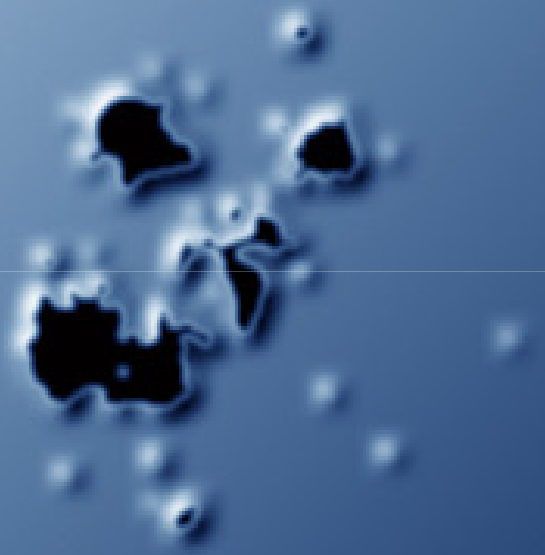
# The Continuous Star Formation of NGC 5471

Grupo de Astrofísica
Universidad Autónoma de Madrid

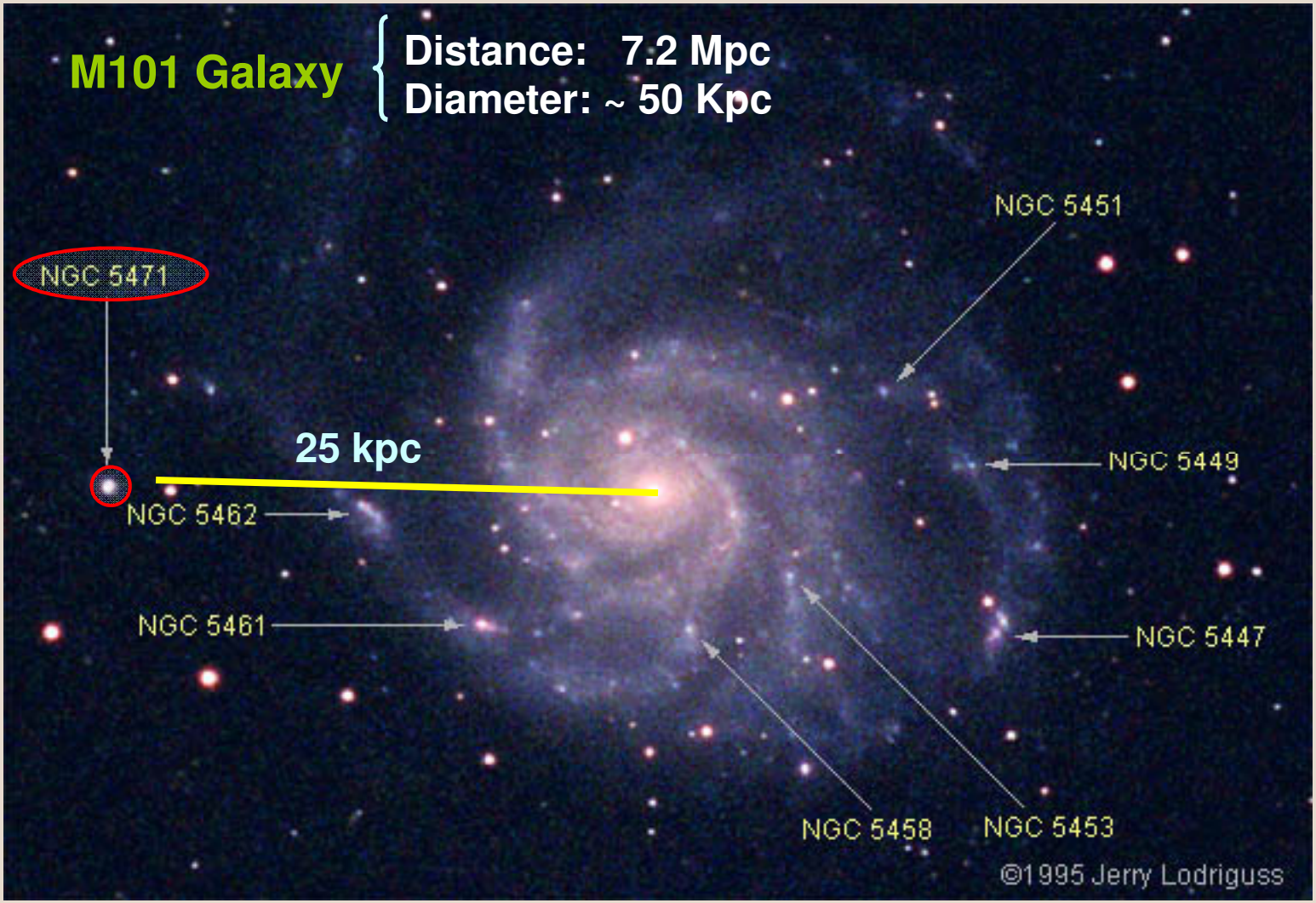
R. García-Benito, E. Pérez, A. Díaz,
J. Maíz & M. Cerviño



V Workshop
Estallidos de Formación Estelar en Galaxias
2007

## The Continuous Star Formation of NGC 5471



I. Images & Morphology

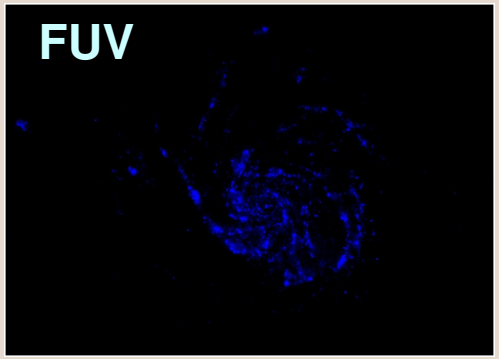
II. Integrated Study

III. Stellar Study

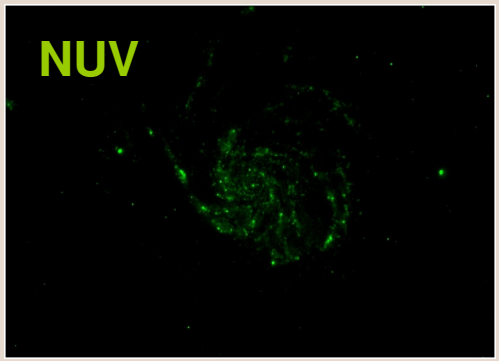
IV. Conclusions

## The Continuous Star Formation of NGC 5471

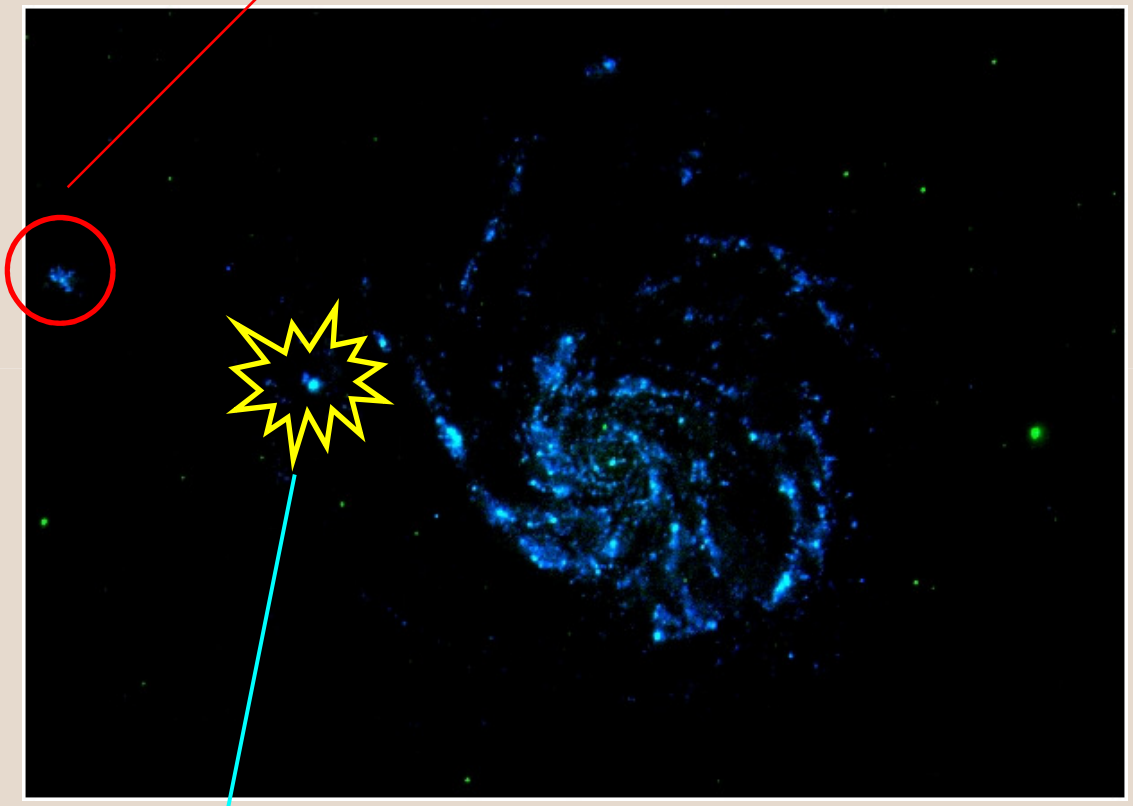
# GALEX




+




NGC 5477 (Irr) – Davies et al. (1980)



