The Connection between Molecular Gas and Star Formation in XUV Disks

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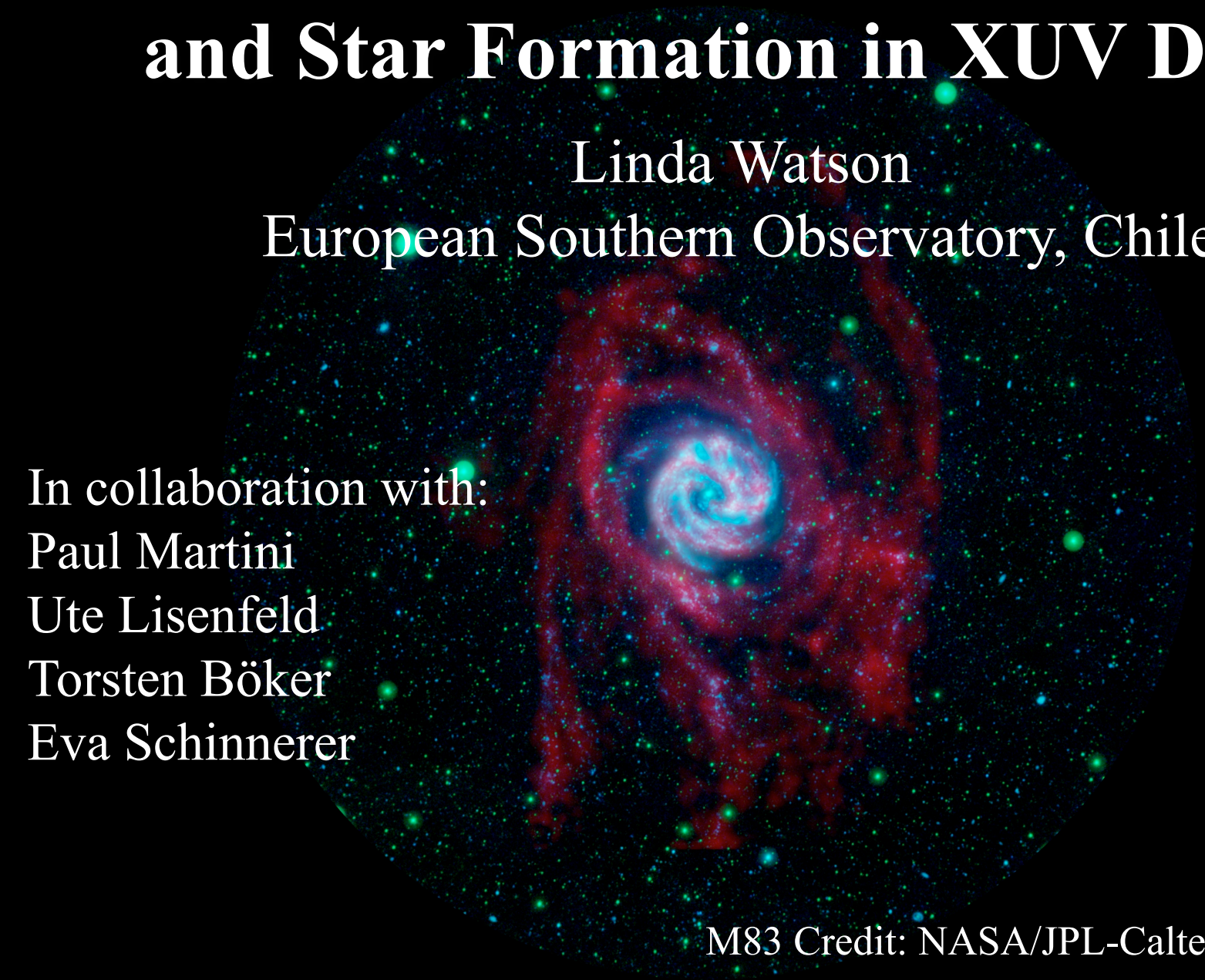

