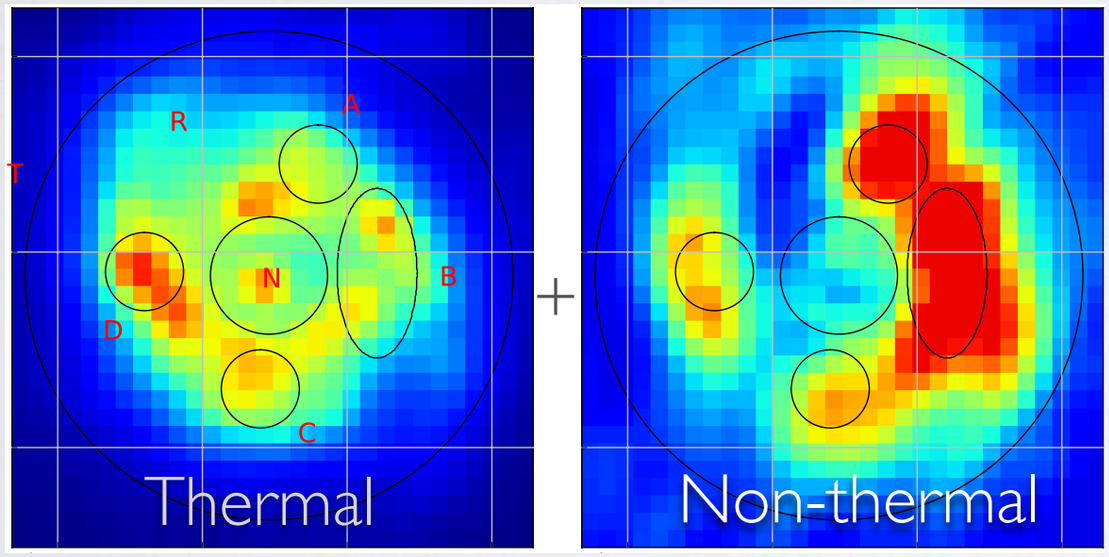
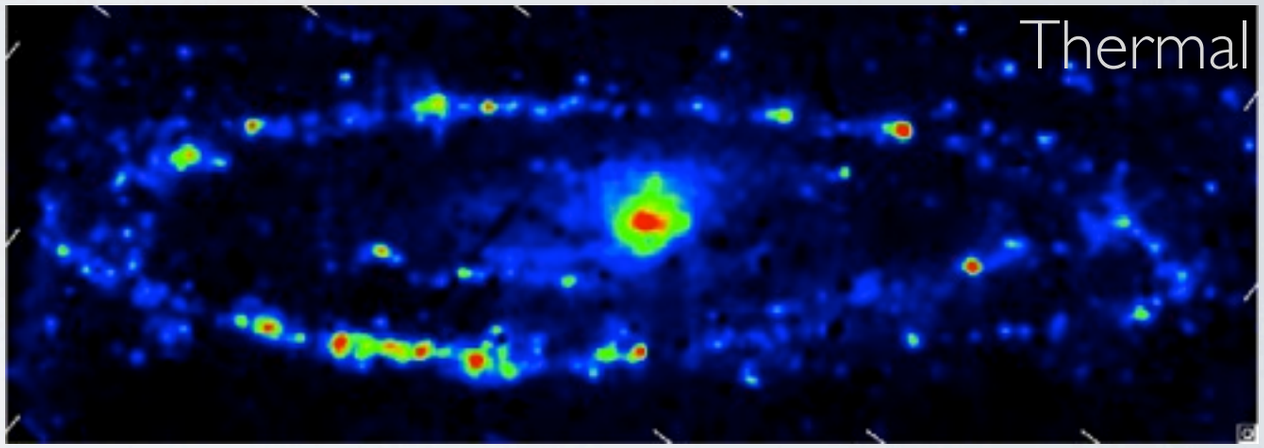
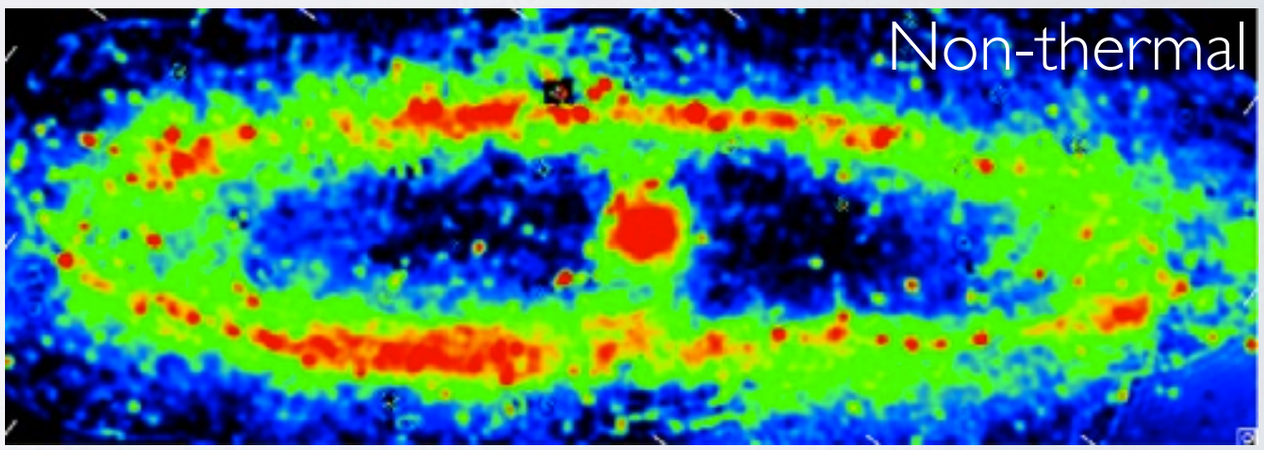