NGC 5471: FUV peak in M101

FUV = $9.8 \times 10^{-14}$ erg/s/cm2/A

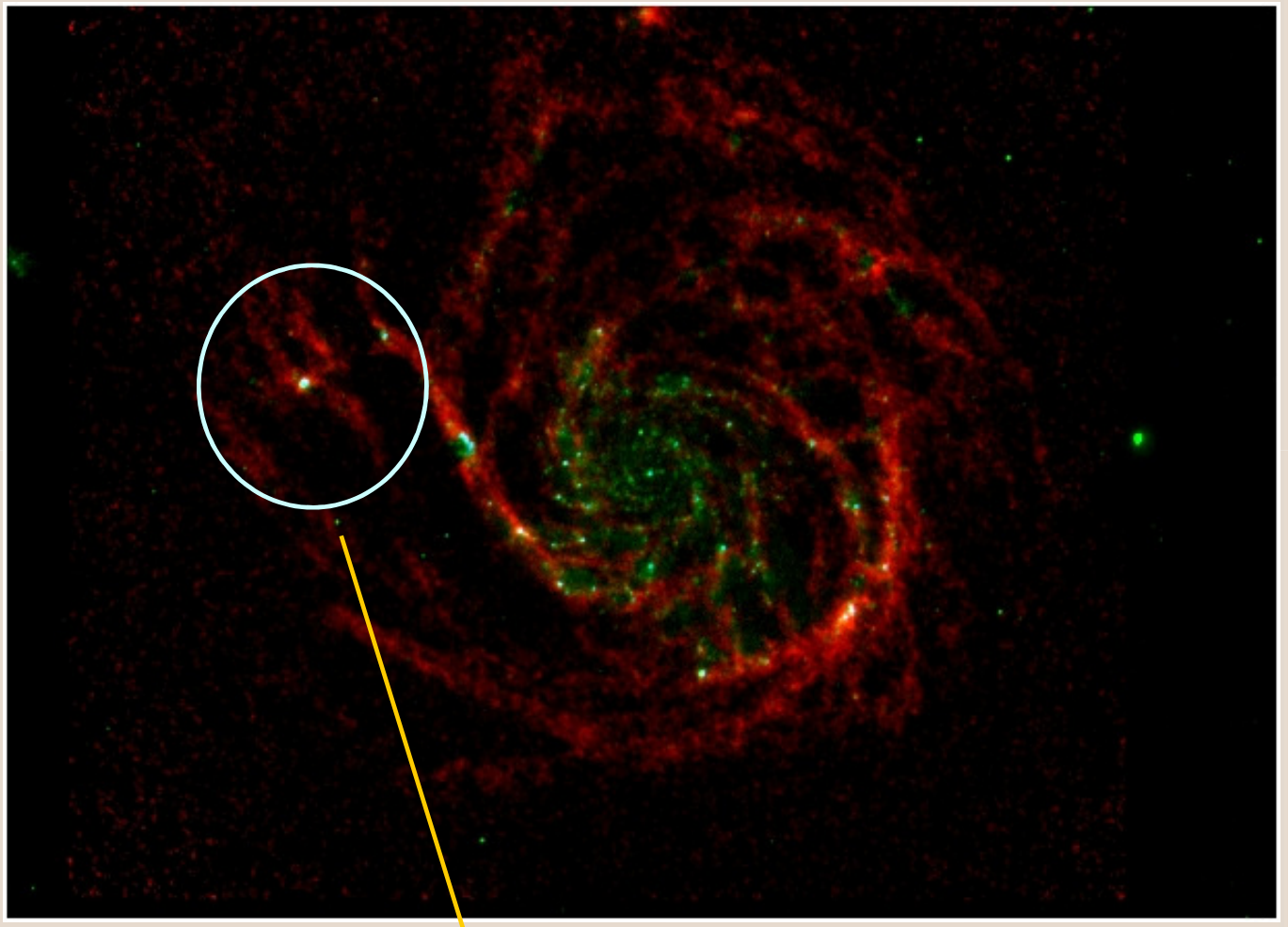
## The Continuous Star Formation of NGC 5471