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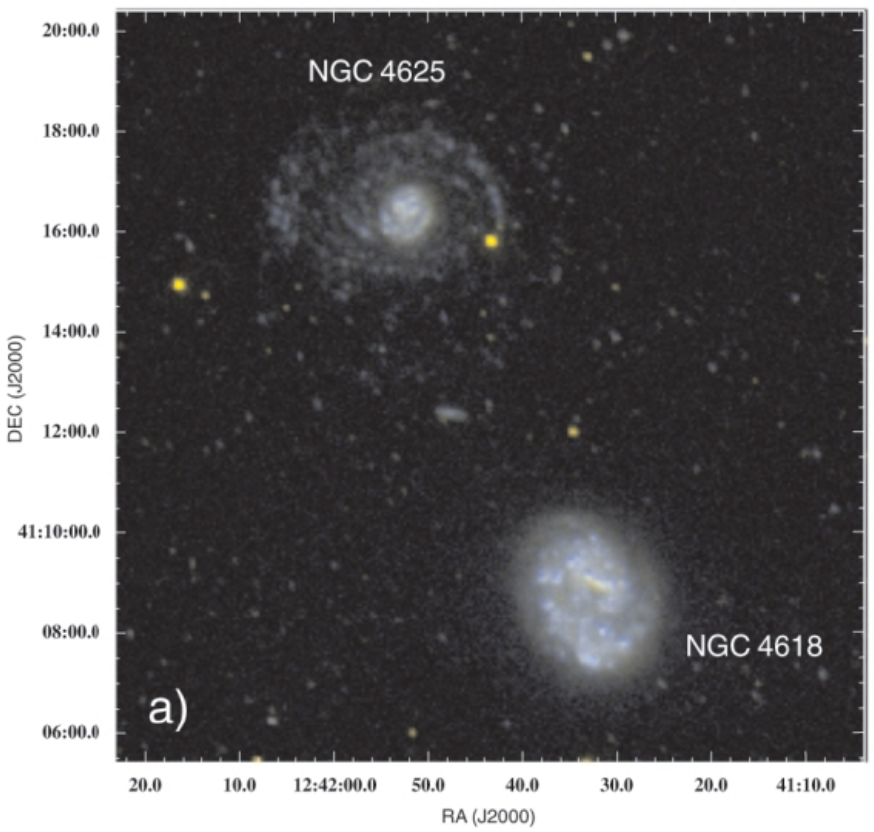
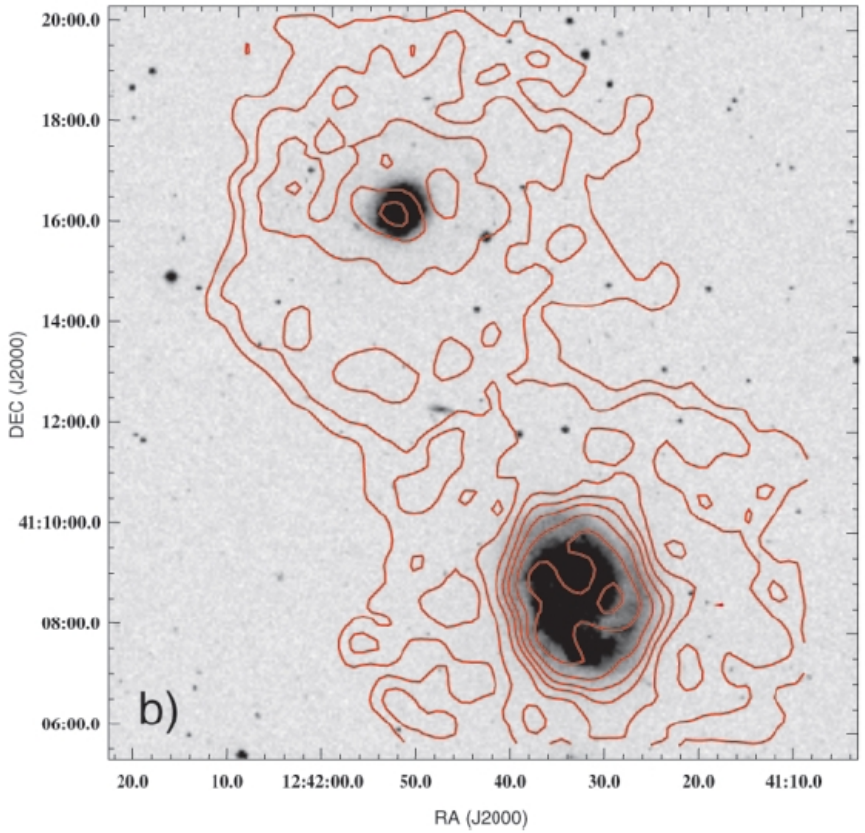
Ute Lisenfeld
Torsten Böker
Eva Schinnerer

