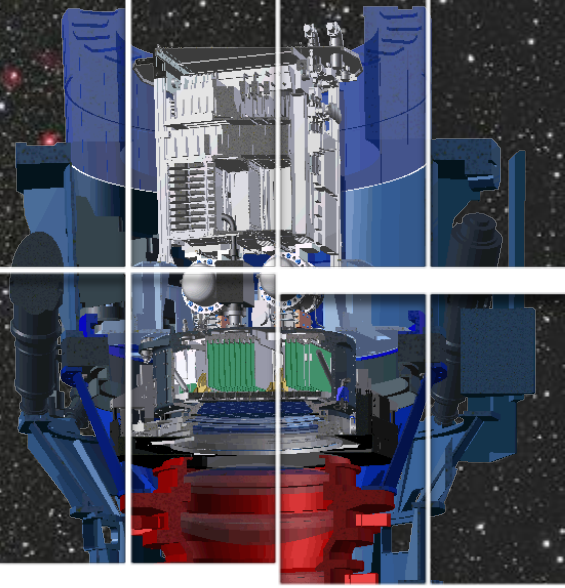
局所銀河群で探る銀河進化：矮小不規則銀河NGC6822

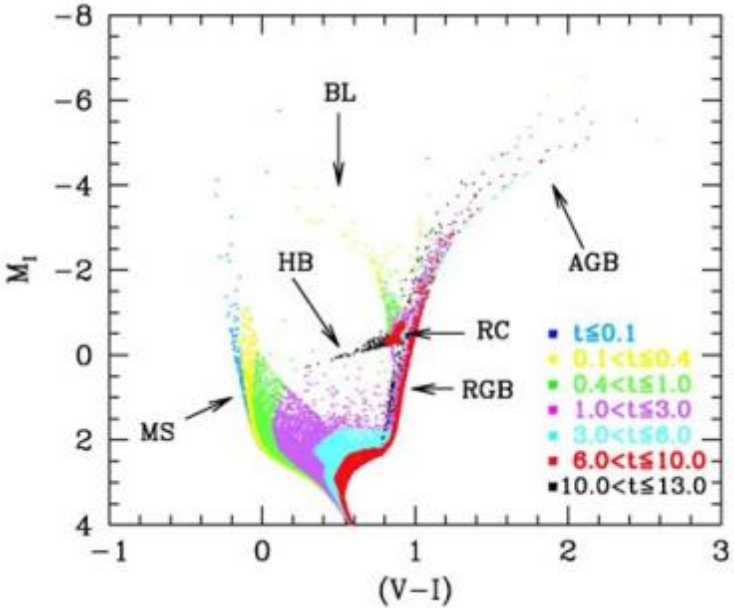


国立天文台
小宮山　裕

第3回銀河進化研究会　2016/6/2

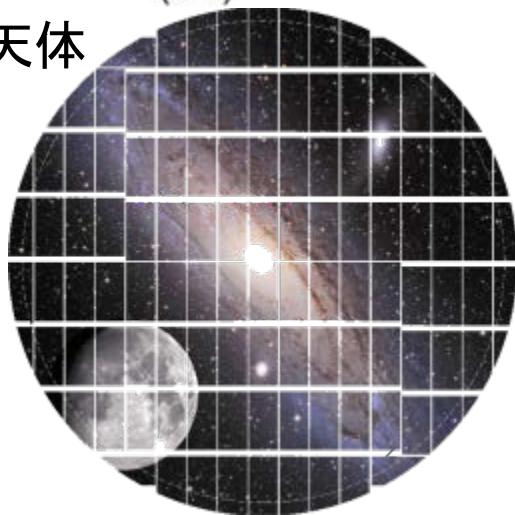
局所銀河群で探る銀河進化

- 近傍銀河＝育ってしまった銀河
- だがその進化の歴史を内包している
- 近くにいるため、多波長に渡って情報が豊富
  - 星 → Star Formation History, Chemical Evolution
  - ガス → Current Star Formation
  - 分光 → Abundance, Dynamics



- 矮小銀河＝大きな銀河の’building block’
- 特に興味深い矮小不規則銀河
  - MW,M31等の大きな銀河と孤立した環境
  - 現在もガスを保持し、星生成を行っている

→ 銀河というシステムの進化を研究するうえで格好の天体



- Hyper Suprime-Cam (HSC)

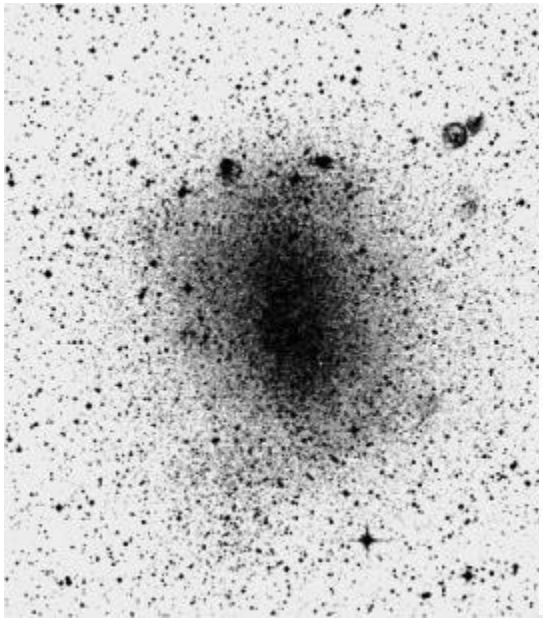
→ 見かけの大きな近傍銀河研究には最適なカメラ

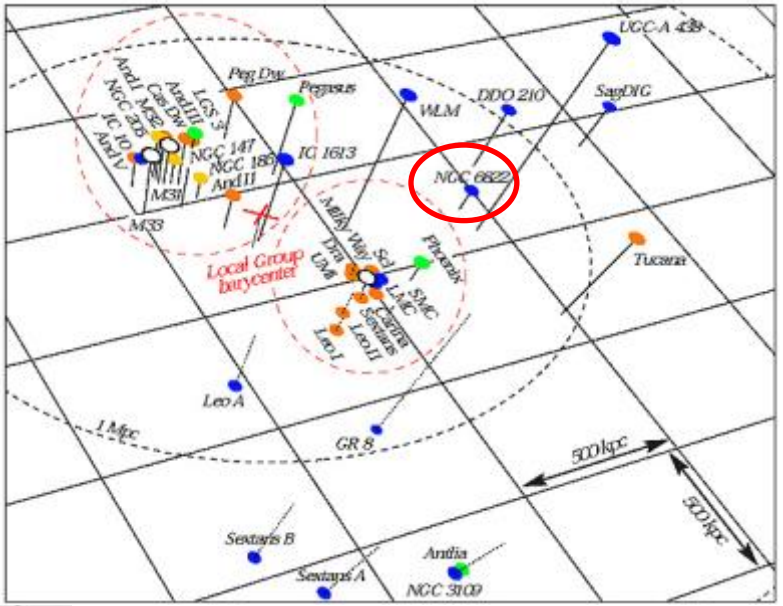
Dwarf Irregular: NGC6822

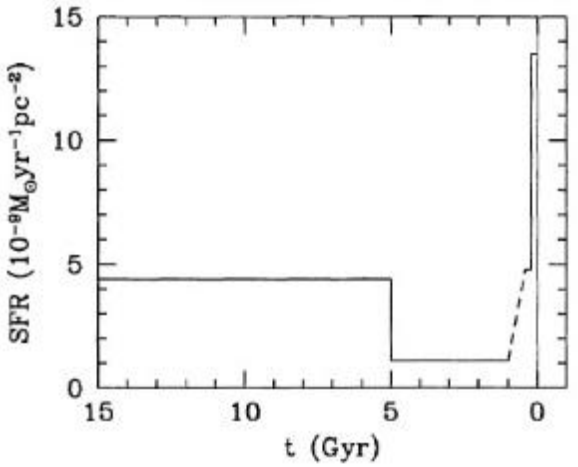
- Star-forming dwarf irregular galaxy at the distance of 500kpc.
- Mv = -15.2mag, r_h=354pc (2’.65), M*=10^9Ms, M_HI=1.3x10^9Ms
- Current SFR ~0.01-0.06Ms/yr
- SFH studies show enhanced SFR at 100-200Myr ago (e.g., Gallart et al. 1996)

- Observation by HSC

  → deep broad-band (g, r, i) data, Halpha (NB0656) data are available.