**FUV + NUV + HI**

- HI brightest concentration M101

- HI peak close HII peak

- HI ~ $10^8$ $M_{Sun}$



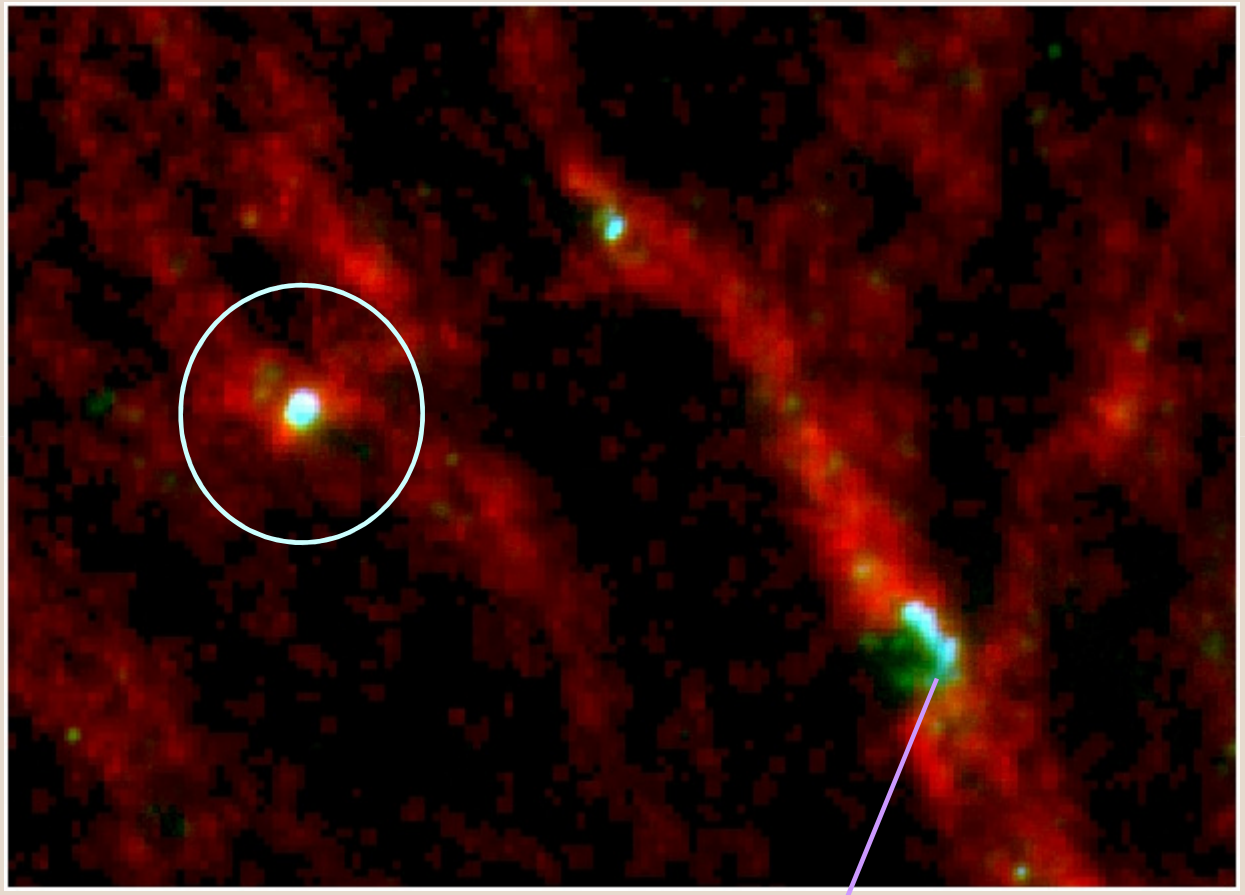
$N_{HI} = 5.8 \times 10^{21}$ $cm^{-2}$

## The Continuous Star Formation of NGC 5471

**NGC 5471**

- Enhancements 21cm line near FUV peaks

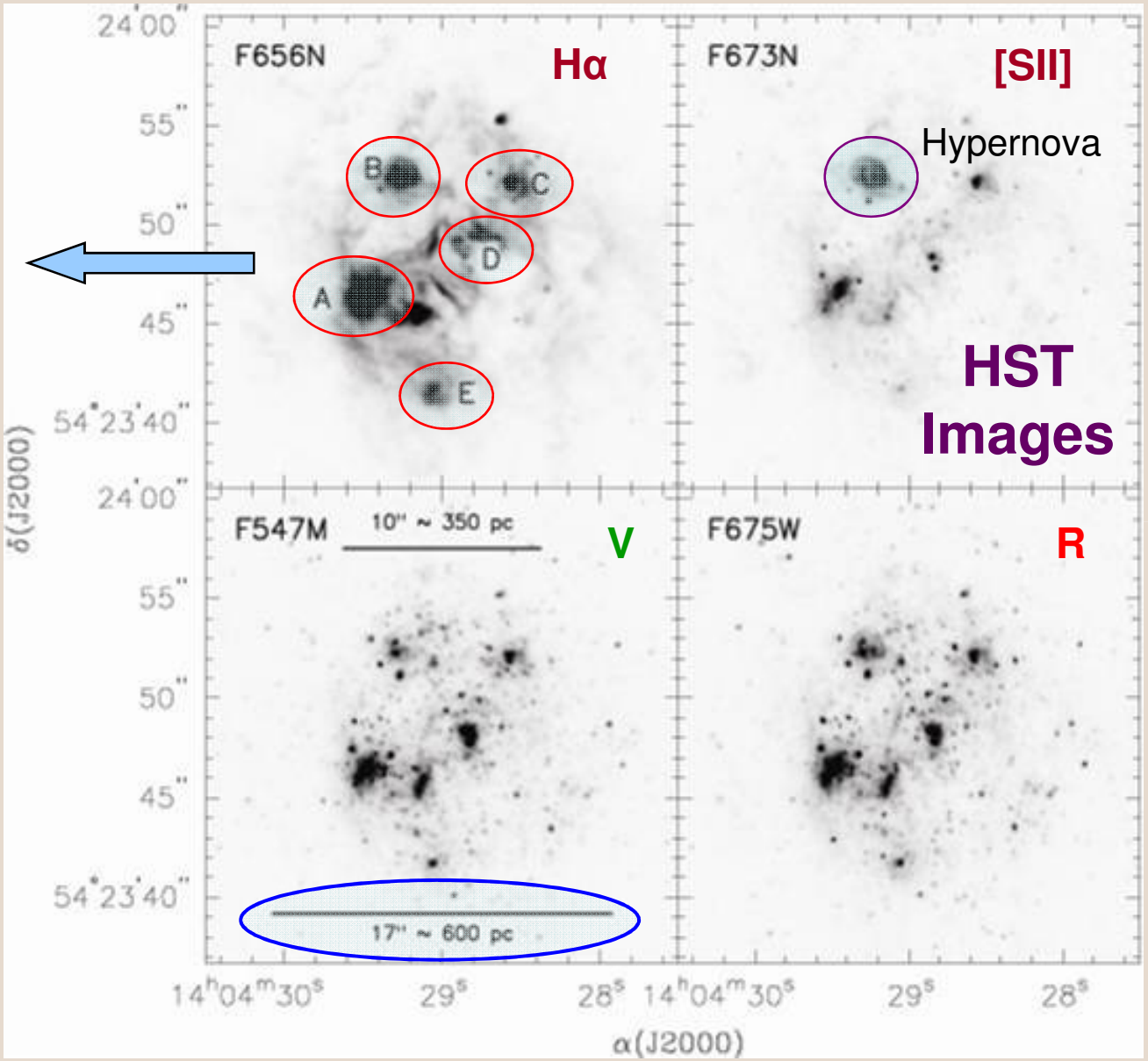
- Decrease molecular contents sorrounding NGC 5471 → dissociated by high star formation efficiency (highest in M101)



NGC 5462

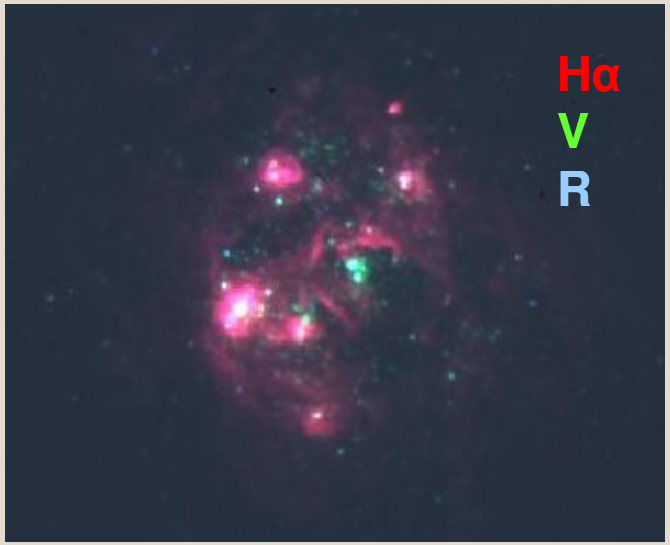
# I. Images & Morphology

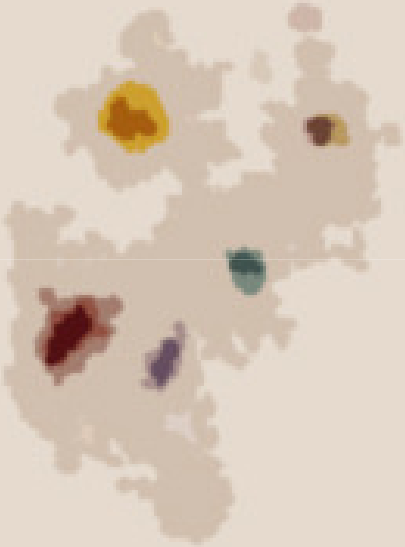
**Skillman 1985**
**(APJ, 290, 449)**

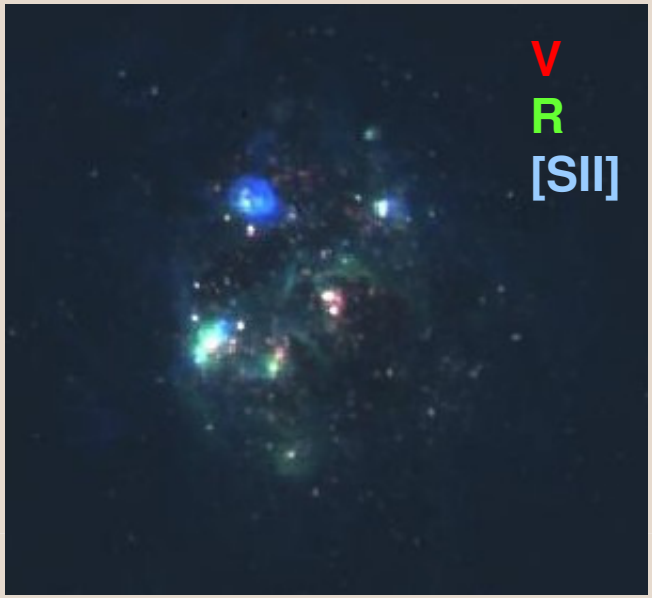


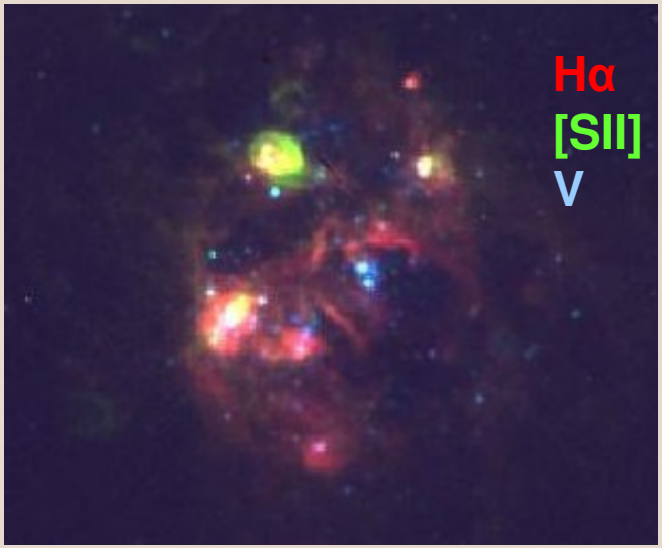
The Continuous Star Formation of NGC 5471