M83 Credit: NASA/JPL-Caltech/VLA/MPIA

Extended Ultraviolet (XUV) Disk Galaxies



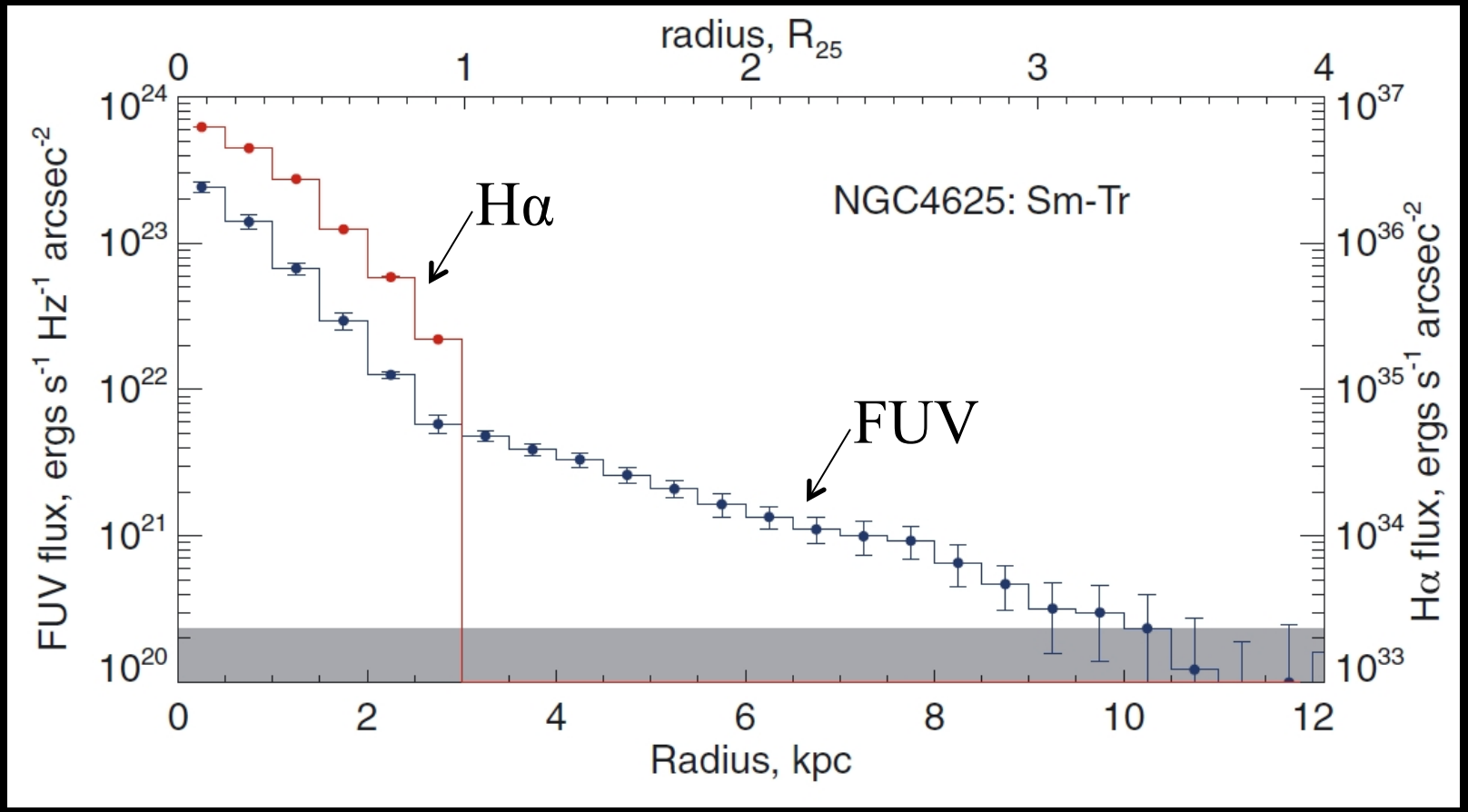


FUV + NUV

Optical + HI contours

Gil de Paz et al. (2005)

Extended Ultraviolet (XUV) Disk Galaxies



Goddard et al. (2010)

- Potential causes: aging of stellar populations, stochasticity, variation in IMF, leakage of ionizing photons

Motivation

- Where do the star forming regions in XUV disks lie relative to the Kennicutt-Schmidt law?
- Which star formation rate tracer correlates best with the molecular gas density?
- What is the evolutionary state of XUV disk star forming regions?

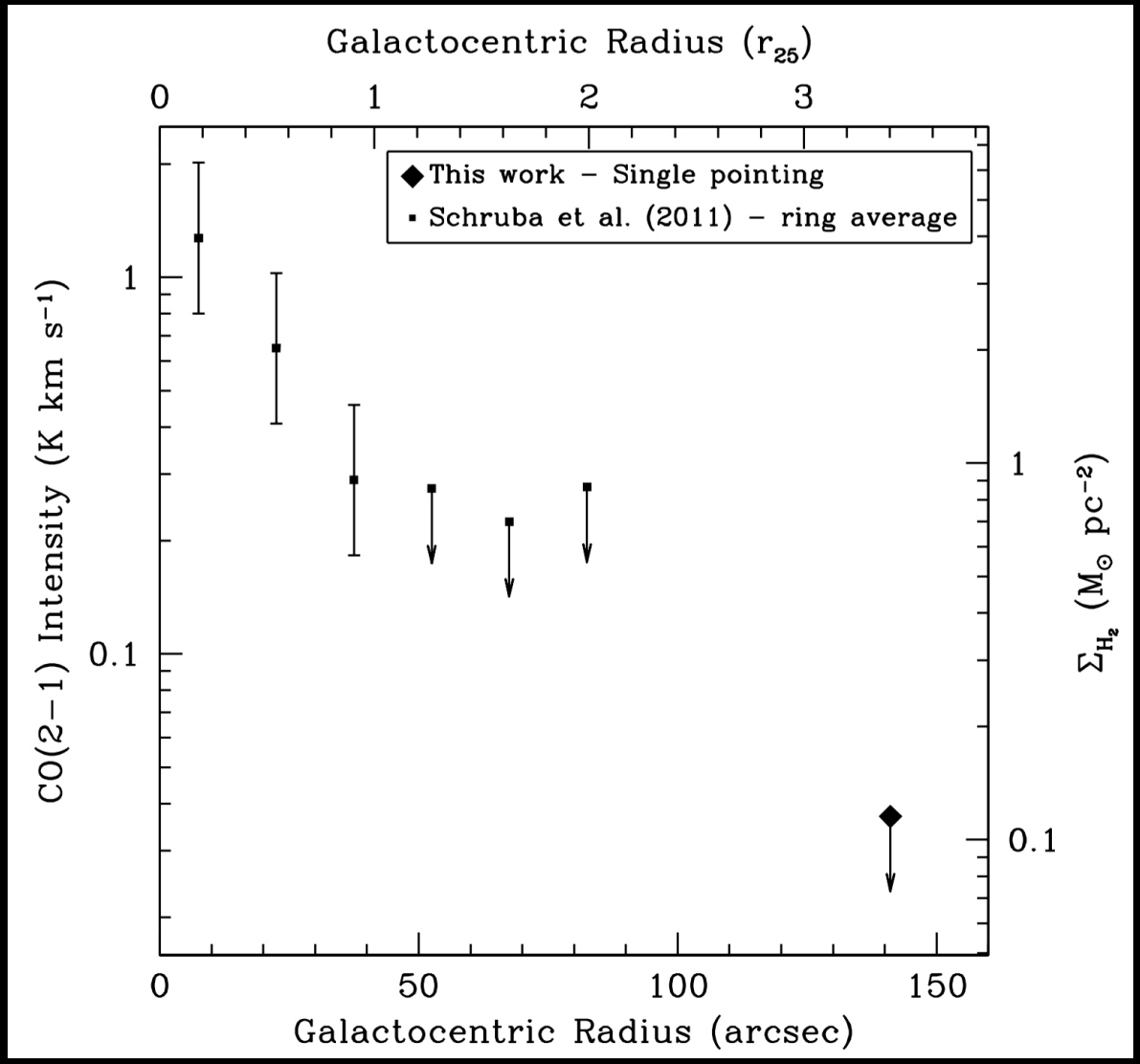
The Data

- Deep IRAM 30m CO(1-0) and CO(2-1) observations of star forming region in XUV disk of NGC 4625 (single pointing)
  - Non-detection