(Herrero-Illana et al. 2014)
(Xu et al. 2015)

M31(20cm)

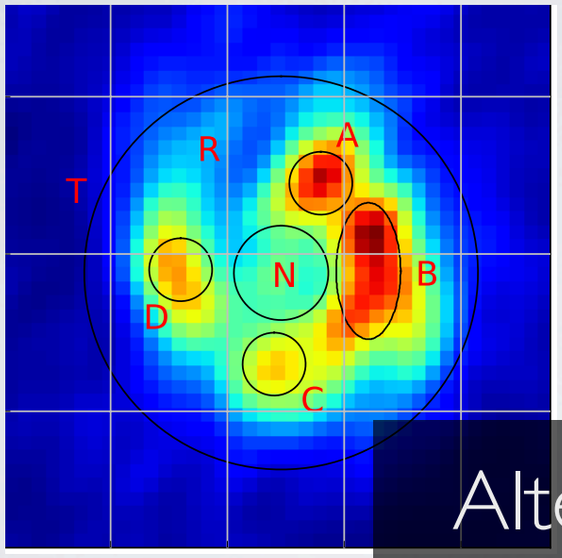




(Tabatabaei et al. 2013)

RADIO DECOMPOSITION

NGC1614 (3.6cm)



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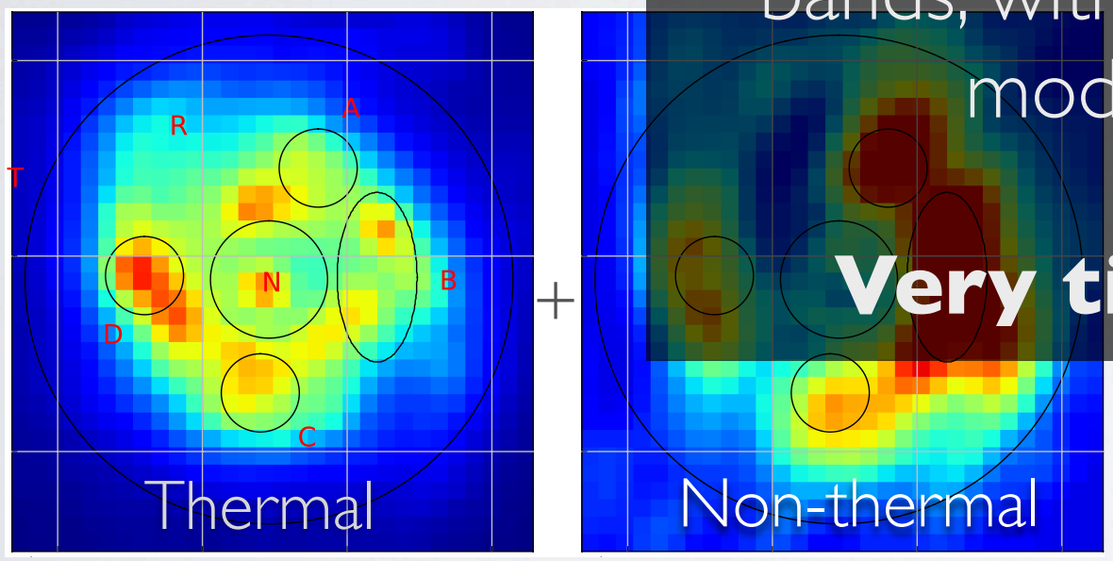