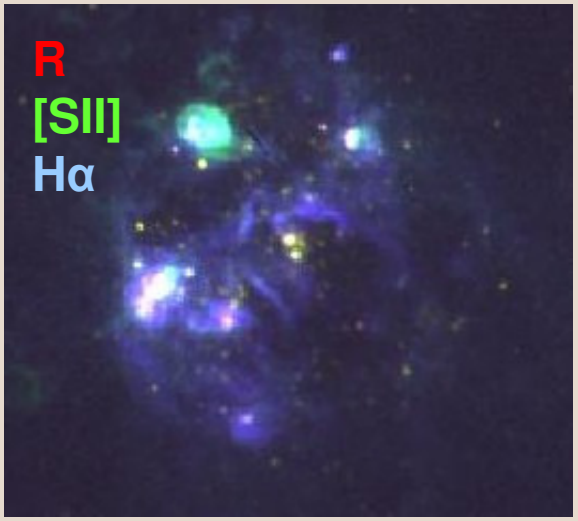
# I. Images & Morphology





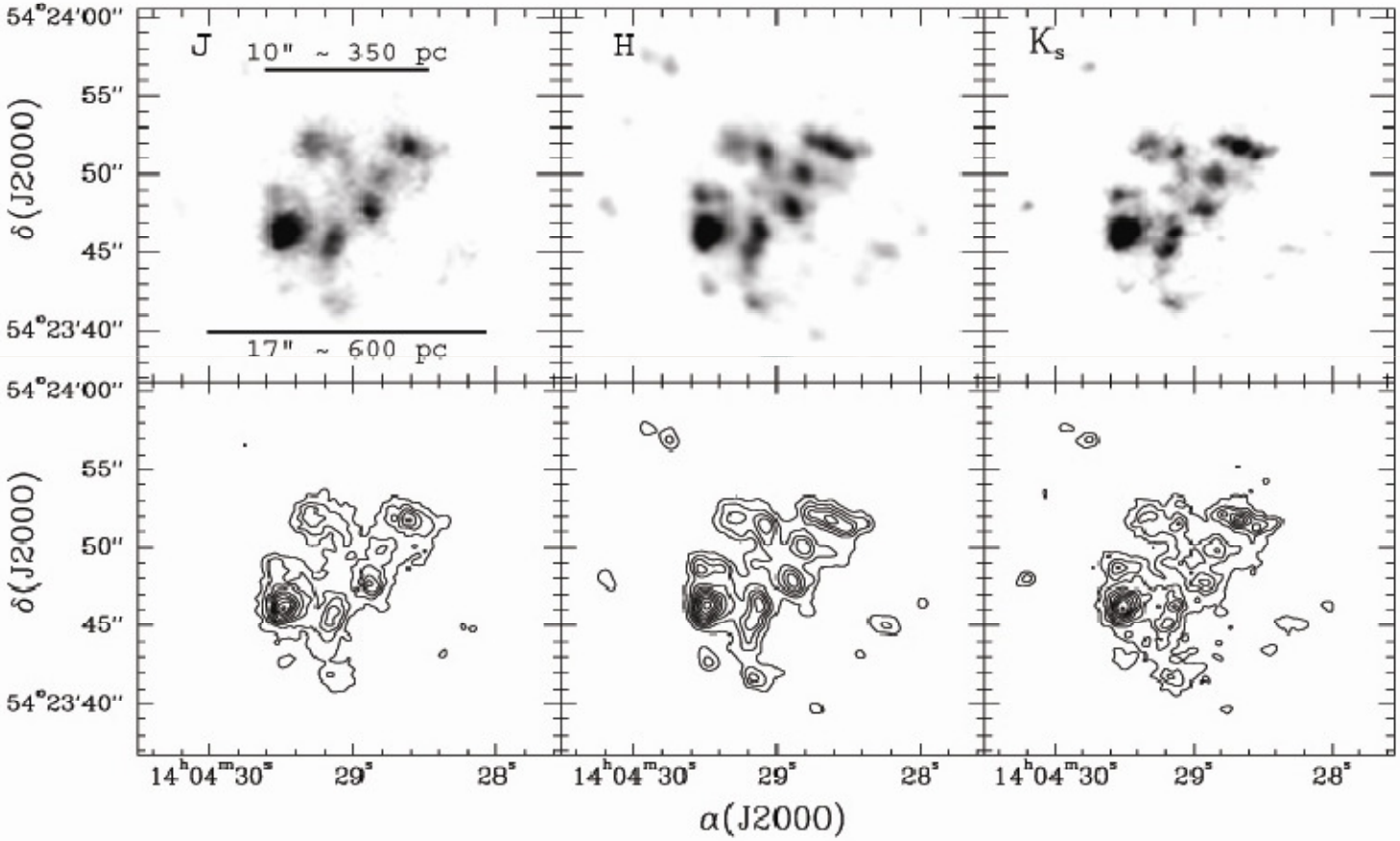




$L(H\alpha) = 2.5 \times 10^{40}$ erg/s

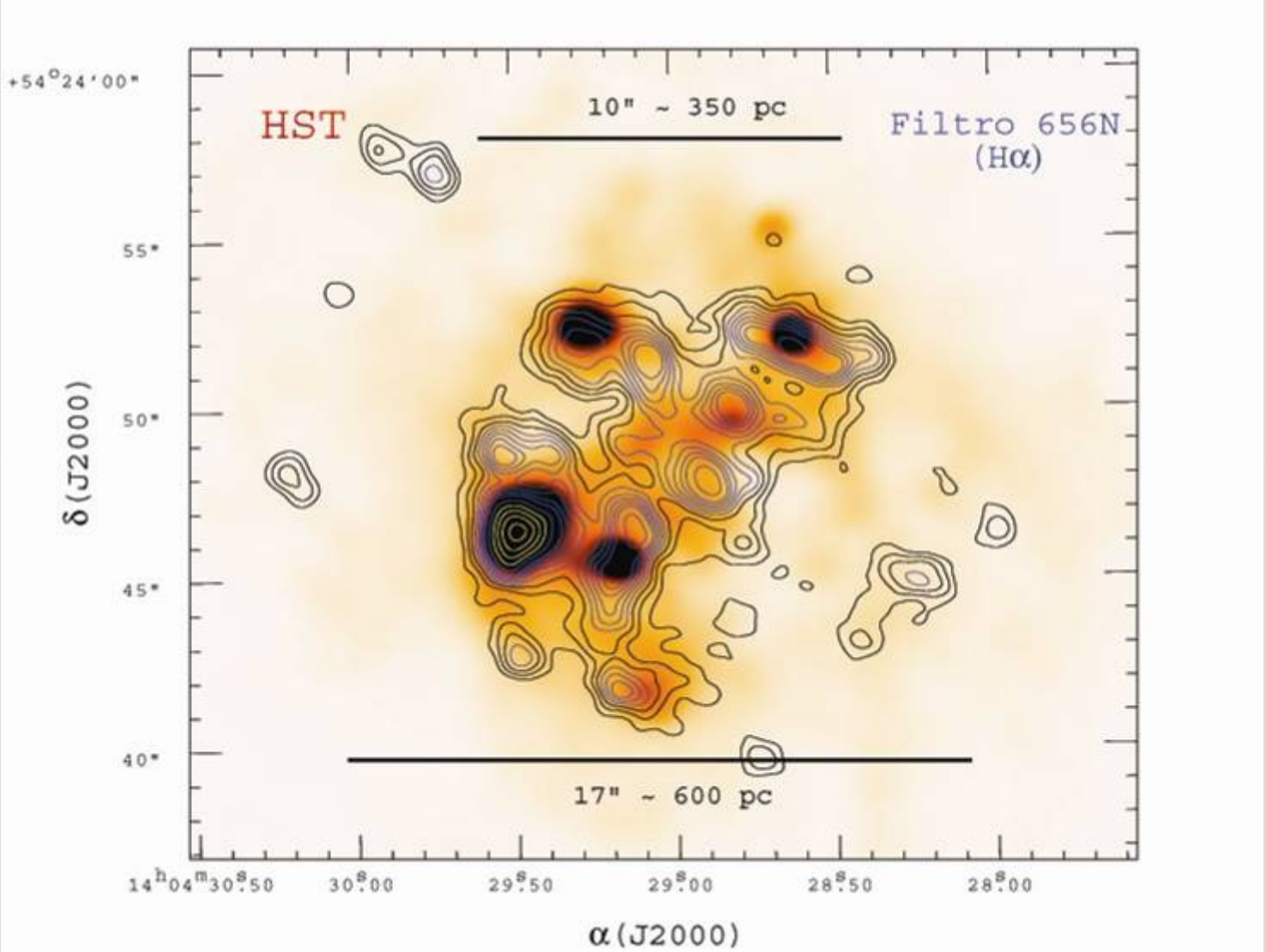
$M(HII) \sim 6 \times 10^{5} M_{Sun}$

**TNG+ARNICA** (April 1999, E. Perez)

**Infrared Images**



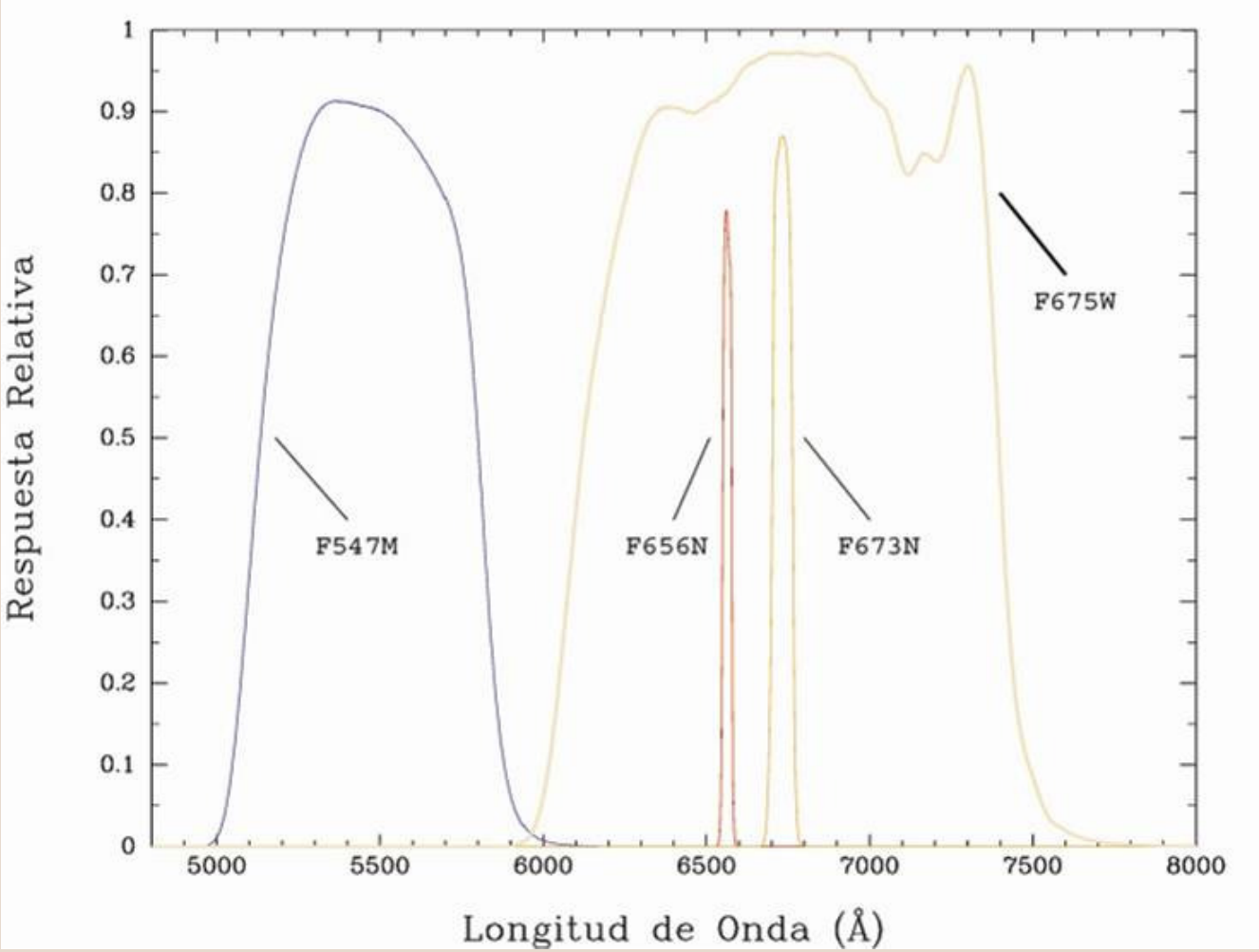
# I. Images & Morphology




**Hα degraded image + H contour**

## Decontaminate 675W:

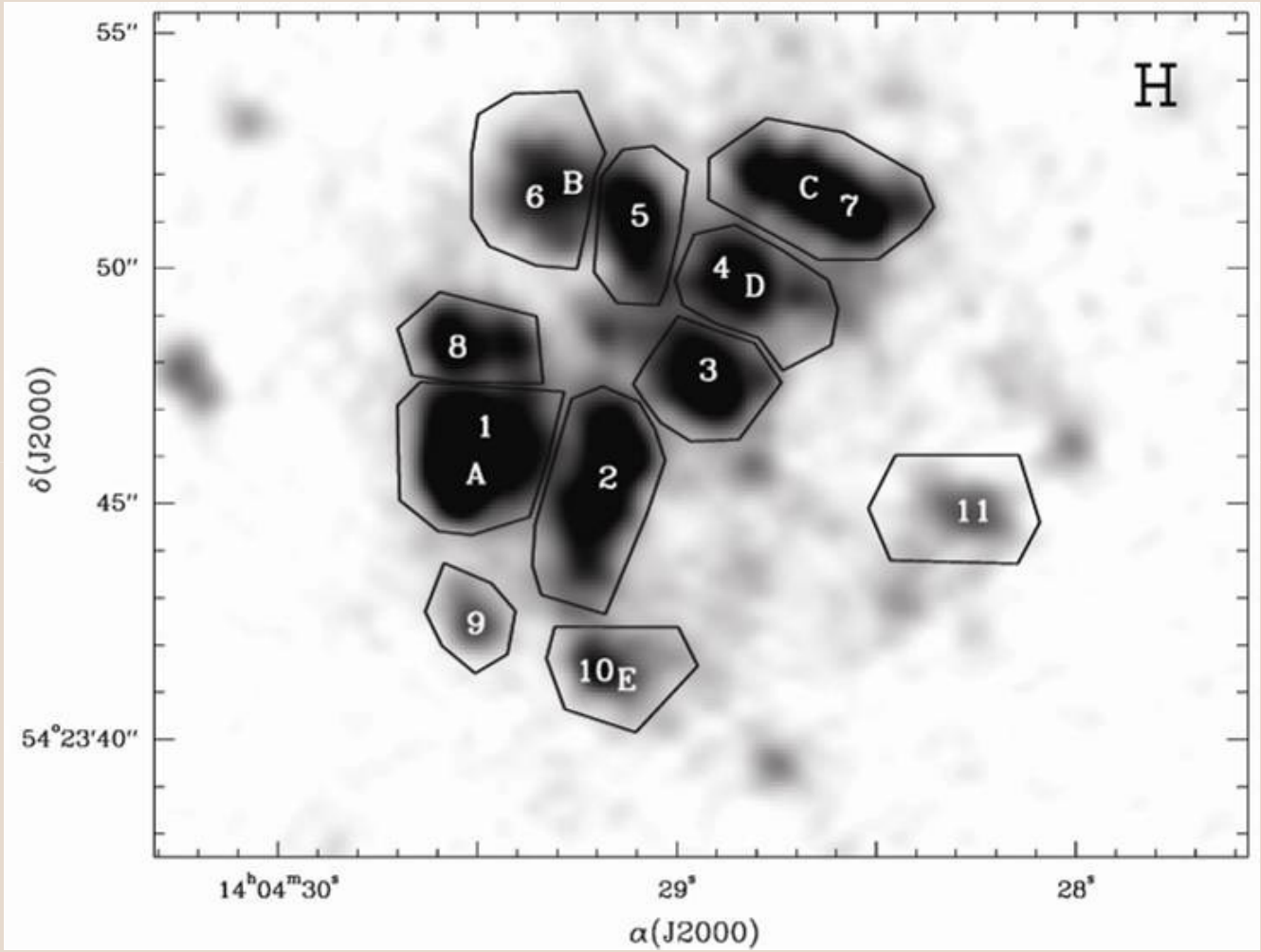