- Published CO data for star forming regions in outer disk of NGC 6946 (Braine et al. 2007)

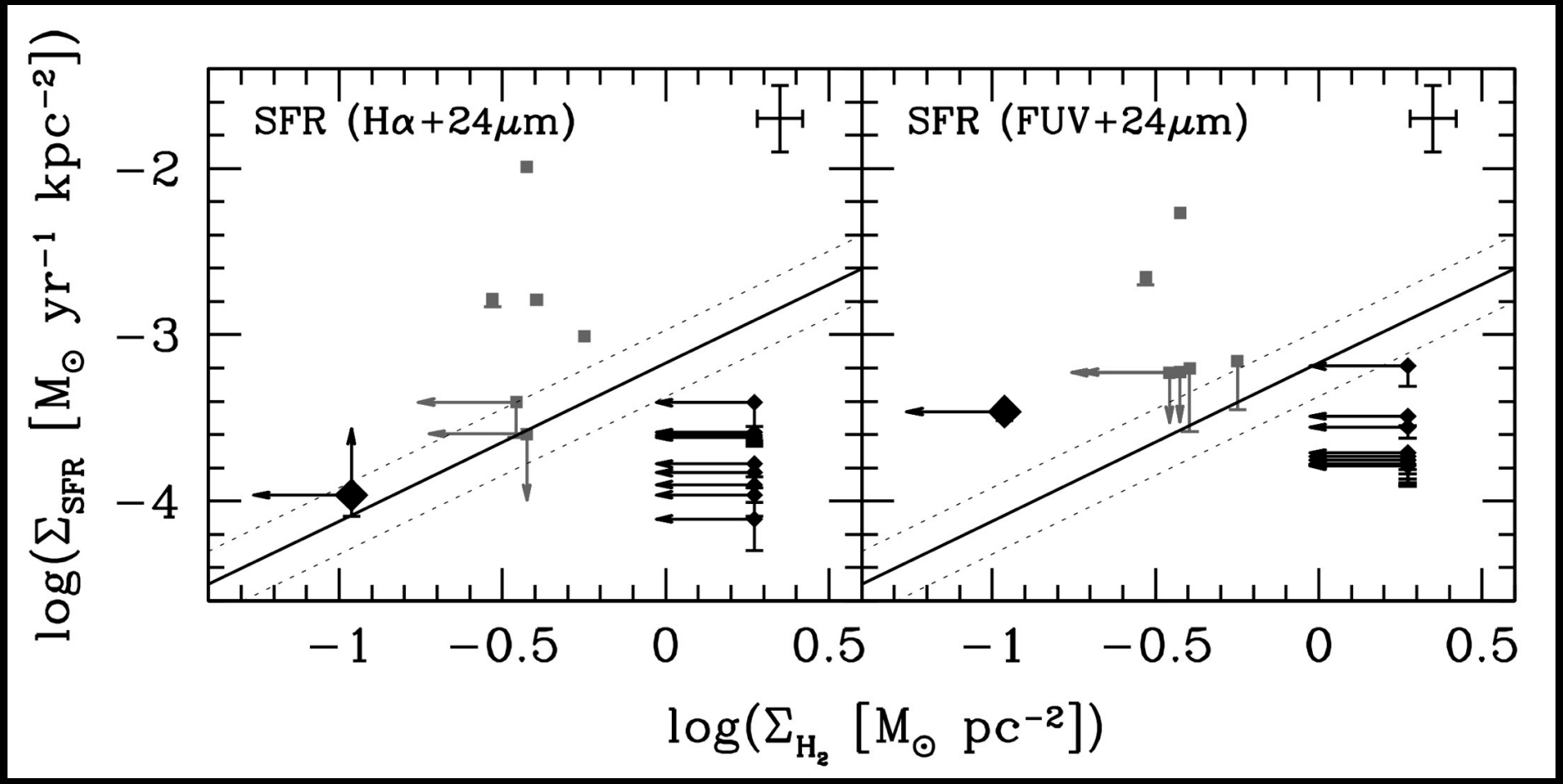
- Published SFR images
  - FUV from NGS (Gil de Paz et al. 2007b)
  - Hα from LVL (Kennicutt et al. 2008)
  - 24 μm from SINGS (Kennicutt et al. 2003)