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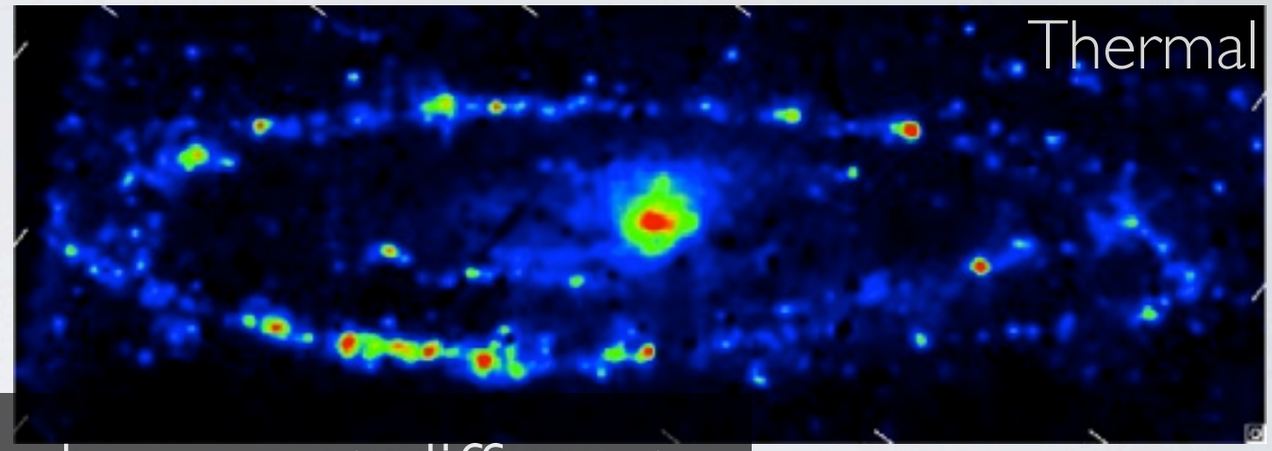
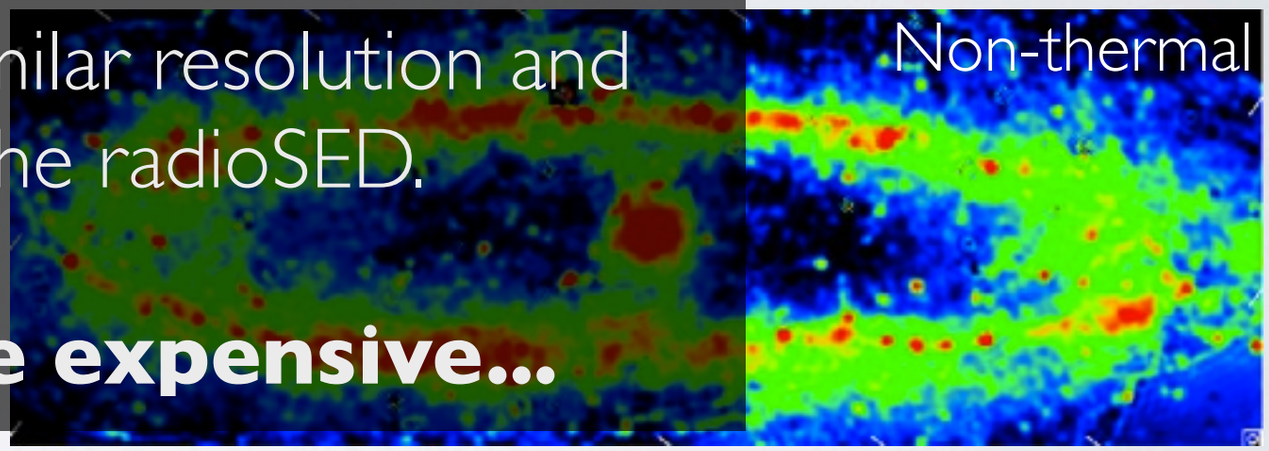




Alternative: To observe at different bands, with similar resolution and model the radioSED.

Very time expensive...

(Tabatabaei et al. 2013)

(Herrero-Illana et al. 2014)
(Xu et al. 2015)

THE SKA REVOLUTION IN NEARBY GALAXIES

With ~4 hours per target, SKA1-MID will obtain the complete 1.6 - 10GHz continuum at μJy sensitivity

SKA will isolate key phases of SF:

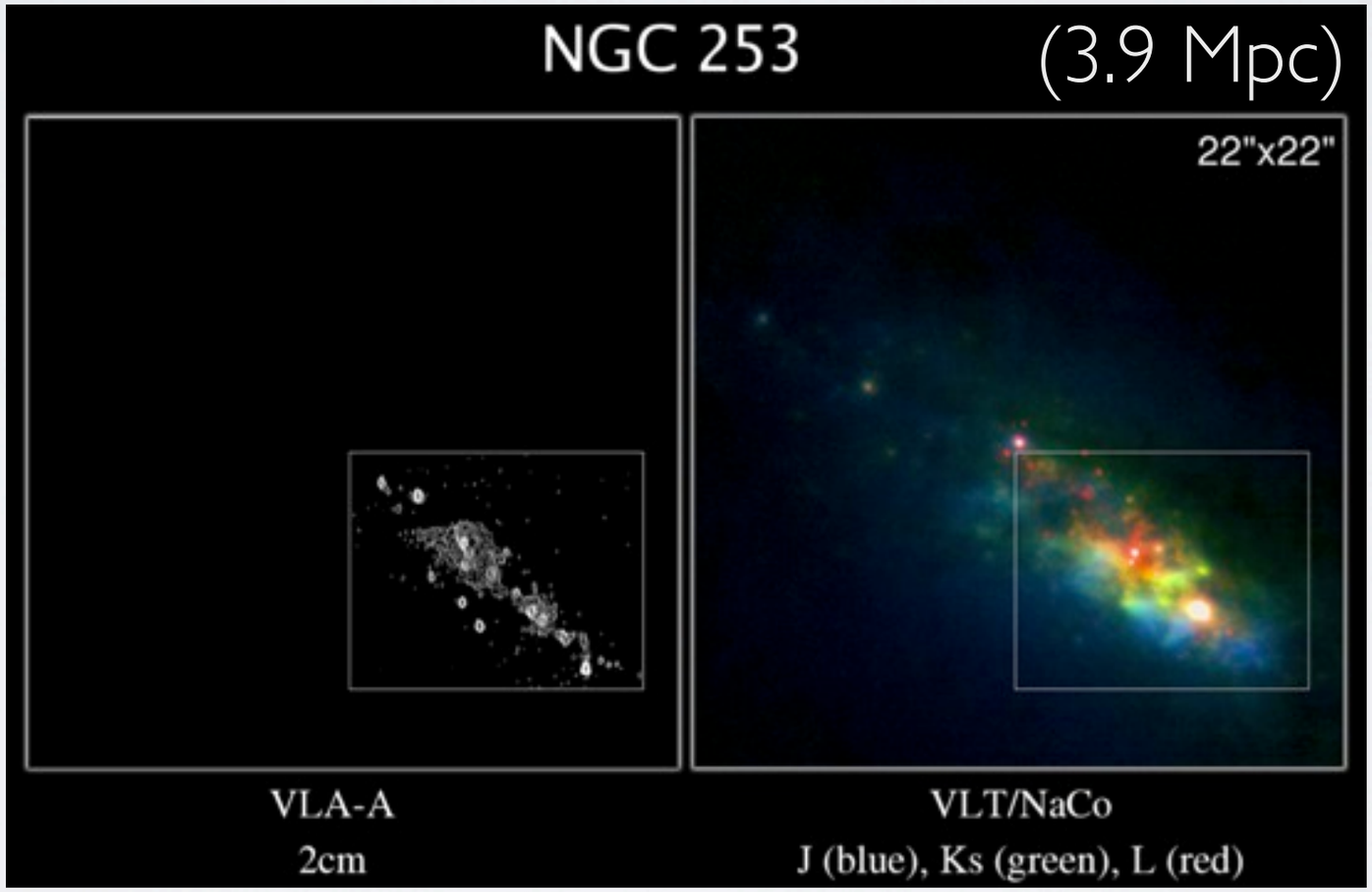
Super Star Clusters

SNe & SNR

Constrains & Calibration of other tracers

SUPER STAR CLUSTERS

- Currently accessible to UV, optical & near-IR, but hampered by dust.
- Radio: Limited angular resolution.



(Ulvestad & Antonucci, 1997)