## 675W' = 675W – Hα – [SII]




**Final useful photometric Images:**

**547M + 675W'**
**(V + R)**

## Polygons definition

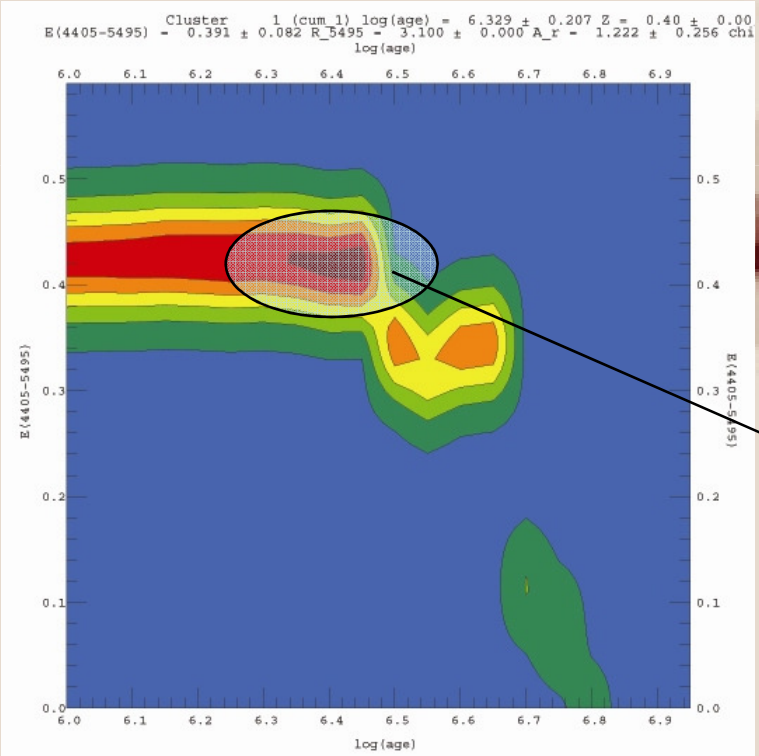



**Measure flux × polygon × image (2 optical + 3 infrared)**

## II. Integrated Study

**V – R – J – H - K** → **Analysis**

CHORIZOS is a Bayesian code for the analysis of photometric an spectrophotometric data using parameterized spectral energy distributions (Starburst 99). The code is written in IDL by Jesus Maiz (Maiz 2004. PASP, 116, 859 ).