Deep CO Upper Limit at $r = 3.4r_{25}$



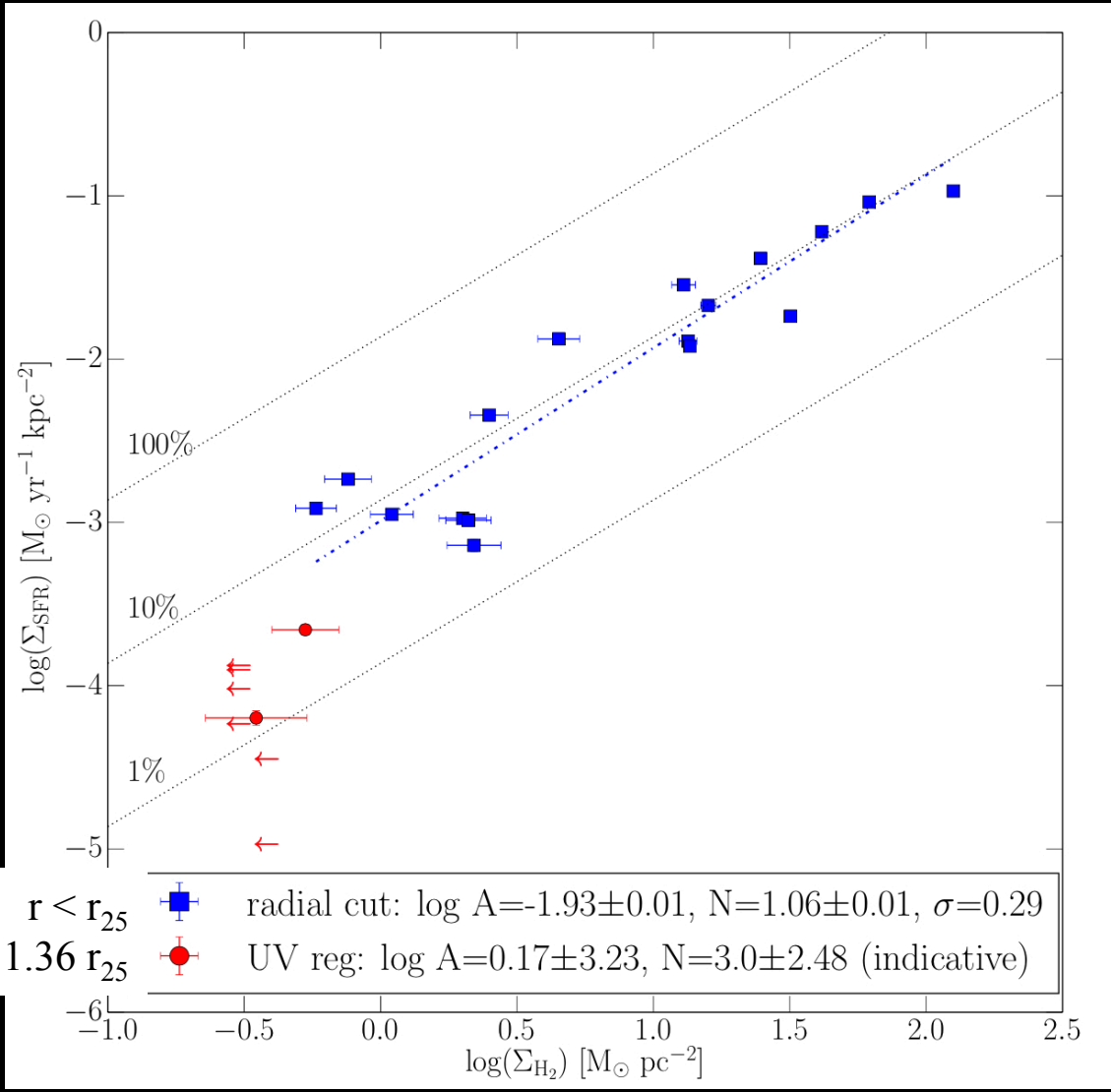
Watson et al. (2015, submitted)

XUV Regions are Consistent with the Molecular-Hydrogen Star Formation Law



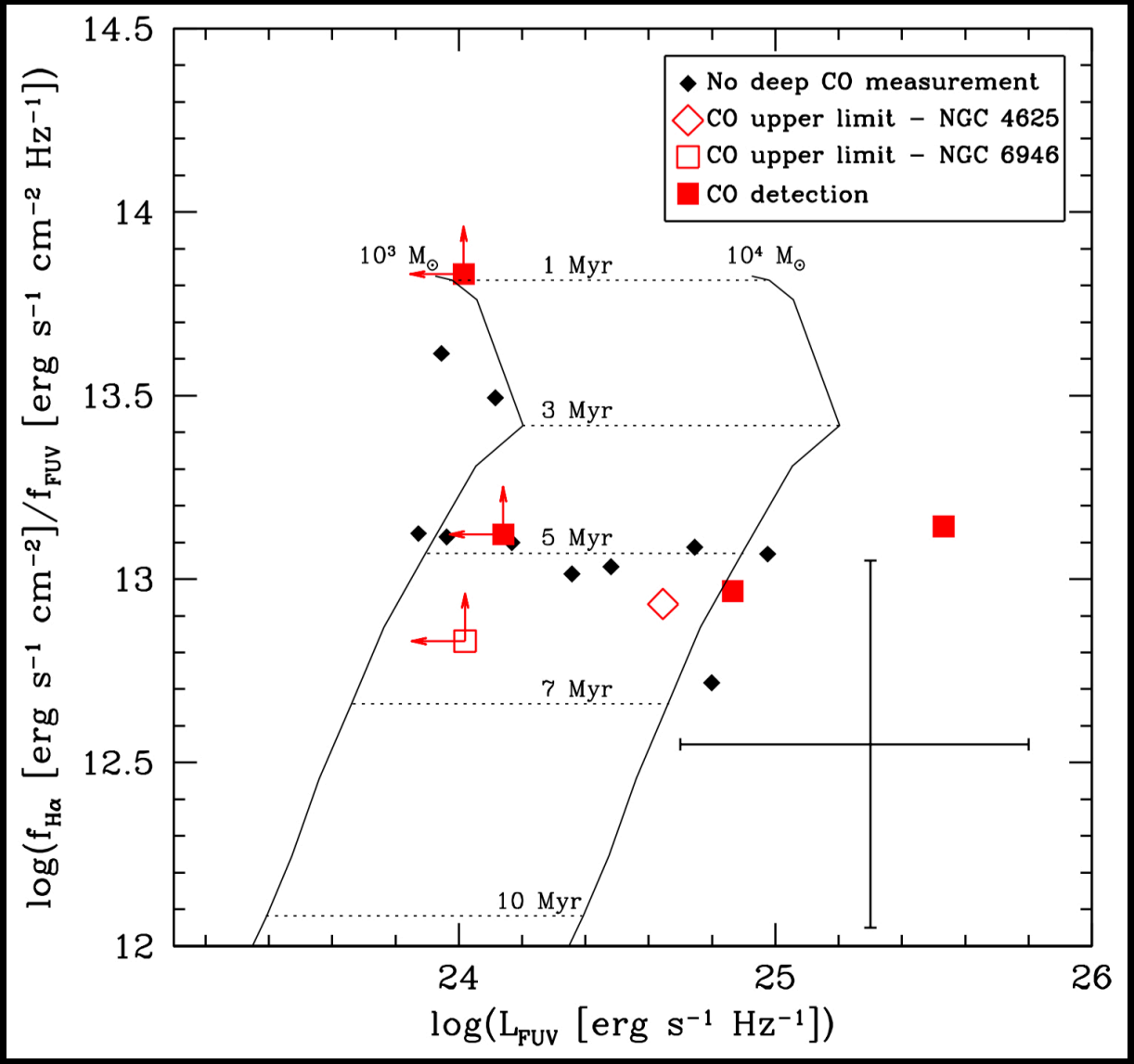
Watson et al. (2015, submitted)