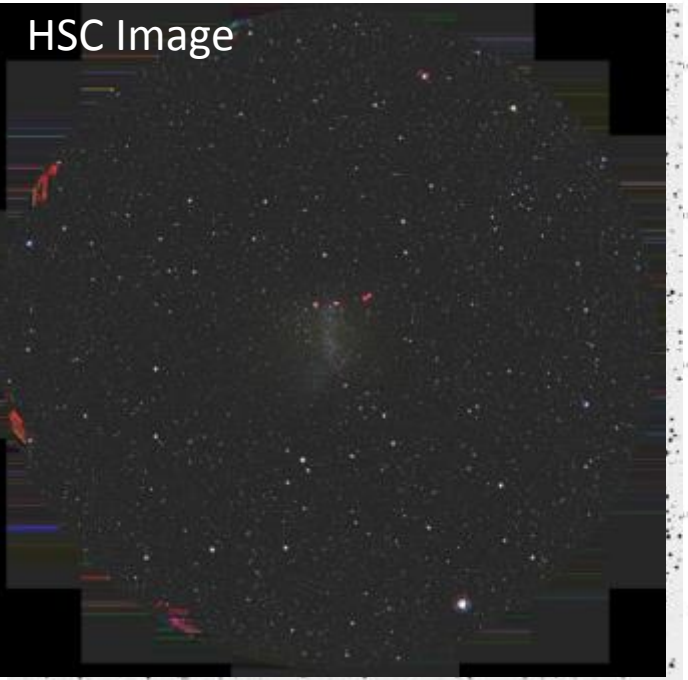


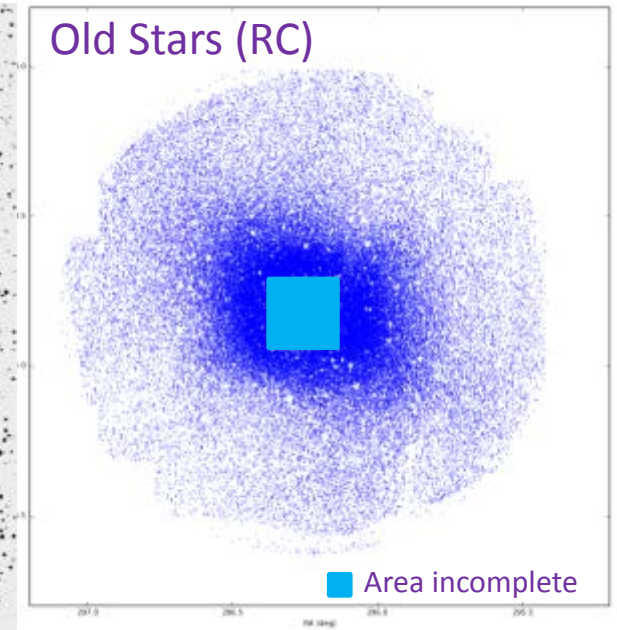


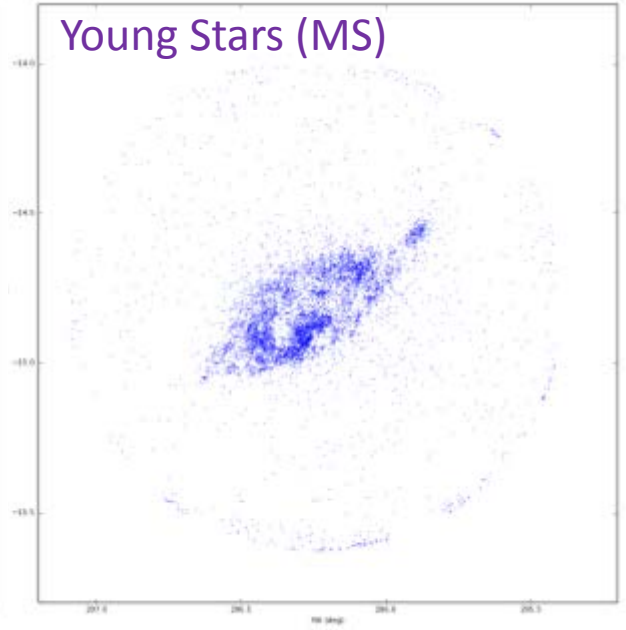


What is known for NGC6822

- Old stars (>>1 Gyr, represented by RGB, RC, C-star) show round and smooth distribution (e.g. Battinelli et al. 2006).
- Young stars (<1 Gyr, represented by MS O~A stars) show elongated distribution (from SE to NW) beyond the main body of NGC6822. The distribution traces the HI distribution very well (e.g., Komiyama et al. 2003).