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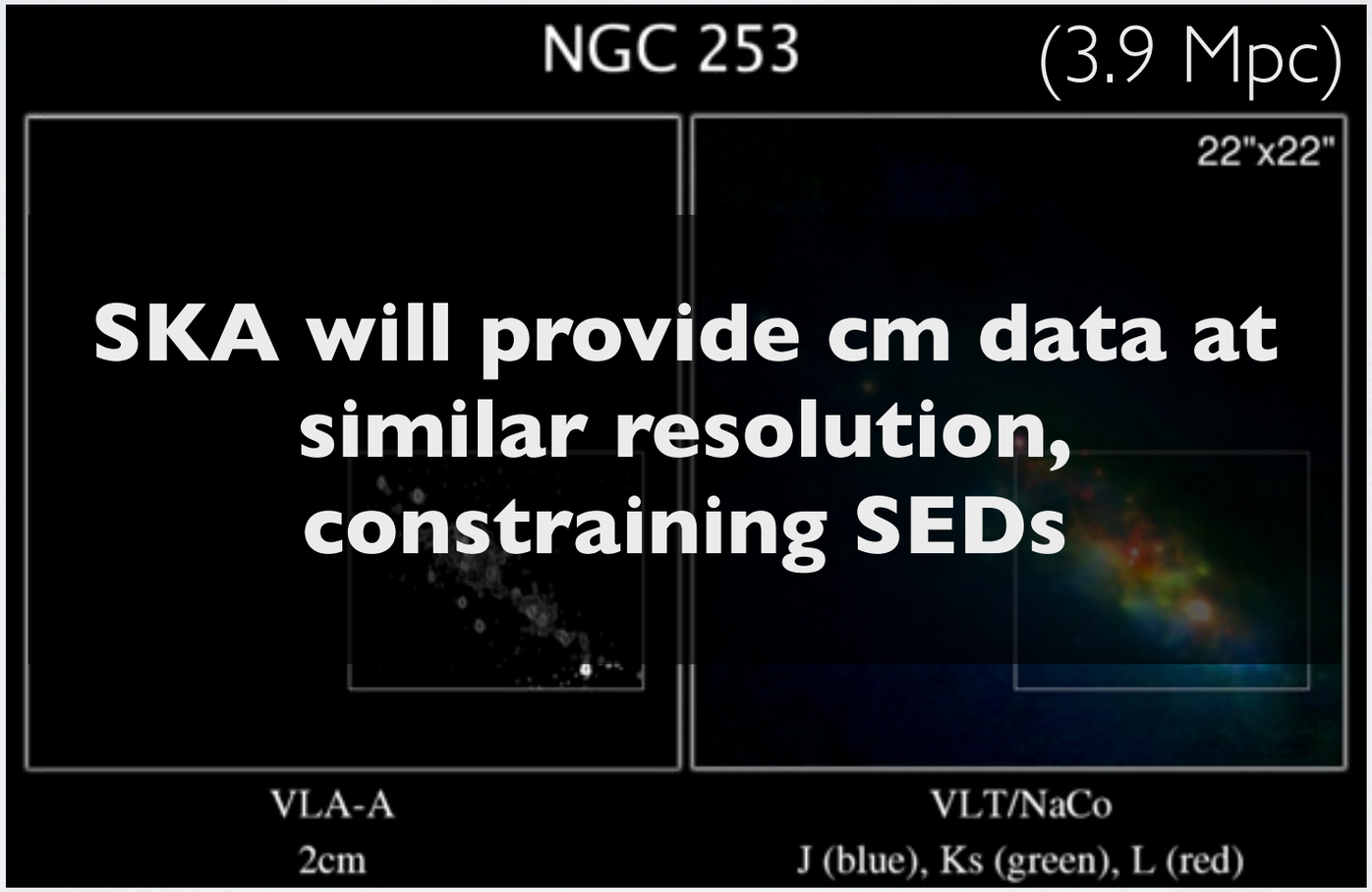