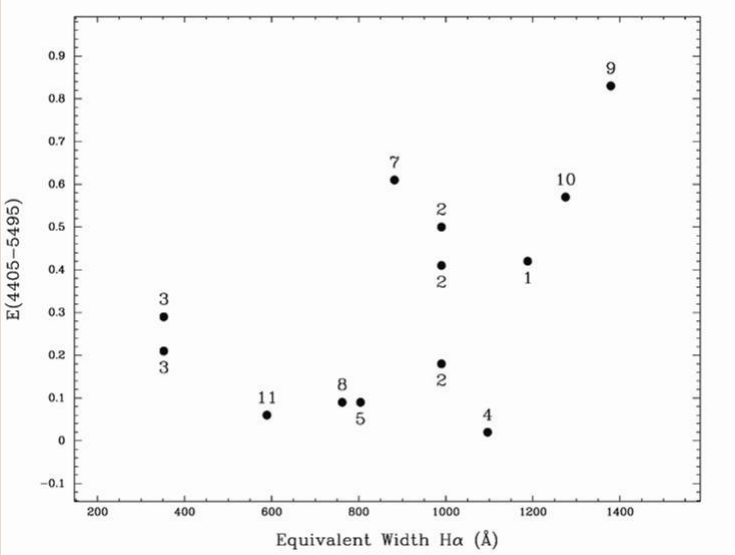

**4 Parameters:** E(B-V), Age, Metallicity, R(V) = A(V) / E(B-V)

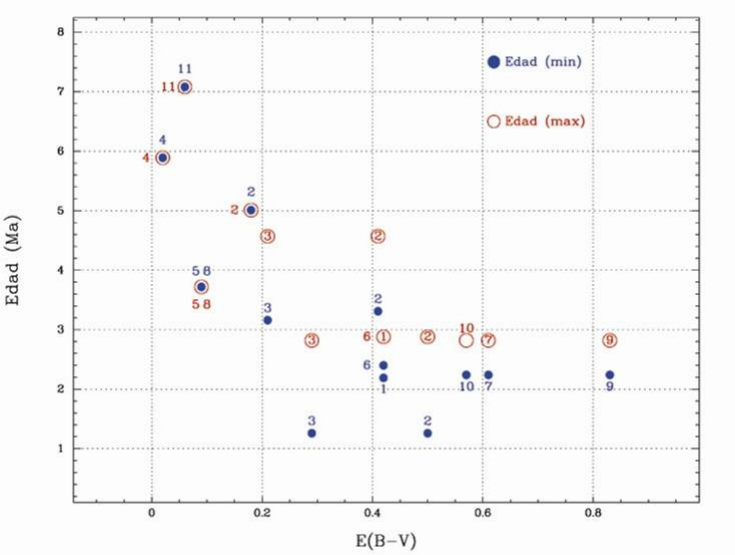
**Fixed:** Metallicity (0.02 ZSun) & R(V) = 3.1

**Free:** Age & E(B-V)

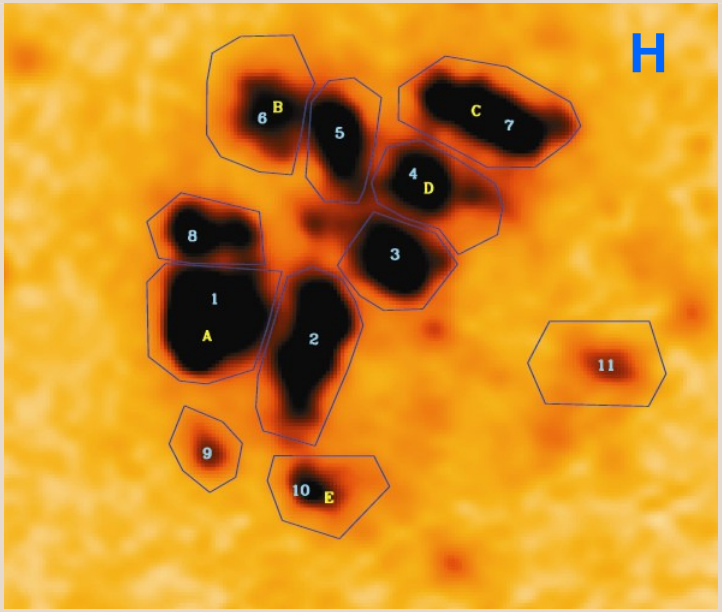
**Most probable value**

## II. Integrated Study

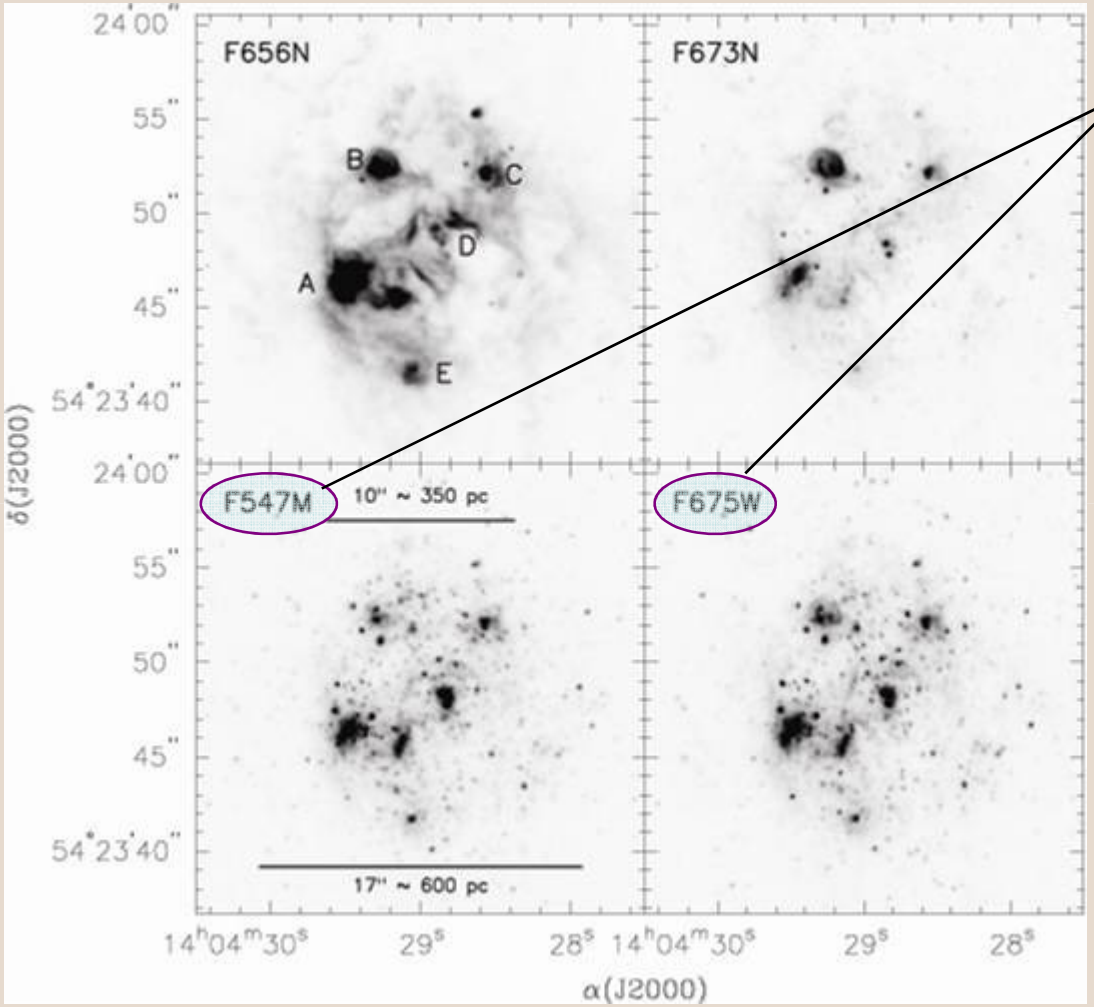



**General trend of decreasing Age and increasing Hα EW with increasing color excess, as expected from general evolutionary considerations of HII regions.**