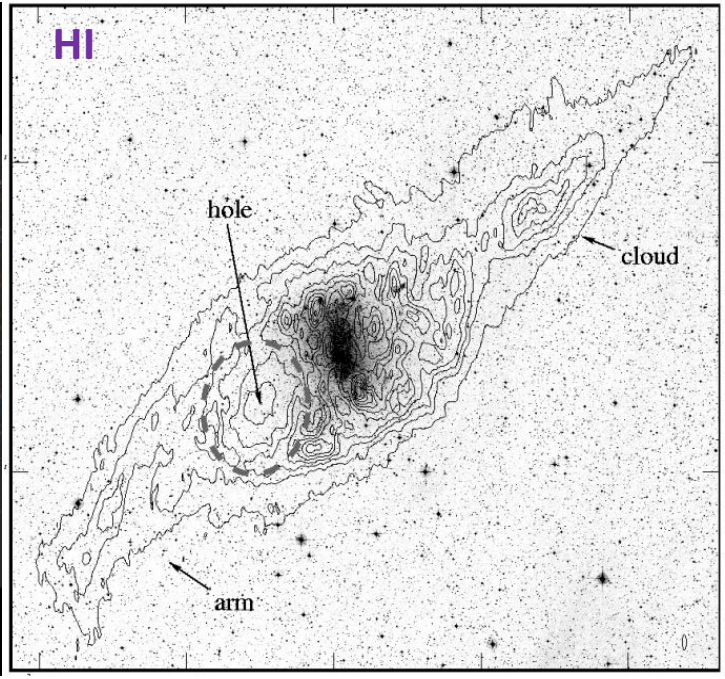




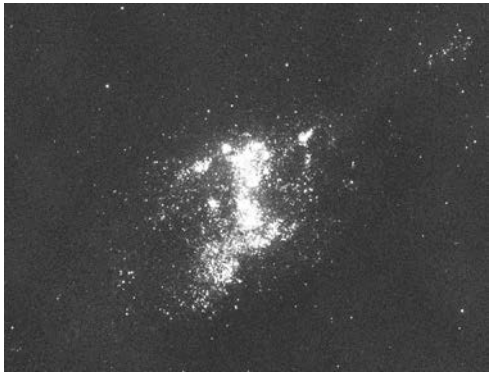


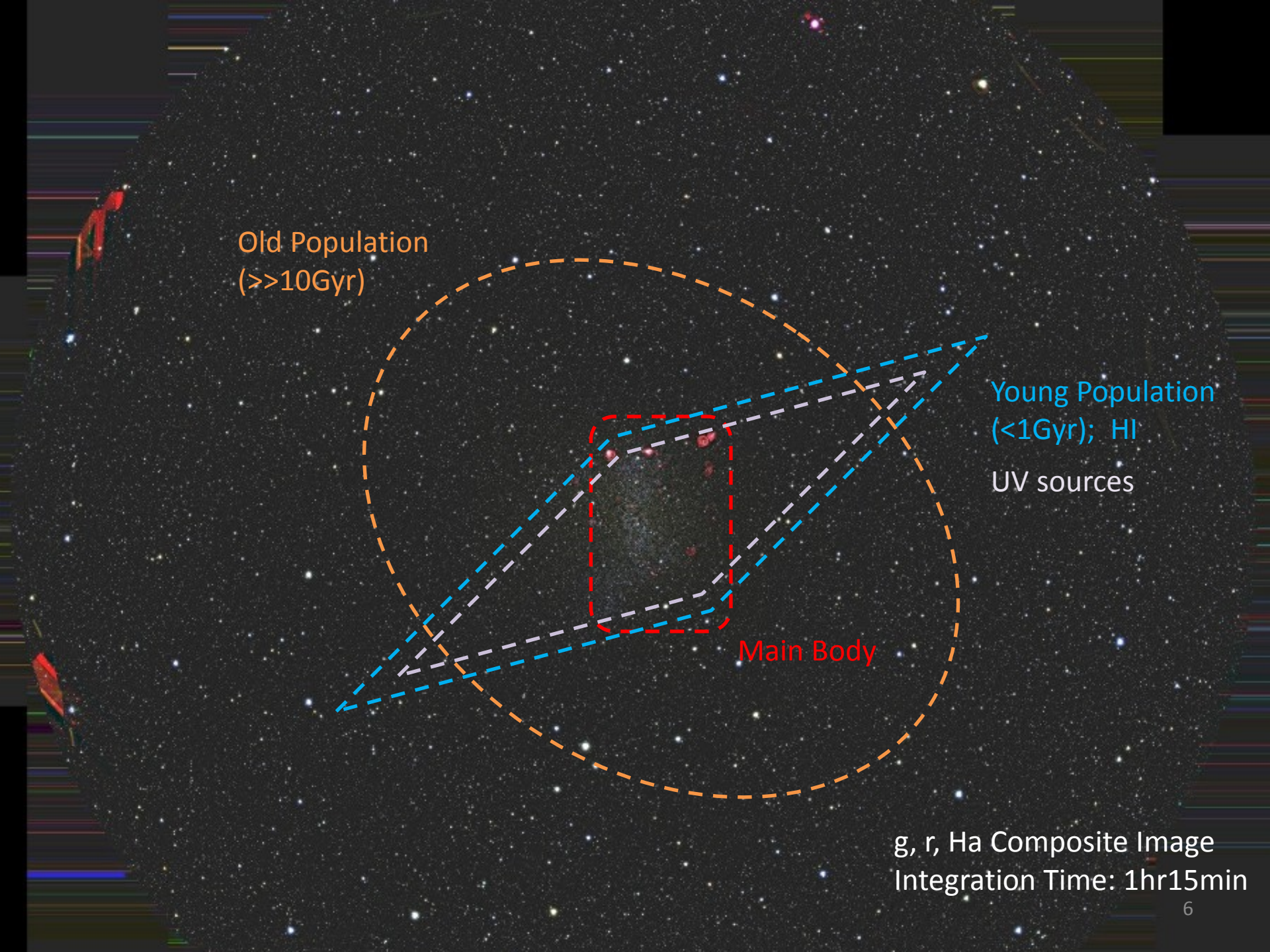
What is known for NGC6822

- HI: elongated distribution, extended beyond R25 (de Blok & Walter 2000)
  - Complex structure with density peak at north-west (NW cloud), extended arm to south-east (SE arm), and giant hole next to the center (hole).
- UV: many sources centered on NGC6822 (Efremova et al. 2011)
  - Less luminous extended structure toward NW-SE direction traces HI and blue star distributions.



GALEX FUV image

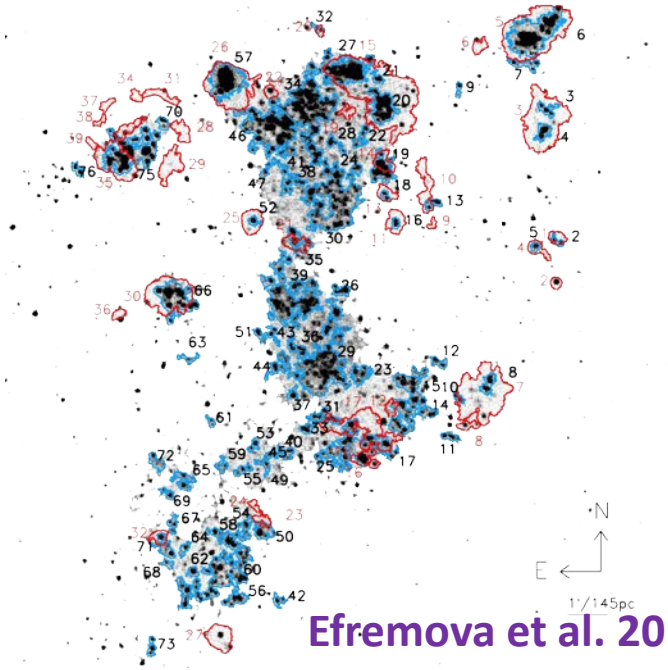



Old Population
(>>10Gyr)
Young Population
(<1Gyr); HI
UV sources
Main Body
g, r, Ha Composite Image
Integration Time: 1hr15min

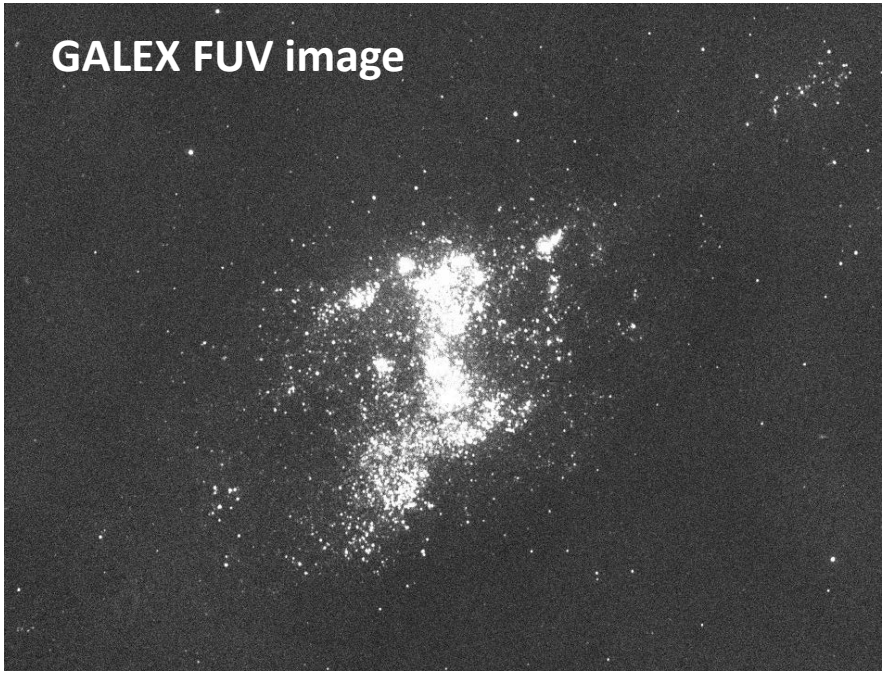
This Study

- Shed light on current star-formation traced by Halpha (and UV)
  - Bright (in Halpha and UV) regions at center are investigated by Efremova et al. 2011.
  - Outer regions and faint regions can be probed by HSC.

  - How is the star forming activities at the outer regions?
  - How significant are these regions in total star formation rate?