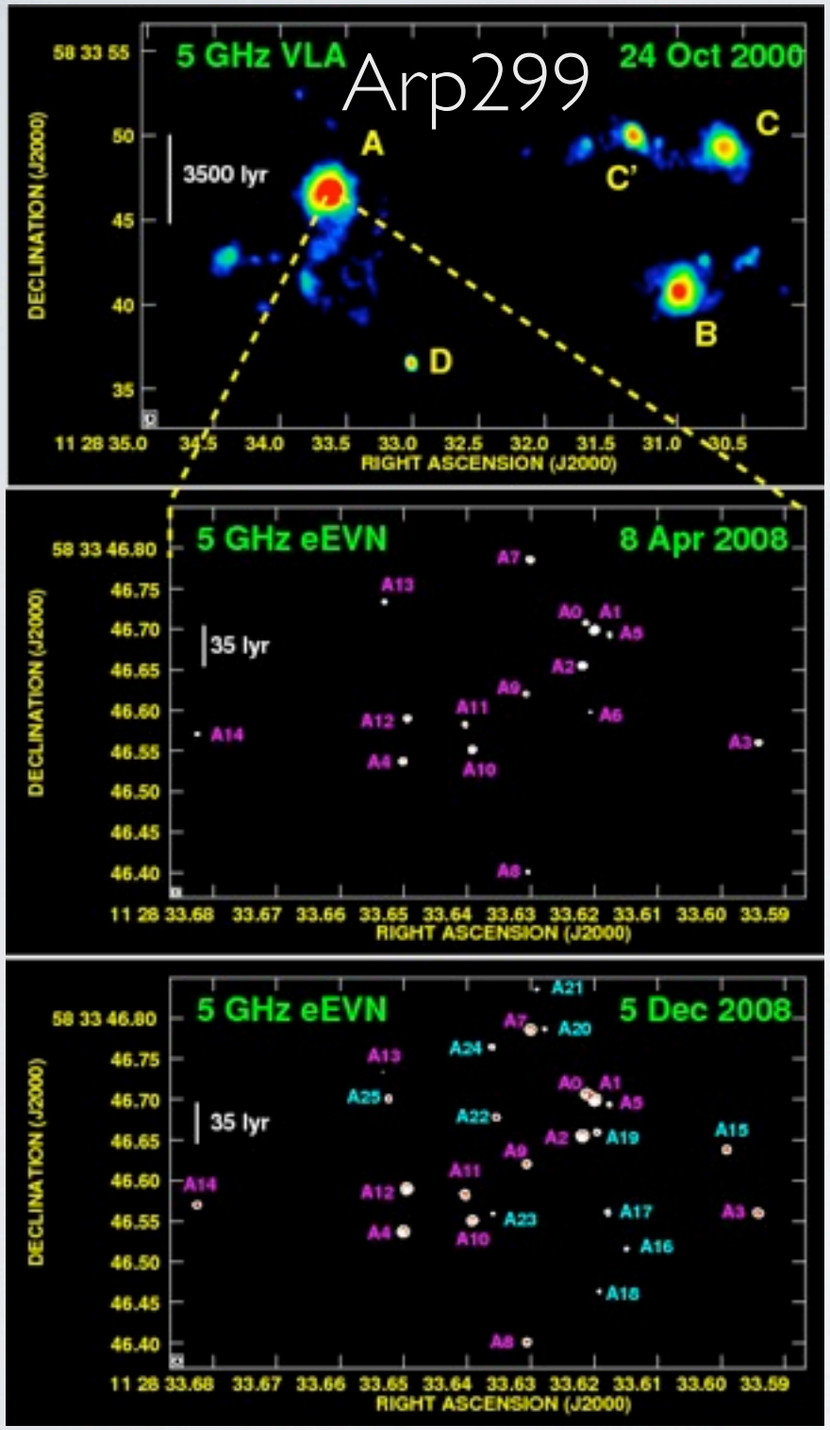
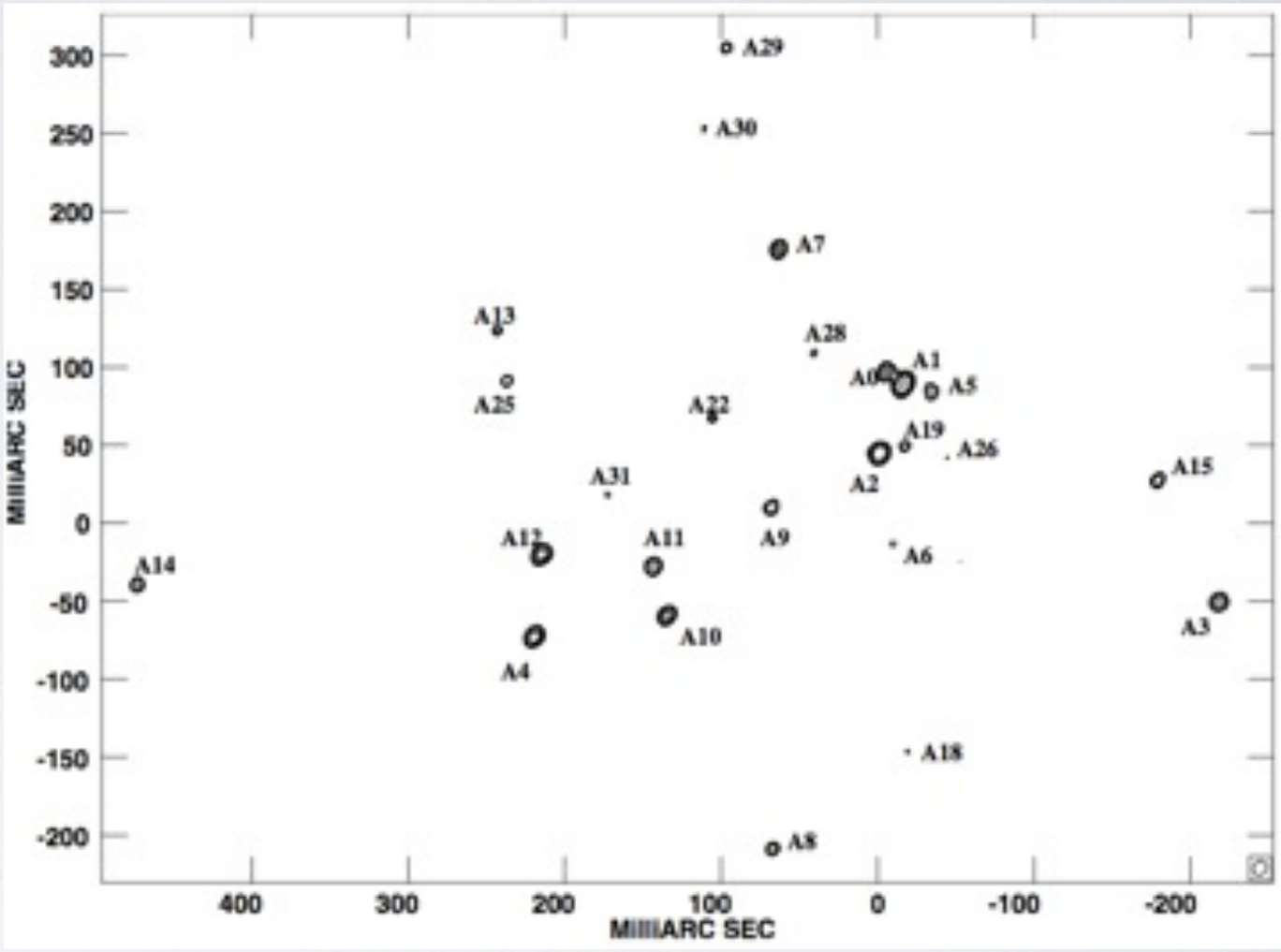