Low SFE in Regions in XUV Disk of M63



Dessauges-Zavadsky, Verdugo, Combes & Pfenniger (2014)

No Correlation between Age and CO Detection Rate



Watson et al. (2015, submitted); see also Goddard et al. (2011)

Summary – Star Formation in XUV Disks

- Star forming regions in the XUV disks of NGC 4625 and NGC 6946 are in general consistent with the same Kennicutt-Schmidt law that applies within optical disks
- Star formation rates based on FUV+24μm and Hα+24μm both produce results consistent with the star formation law
- The star forming regions have ages between 1-7 Myr
- Molecular gas measurements may help distinguish between aging versus stochasticity

NGC 4625 FUV

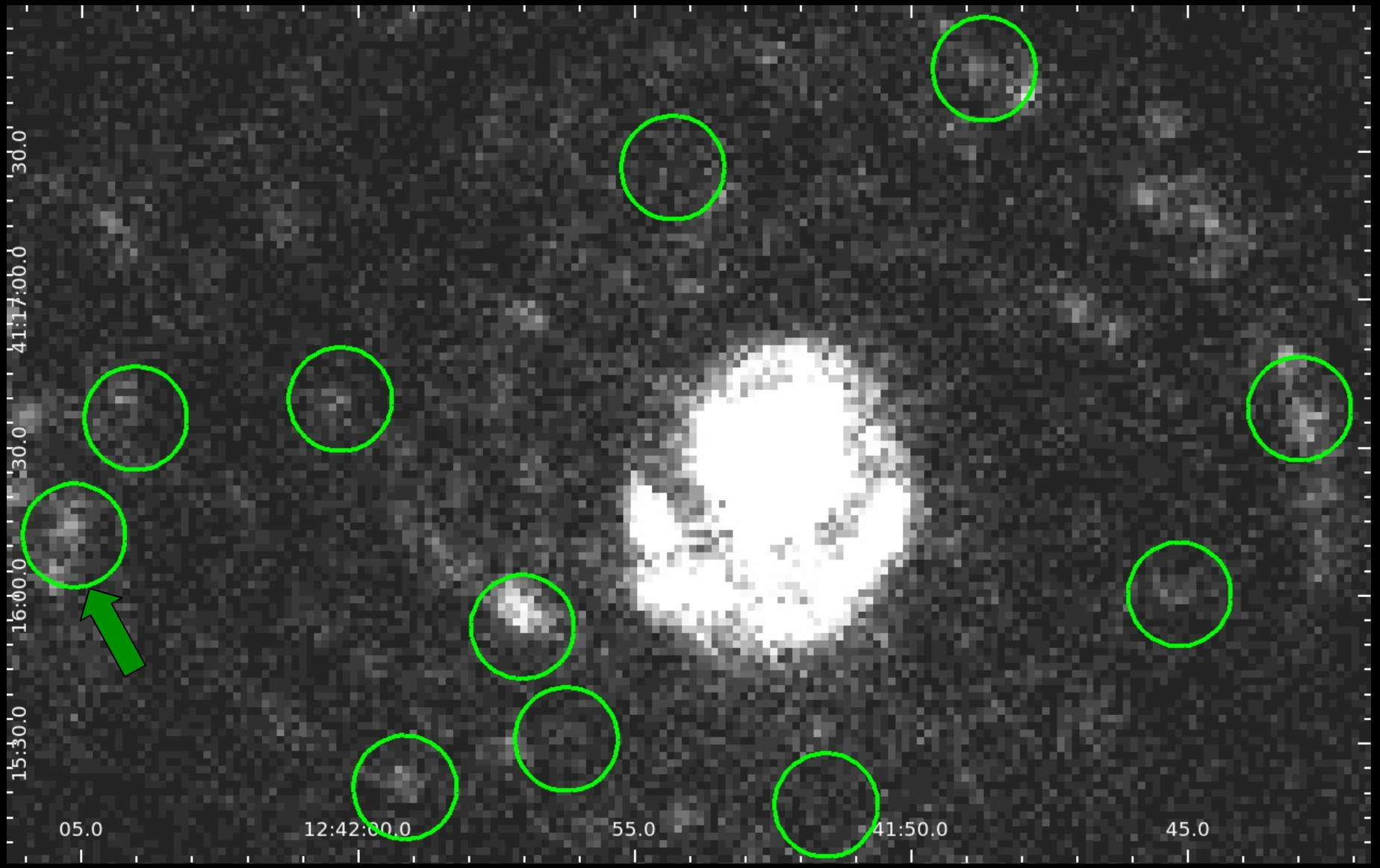
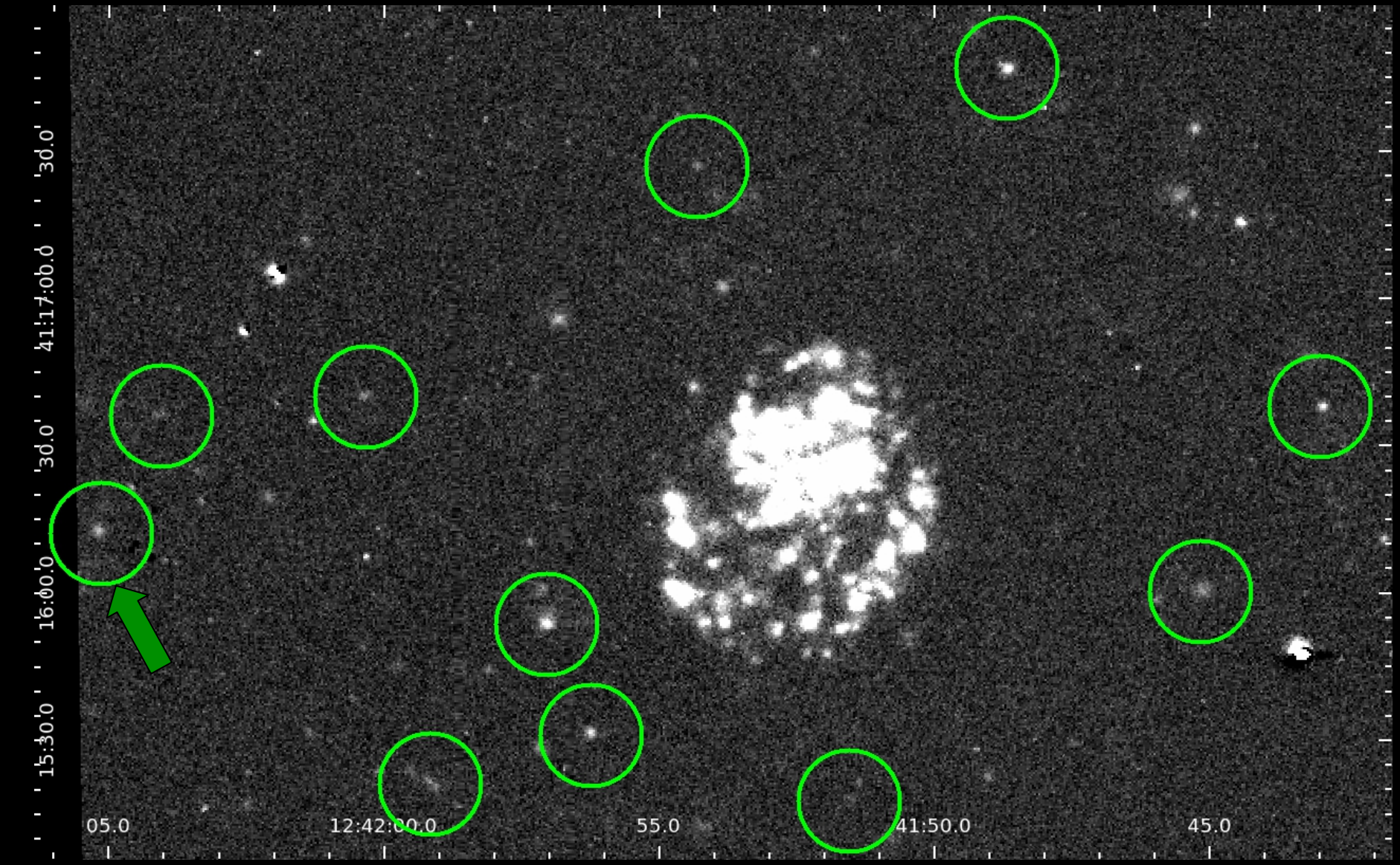