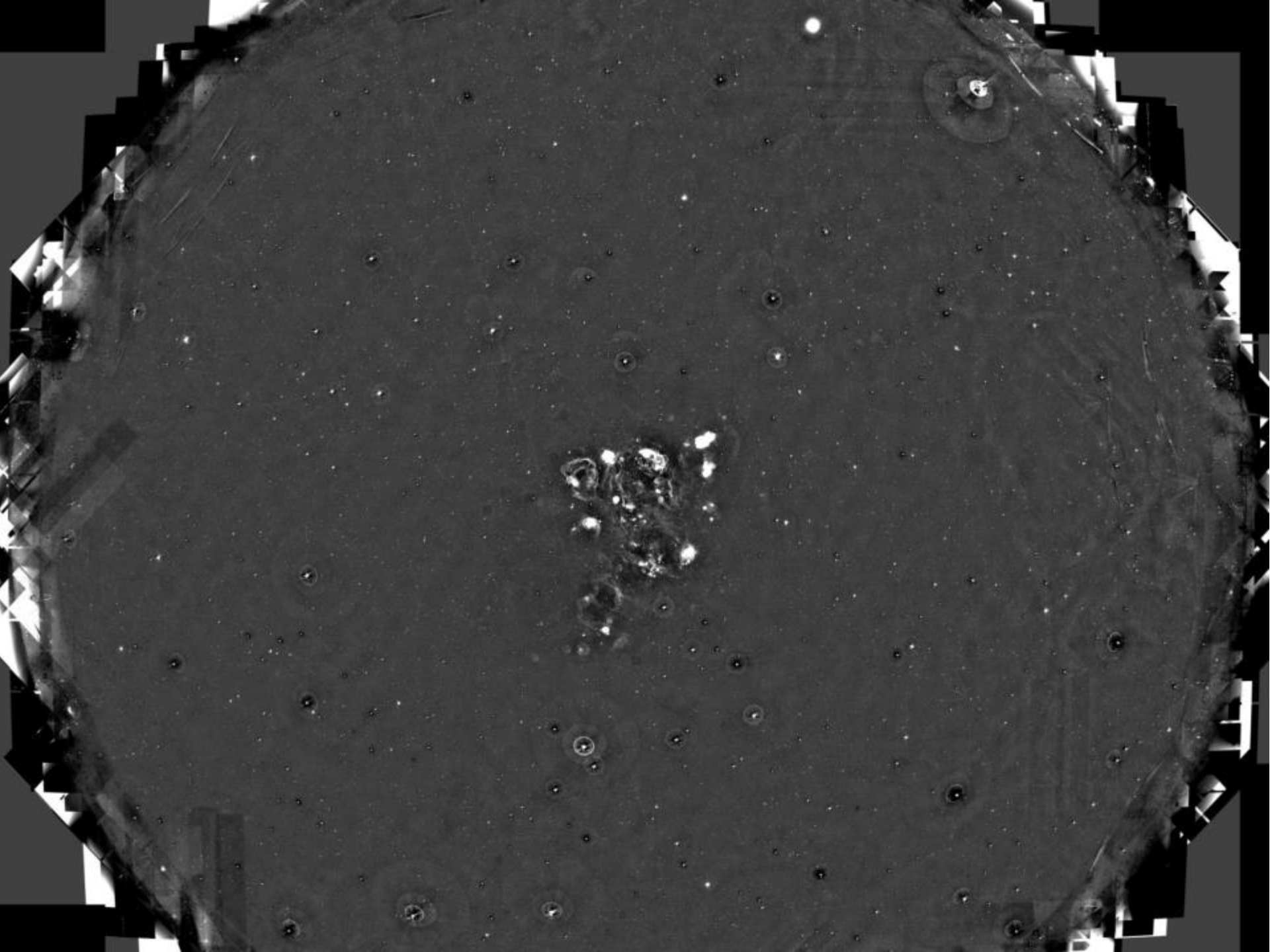


Efremova et al. 2011



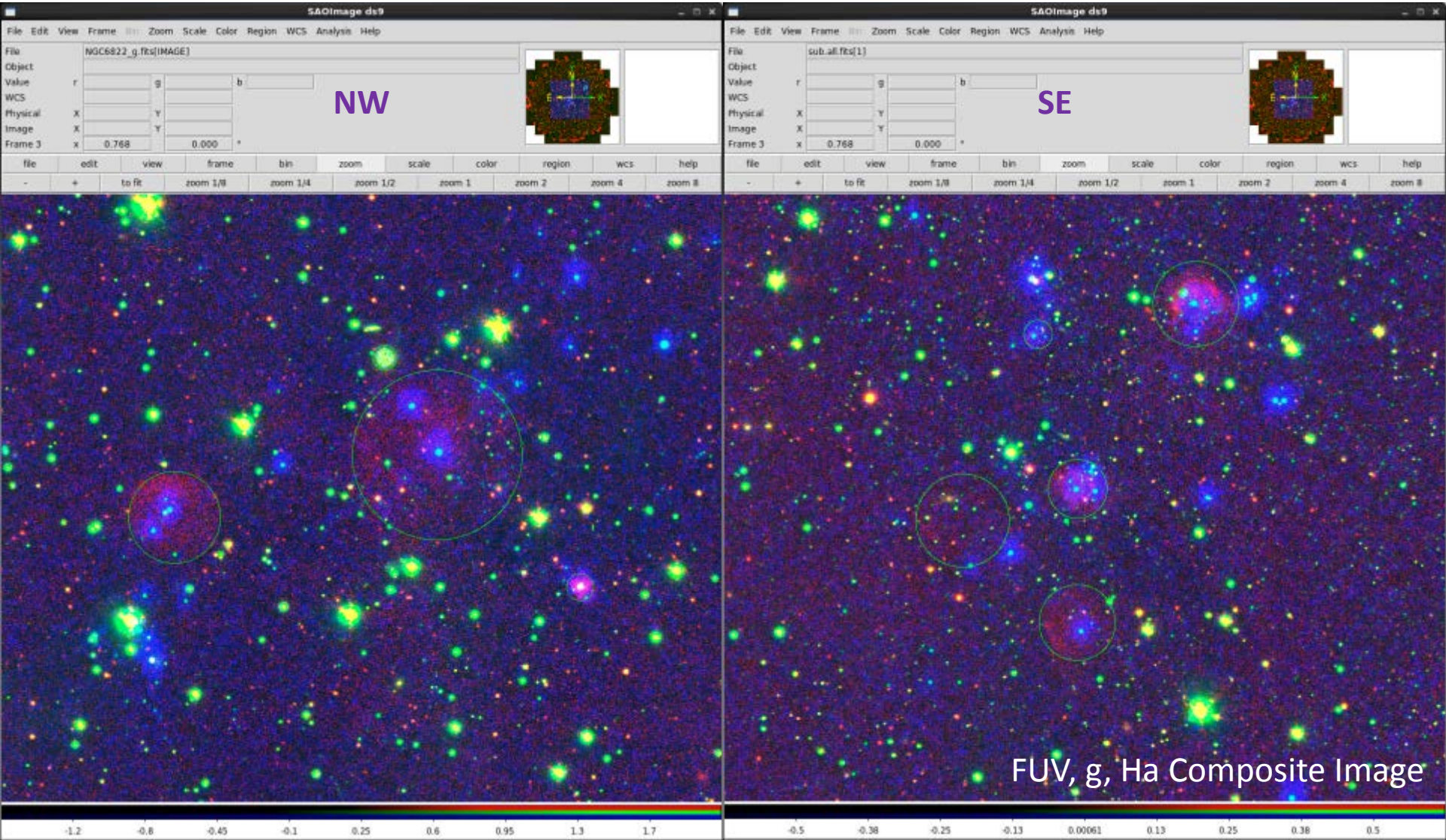
NGC6822: Halpha Image

g, r, Ha Composite Image
Integration Time: 1hr15min

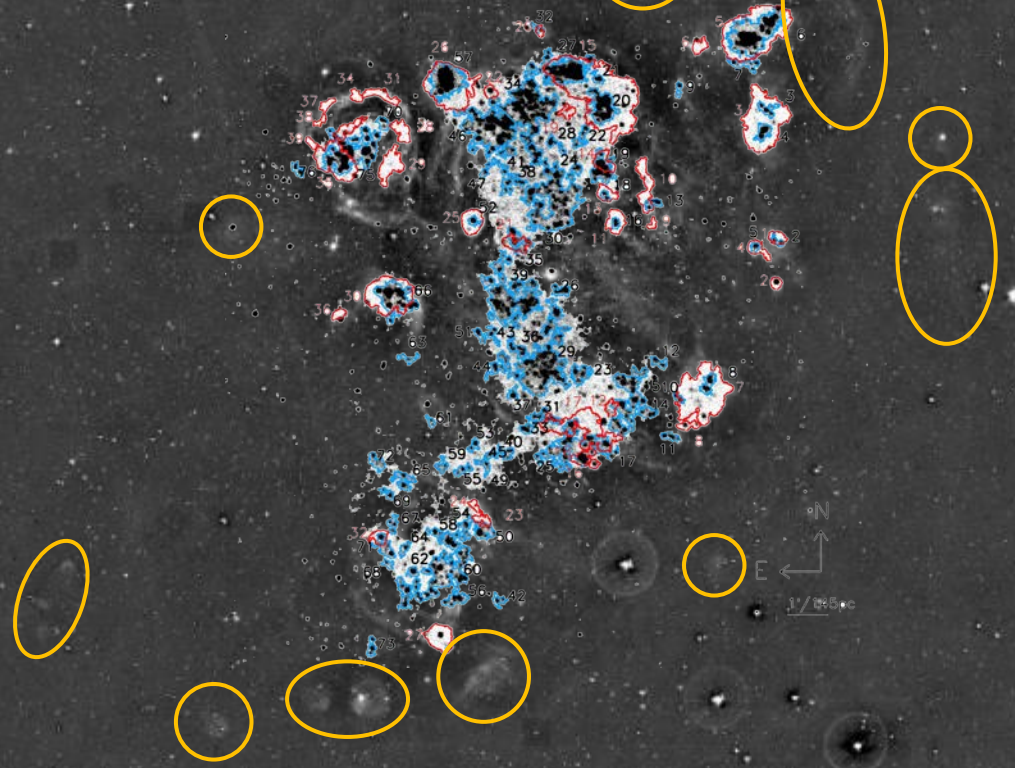