(Ulvestad & Antonucci, 1997)

SUPERNOVAE

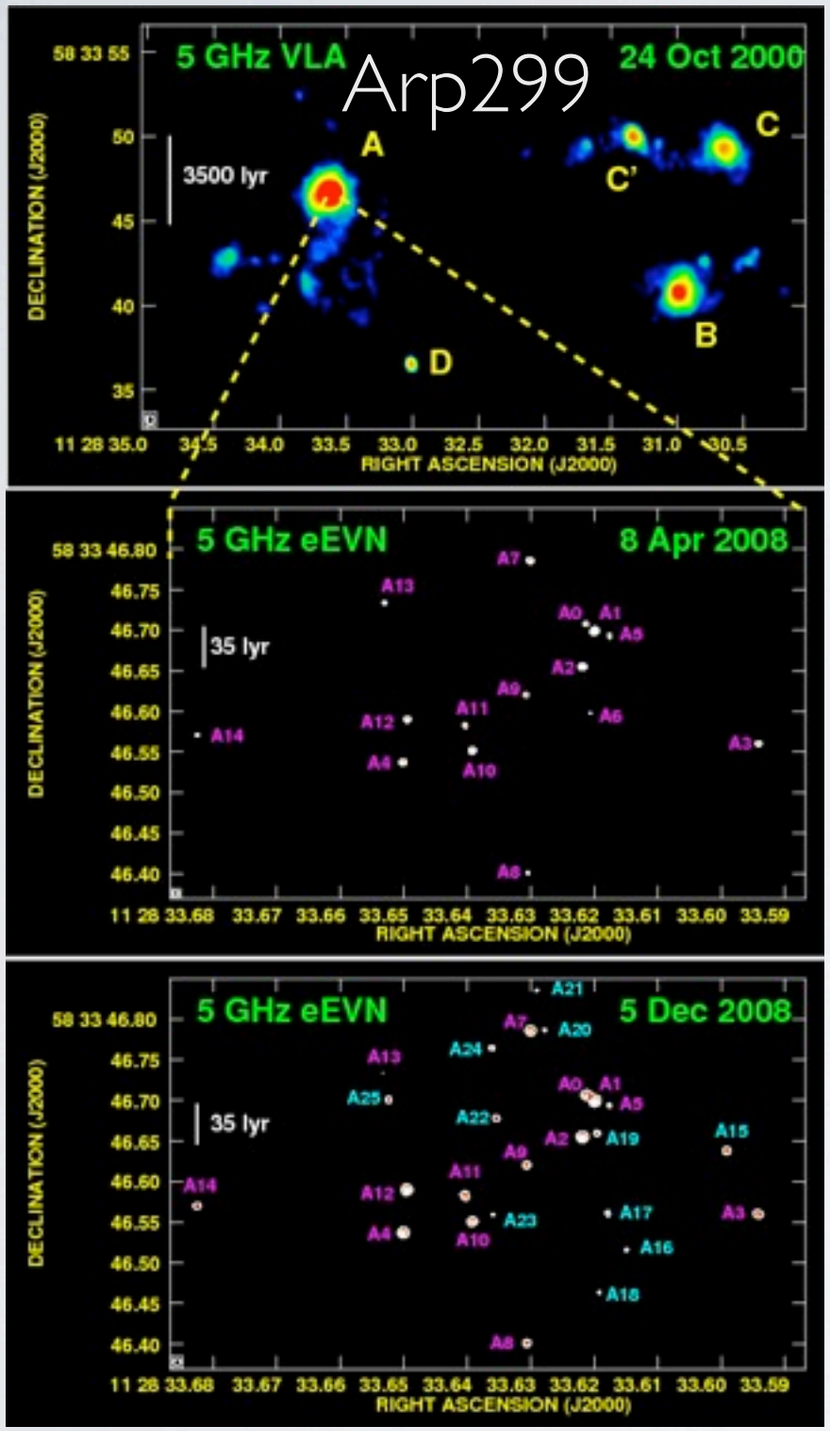


(Pérez-Torres et al. 2009)



(Bondi et al. 2012)

SUPERNOVAE



(Pérez-Torres et al. 2009)

Full SKA: 10mas @ 1.67GHz

Detect much fainter SNe/SNR populations in reasonable time.

Study evolution

Test SN/ISM interaction models

BOTTOM LINES

Large area surveys will obtain high sensitivity observations of all accessible local galaxies, spanning a complete range of type and SF.

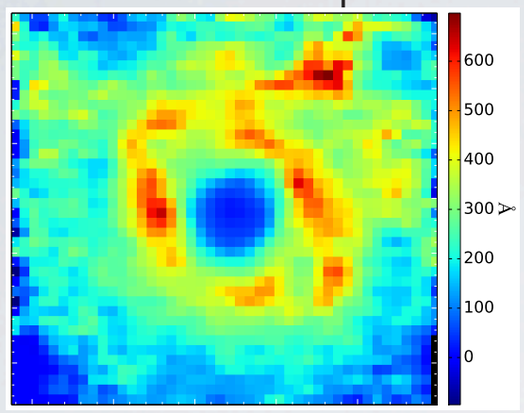
Synergies with current instrumentation.