# III. Stellar Study



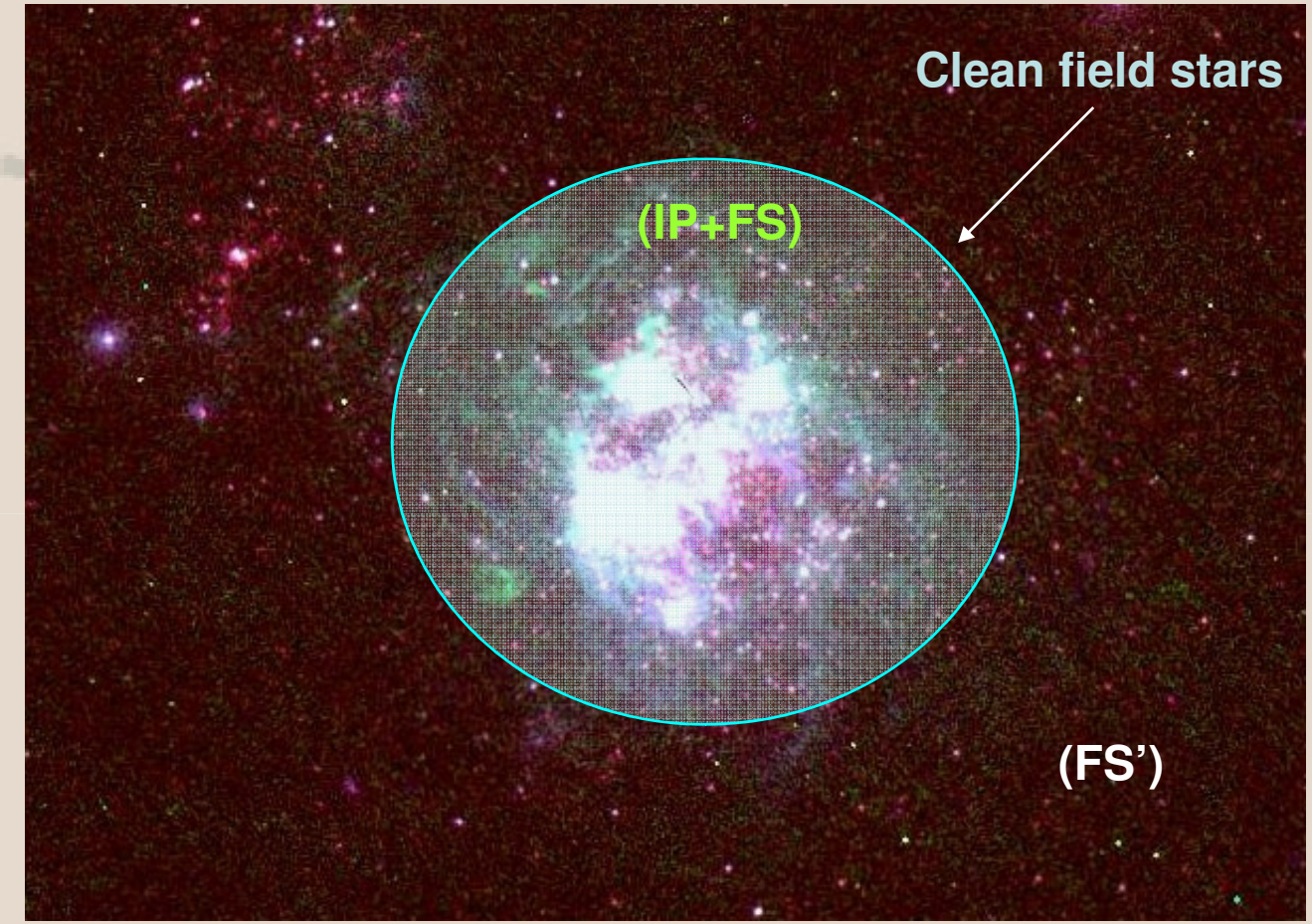

## Photometric analysis

HSTphot is a photometry package specifically designed for use with HST WFPC2 data. It uses a library of Tiny Tim PSFs.

Corrects aperture magnitude and several WFPC2 errors/effects.

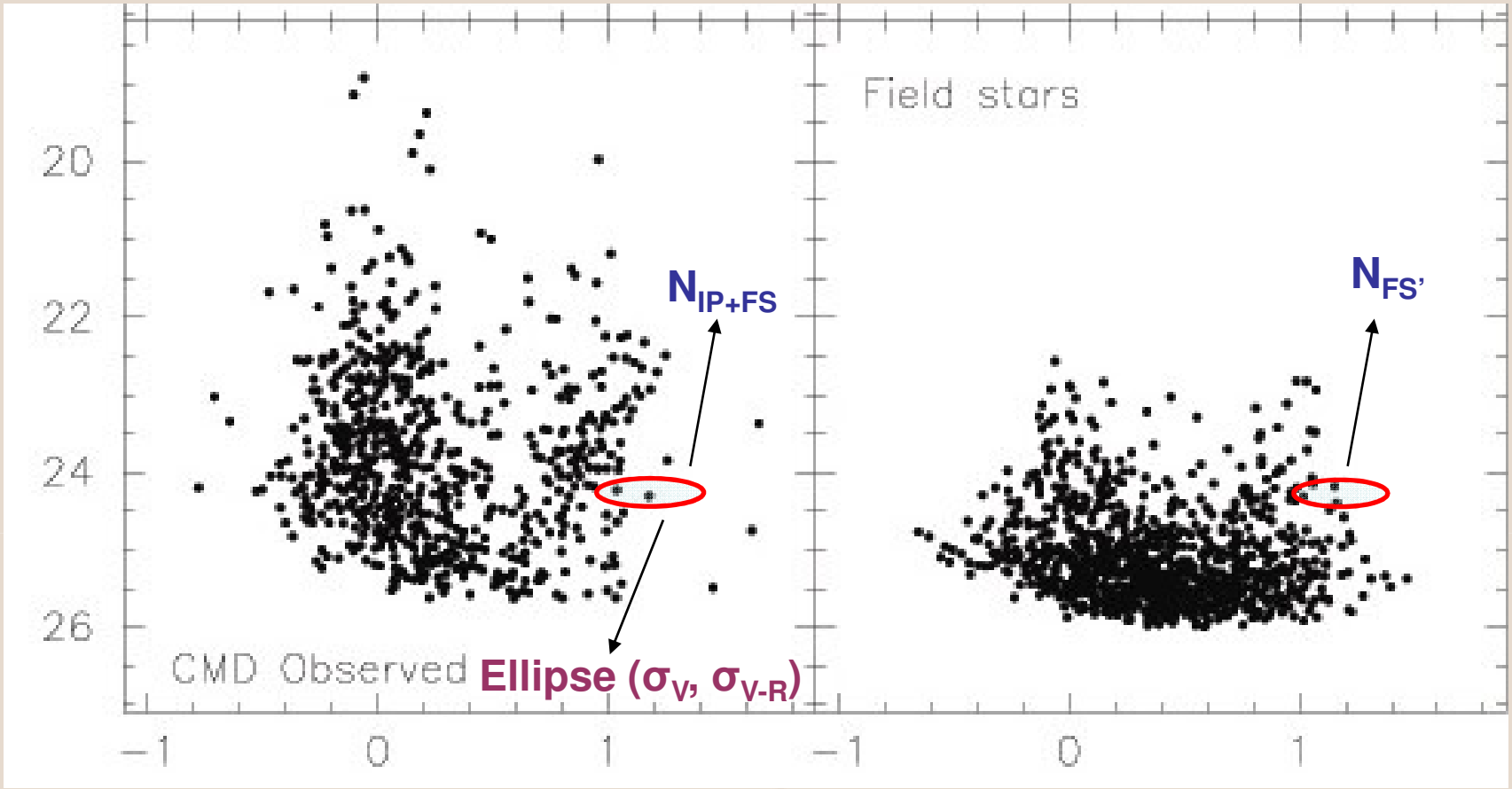
(Dolphin, 2000, PASP, 112, 1383 )

## III. Stellar Study




**CMD (IP+FS) – CMD (FS') ~ CMD (Intrinsic Population)**

## III. Stellar Study



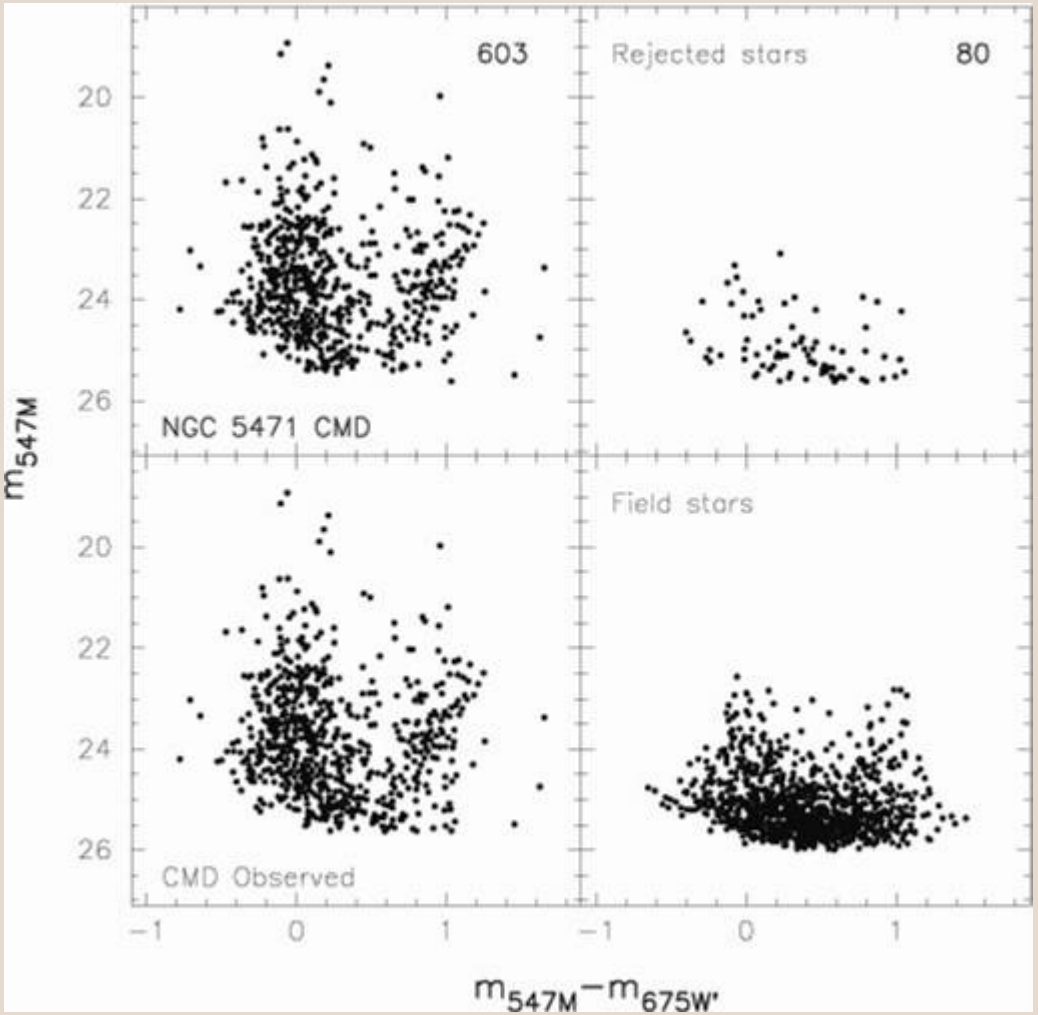

α = Area(IP+FS) / Area (FS')