Outer Diffuse HII Regions

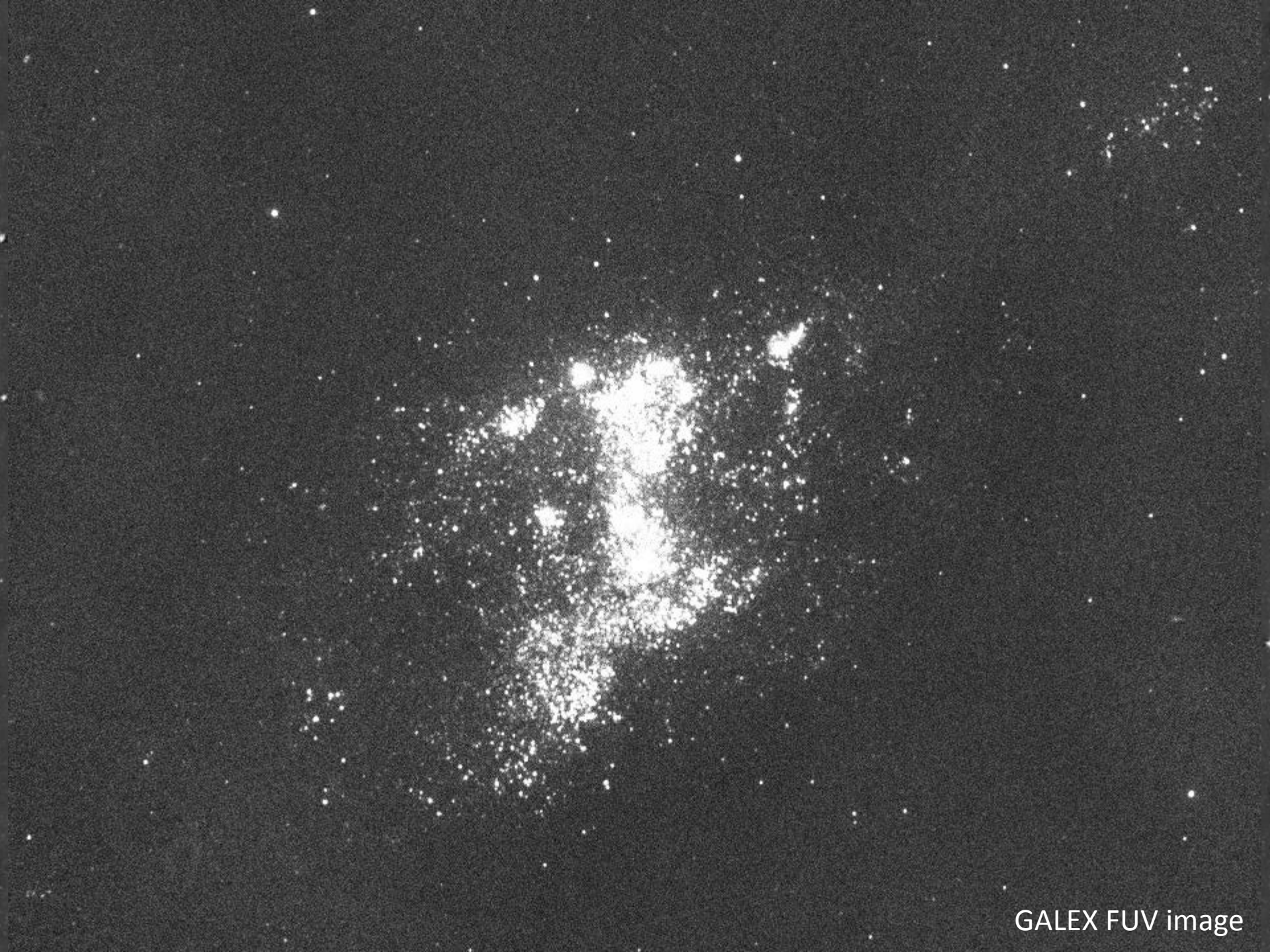
- Diffuse HII regions are detected from Halpha-r image. 49 are detected and photometric properties (Halpha flux, size) are measured.