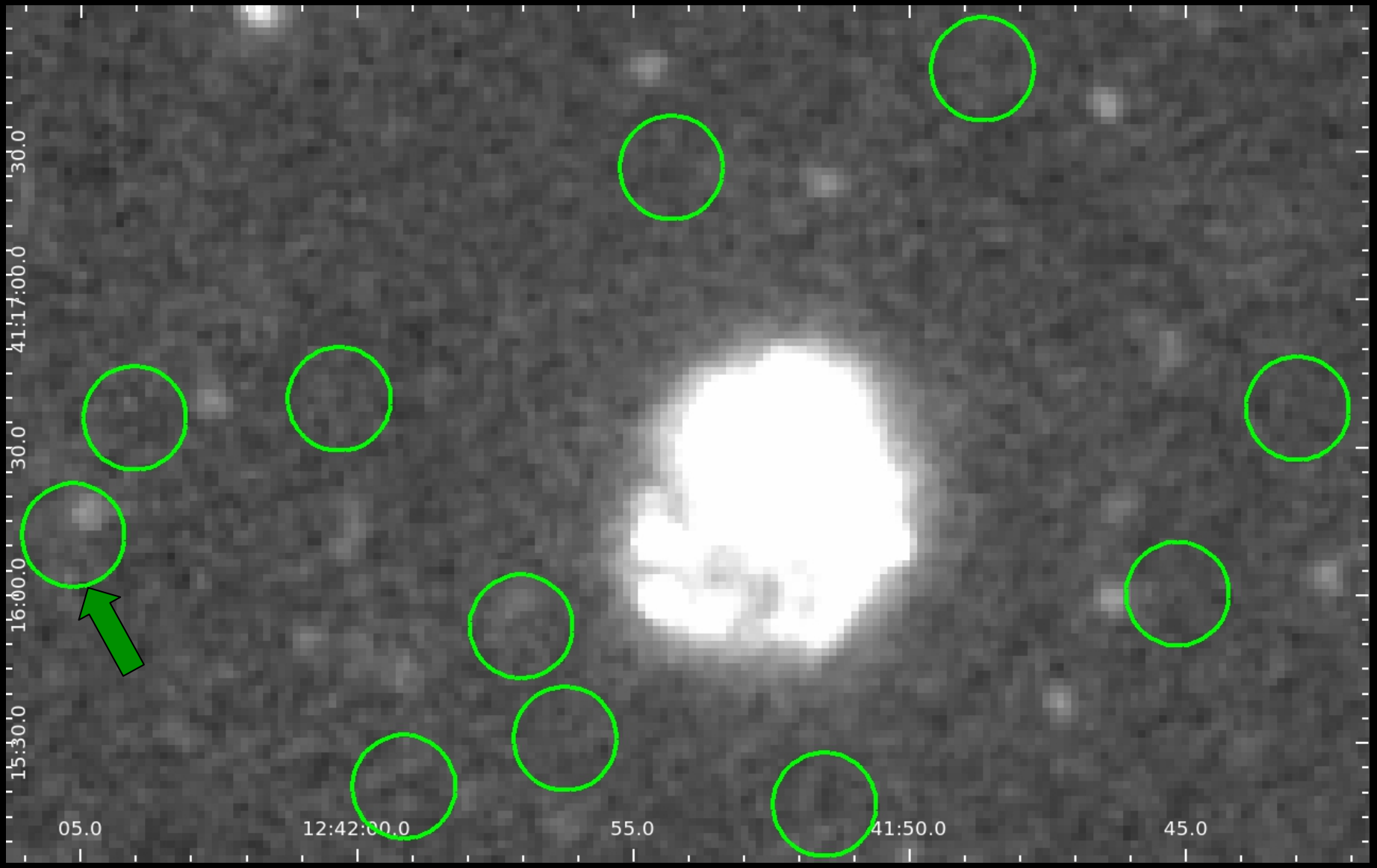
Image from Gil de Paz et al. (2007b)
Regions selected in Gil de Paz et al (2007a)