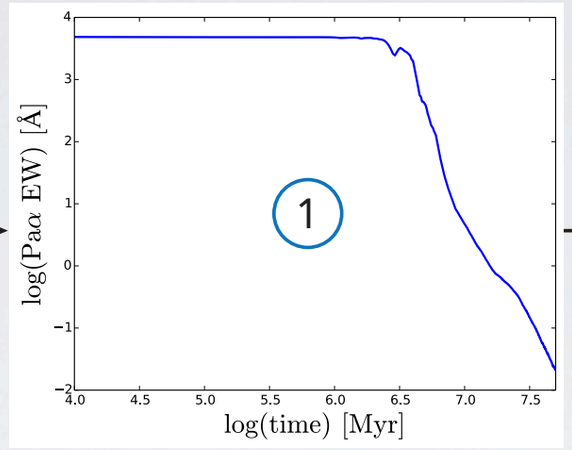
Constrains on the physical mechanisms that power star formation

Thank
you!

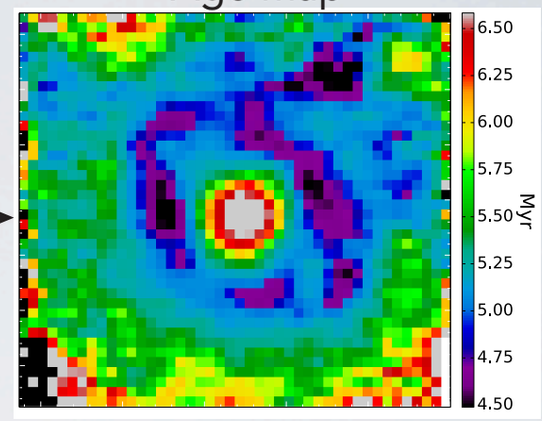
EXTRA SLIDE

Paα EW map

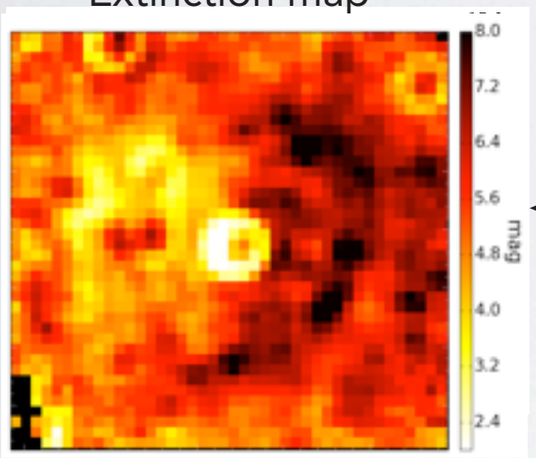


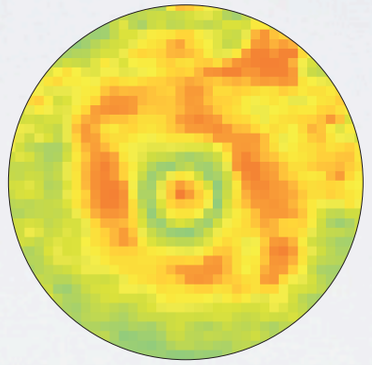


Age map

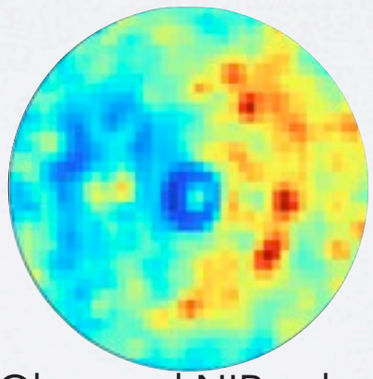


Extinction map

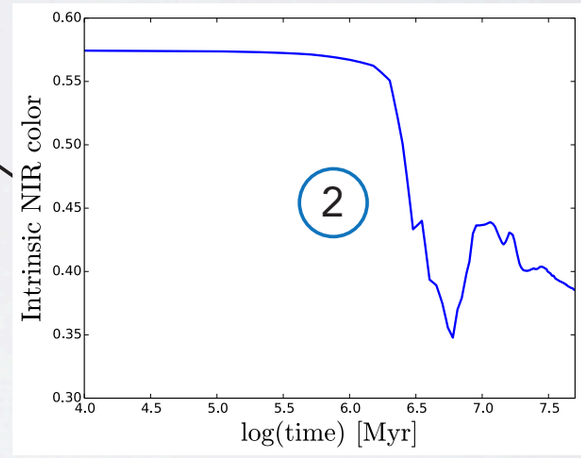




Intrinsic NIR color



Observed NIR color



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