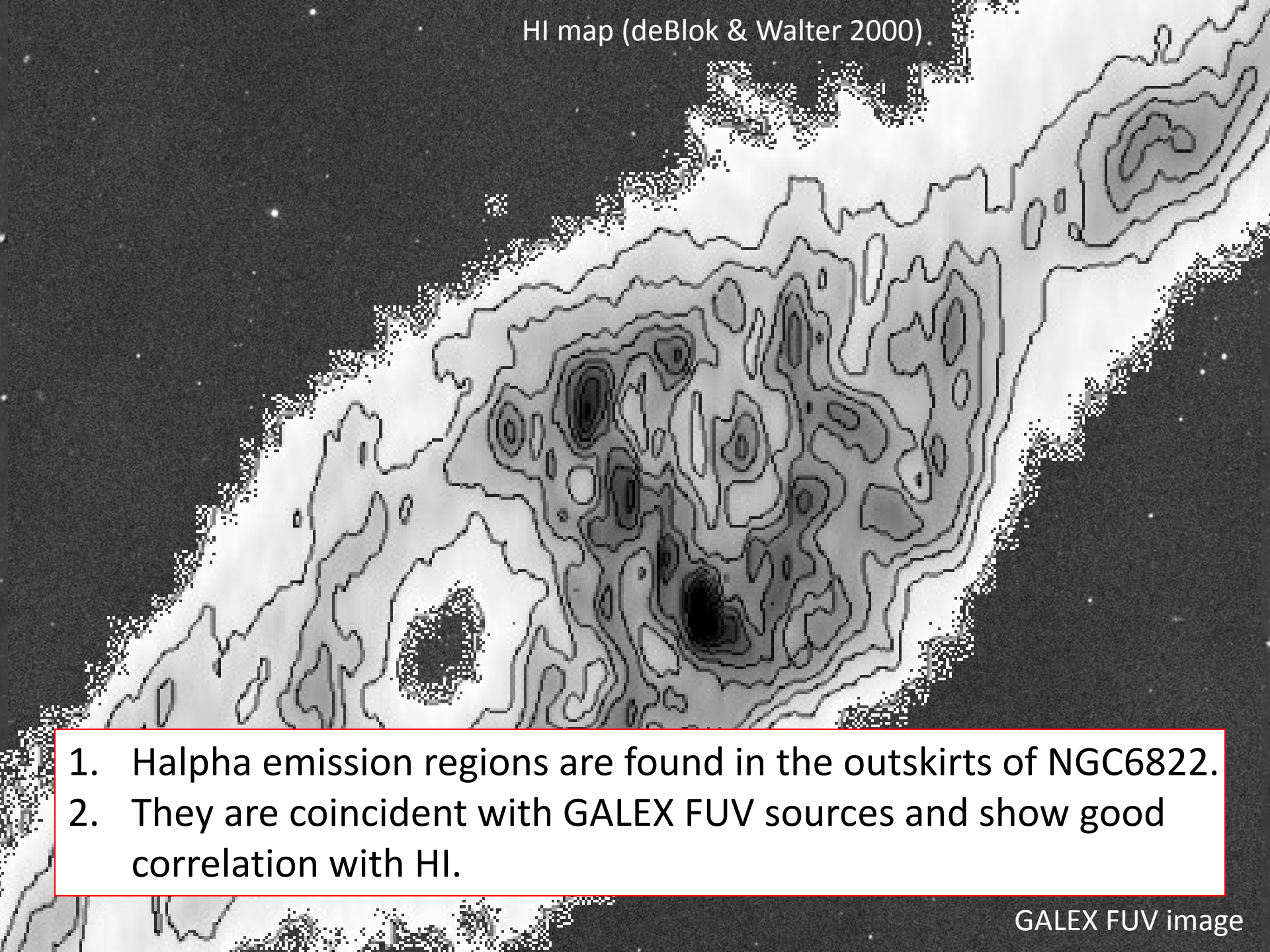


NGC6822: Continuum Subtracted Halpha Image



Overlaid: Efremova+ 2011
Blue: FUV selected SF region
Red: Halpha bright region

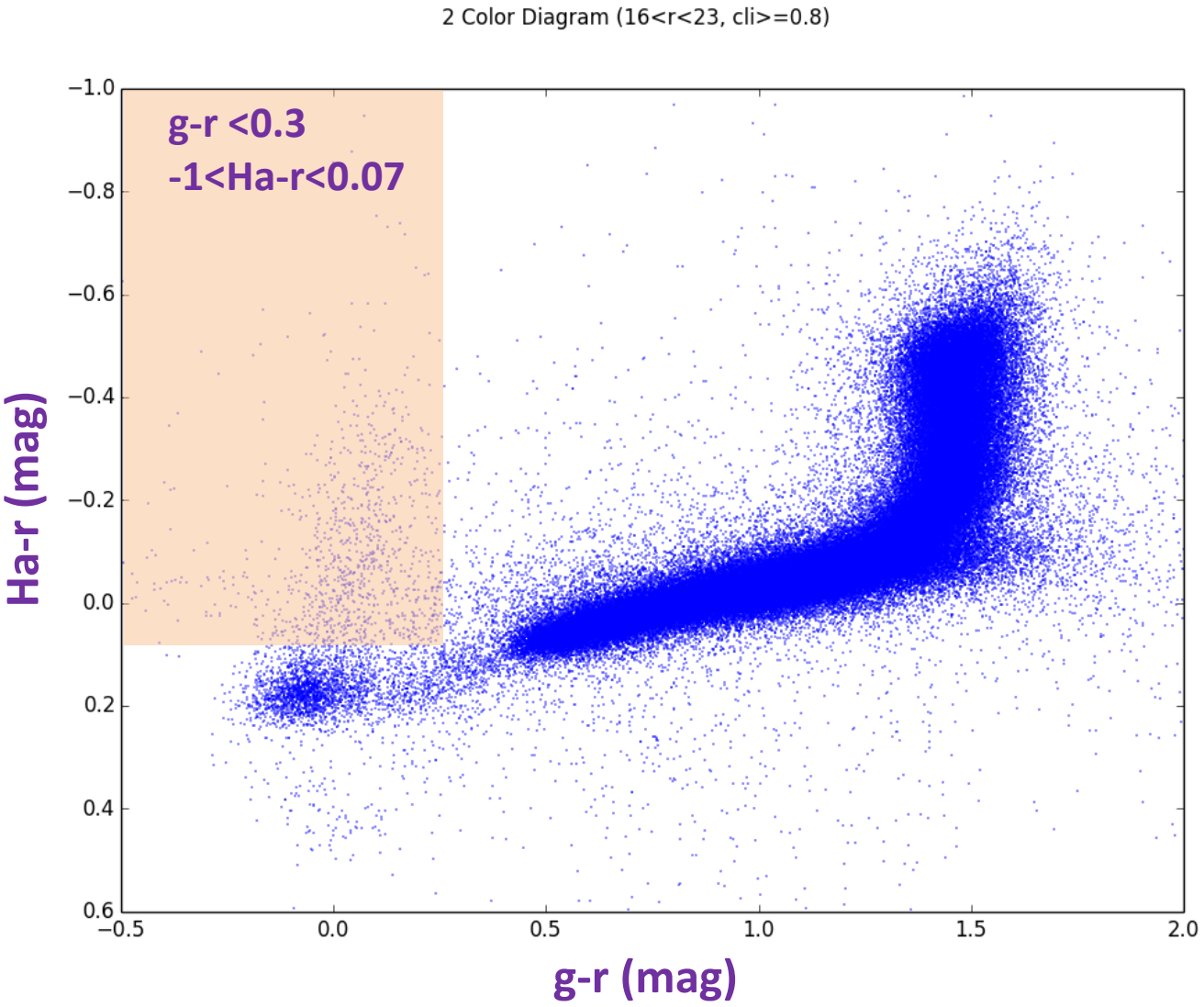

GALEX FUV image



1. Halpha emission regions are found in the outskirts of NGC6822.
2. They are coincident with GALEX FUV sources and show good correlation with HI.