NGC 4625 Hα



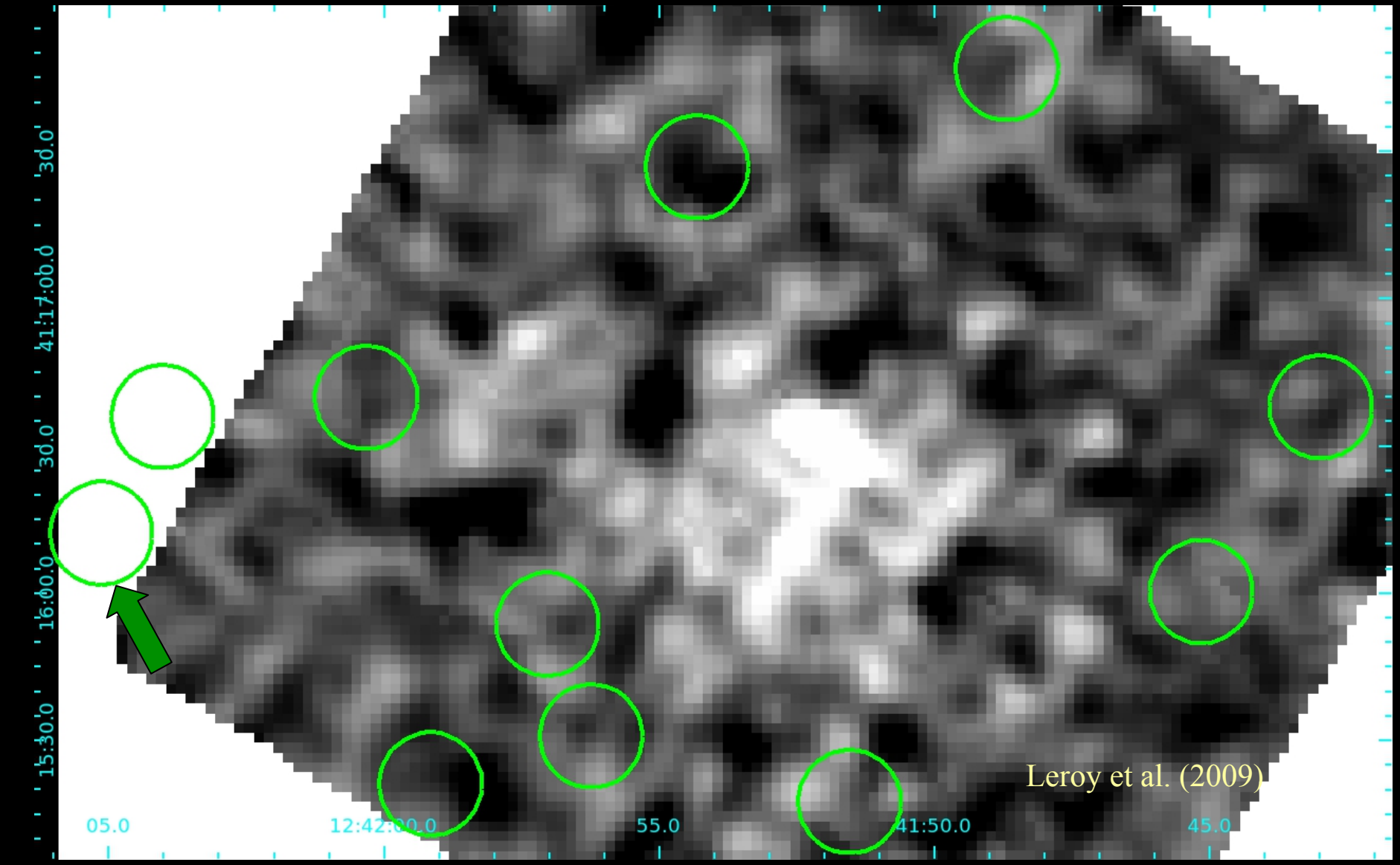
Kennicutt et al. (2008)

NGC 4625 24μm



Kennicutt et al. (2003)

NGC 4625 CO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Leroy et al. (2009)