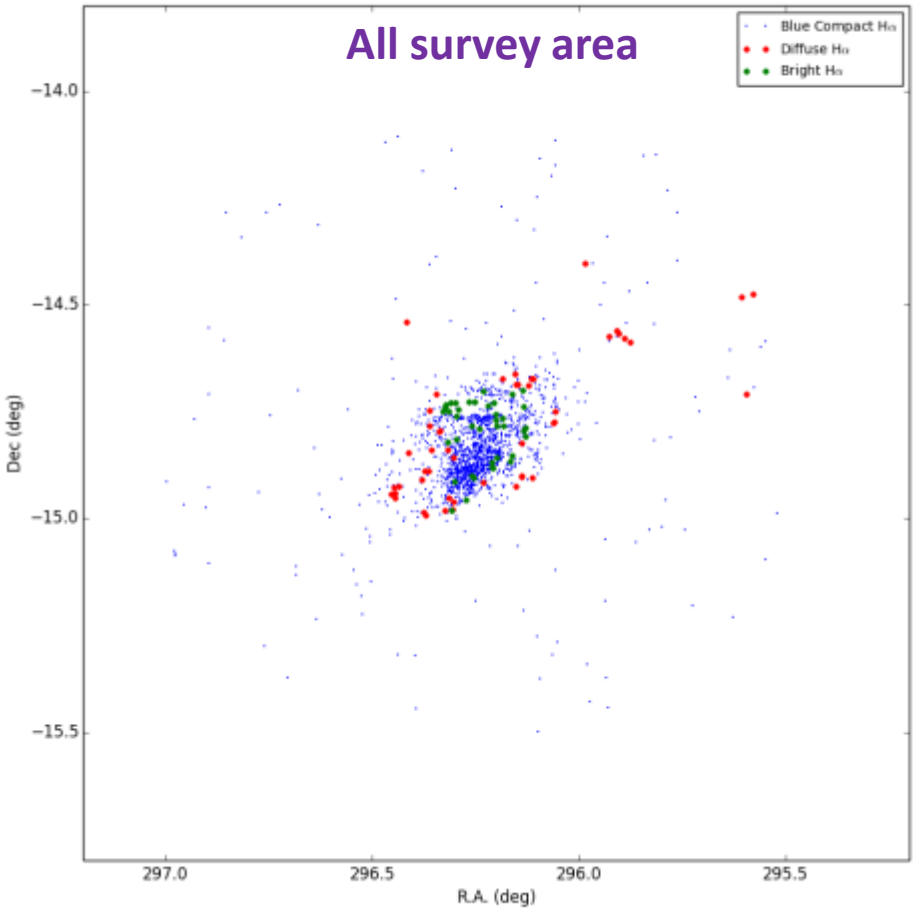
Blue Compact HII Regions

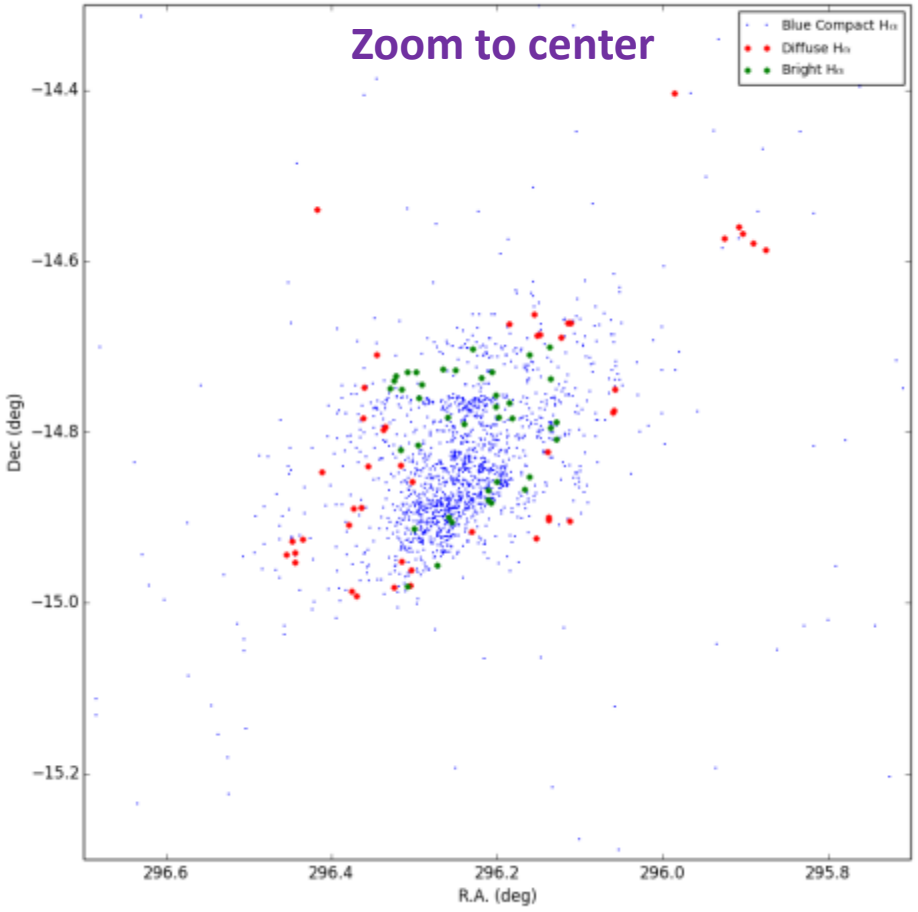
- Compact HII regions are selected based on 2-color diagram. 1698 objects are detected.



Spatial Distribution

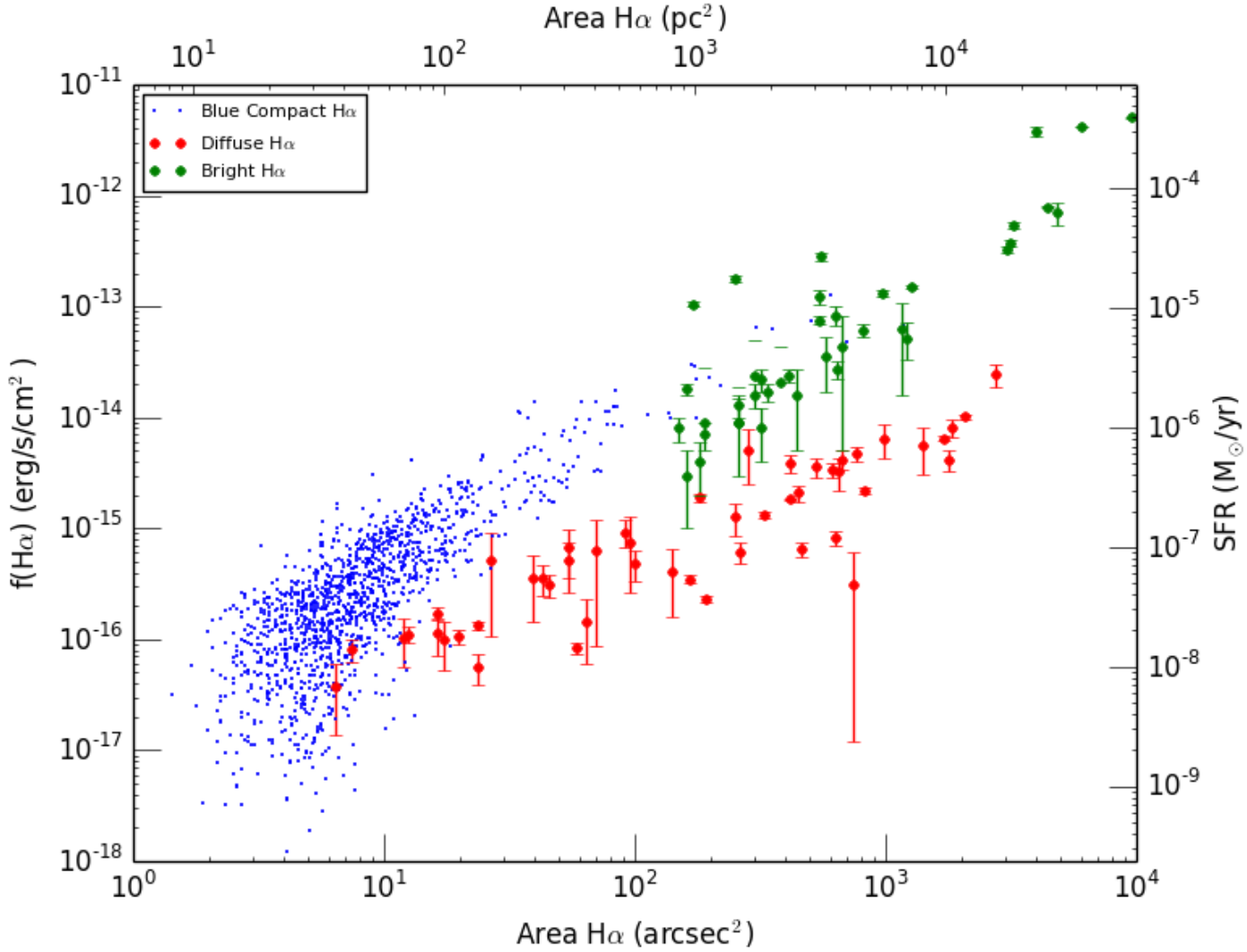
- Most compact HII regions are found around center, following the distribution of UV sources. Diffuse HII regions are widely distributed.





Size vs Halpha Flux

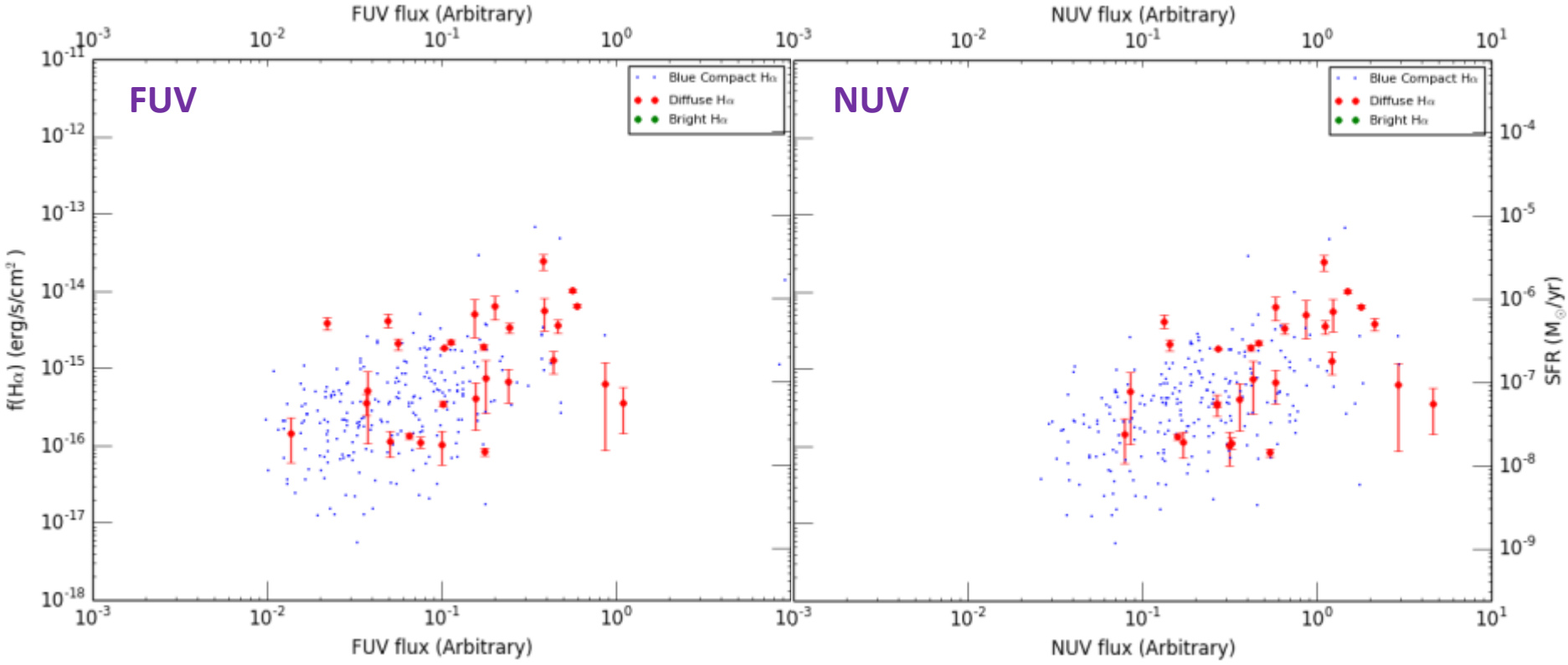
- Compact HII regions follow the size-flux relation of central HII regions. Outer diffuse HII regions follow different relation; Halpha fluxes are x0.1-0.01 fainter or sizes are x10-100 larger.



Coincidence with UV Sources

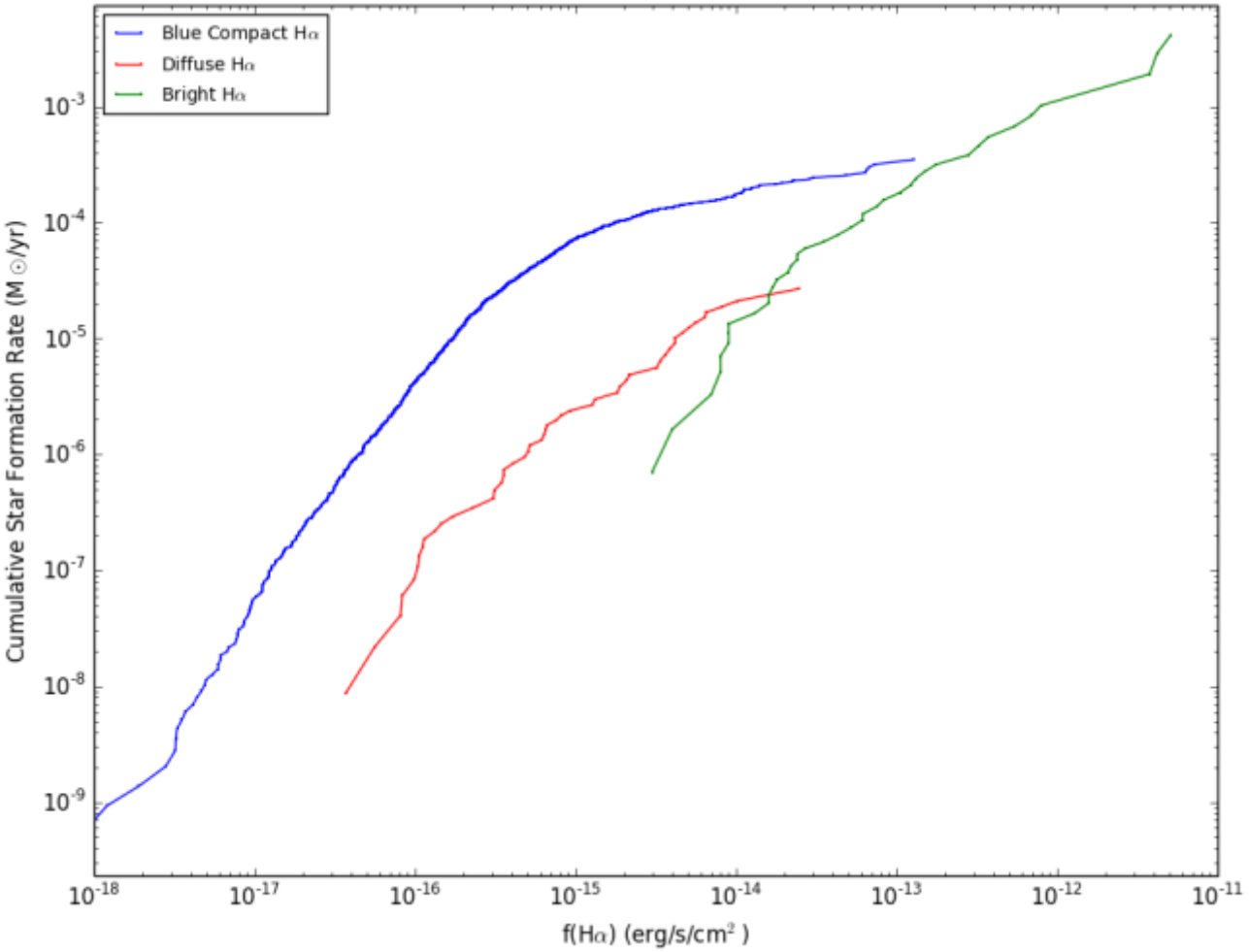
- Many HII regions coincide with UV Sources.
- Compact: 263 (FUV+NUV), 354 (NUV) out of 1698 regions (except for central crowded regions)
- Diffuse: 29 (FUV+NUV), 30 (NUV) out of 49 regions

- Halpha-UV relation is same for both Compact and Diffuse HII regions.



Total Star Formation Rate

- Total star formation rate is calculated for each group.
- SFR(central) ~ 10xSFR(compact) ~ 100xSFR(diffuse)
- Significant fraction of SF in NGC6882 occurs at a few large HII regions.



Summary

Local Group dwarf irregular NGC6822 is investigated using Hyper Suprime-Cam (HSC) on Subaru Telescope. Halpha image is used to study current star forming activities in particular at the outskirts of this galaxy.

- Deep Halpha image reveals 49 diffuse (faint and extended) Halpha emission regions in the outskirts of NGC6822.
- Most of these regions are coincident with GALEX FUV sources. They show good correlation with HI.
- Their Halpha fluxes are x0.1-0.01 fainter (or sizes are x10-100 larger) than 'normal' HII regions found at the center of NGC6822.
- Blue compact HII regions are located at the fainter extension of 'normal' HII regions.
- Diffuse HII regions and blue compact HII regions follow same relation on f(Halpha)-f(UV) plane.
- Contribution to total SFR from diffuse and compact HII regions is not significant: SFR(central) ~ 10xSFR(compact) ~ 100xSFR(diffuse)