$$P = 1 - min\left(\frac{\alpha N_{FS'}}{N_{IP+FS}}, 1.0\right)$$

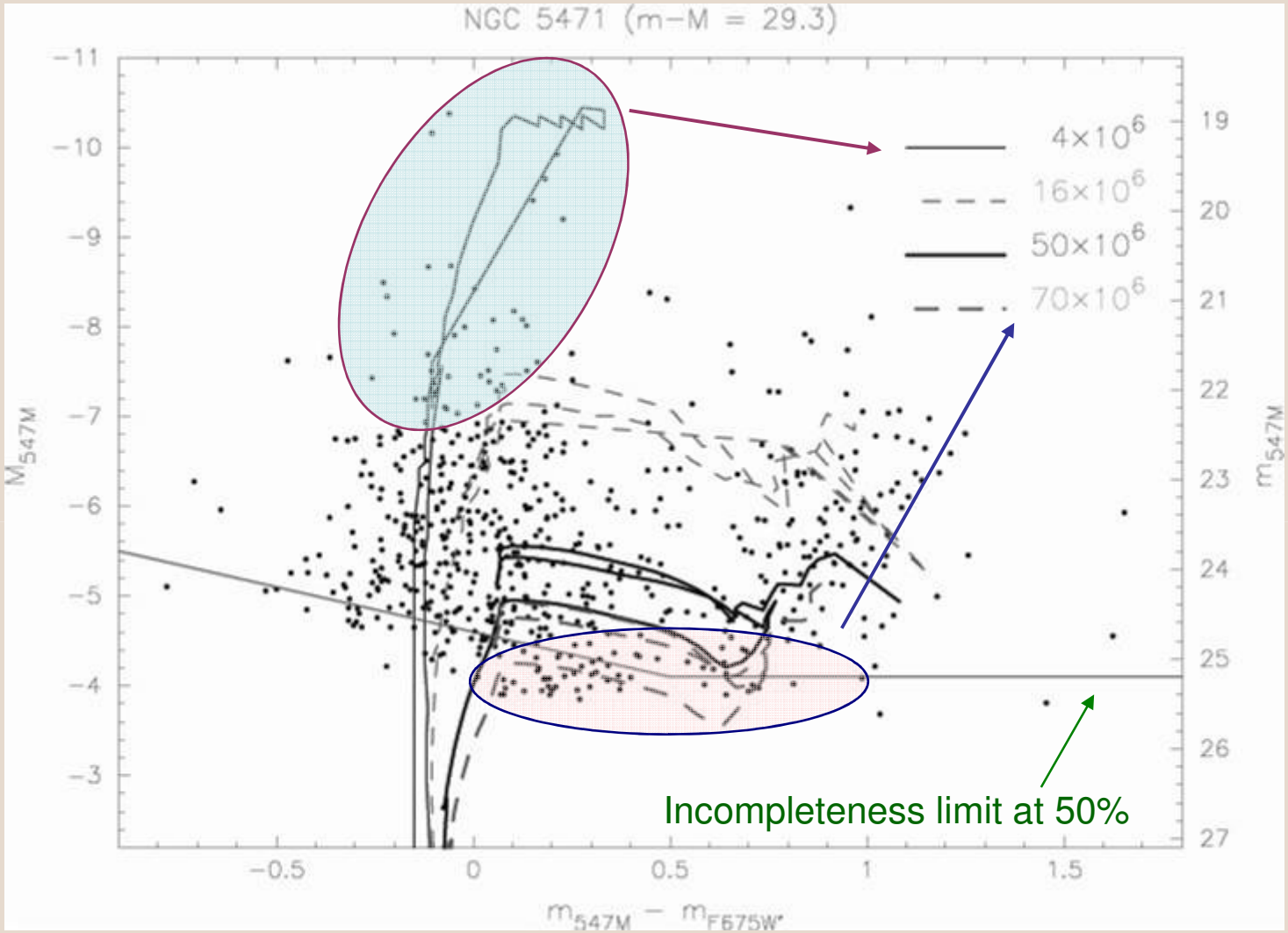
**Random number = 0 < P' < 1** ⟹ **If P' < P → Star accepted as member of NGC 5471CMD**

Bellazzini 1999, MNRAS, 307, 619

# III. Stellar Study

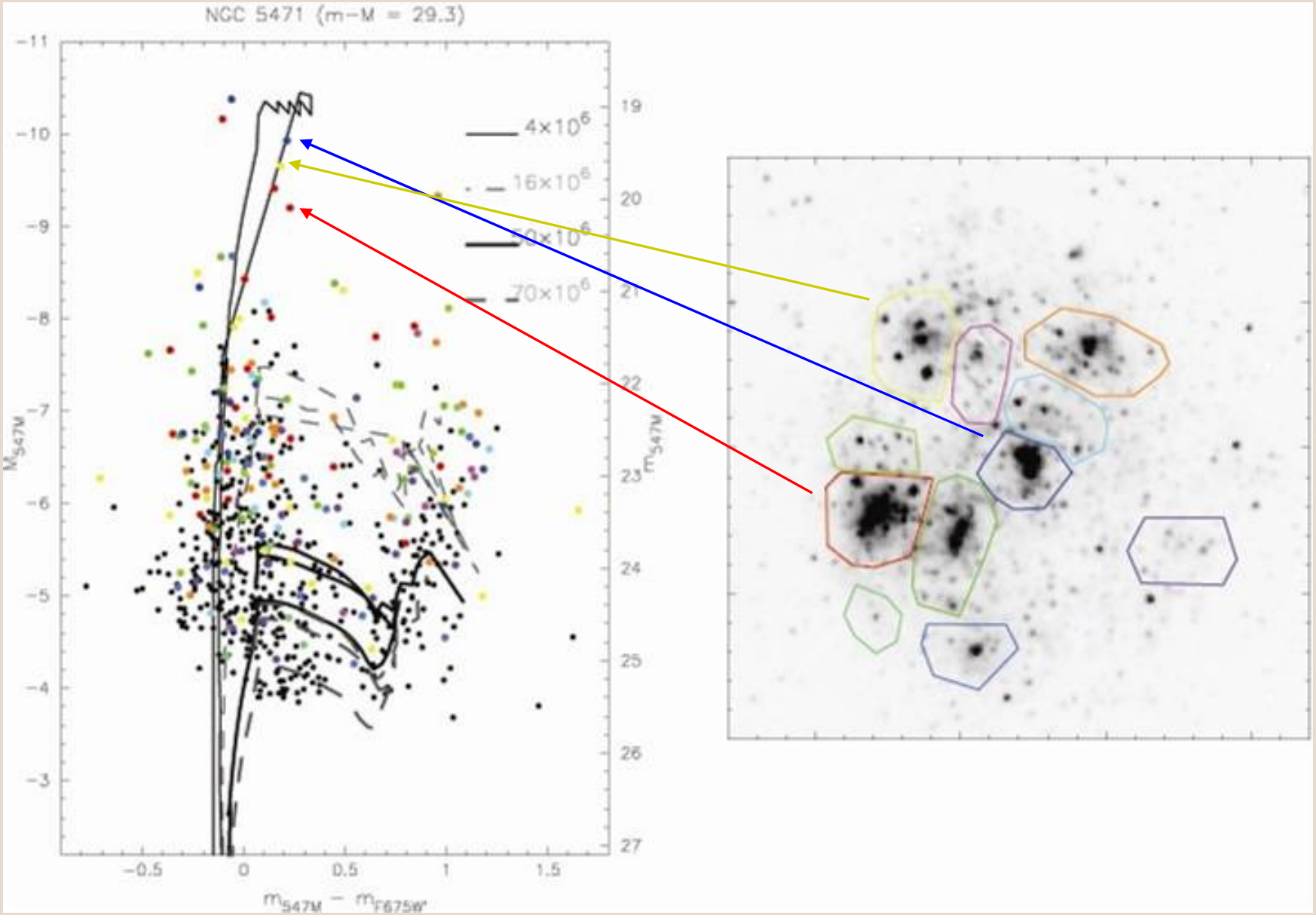


## III. Stellar Study

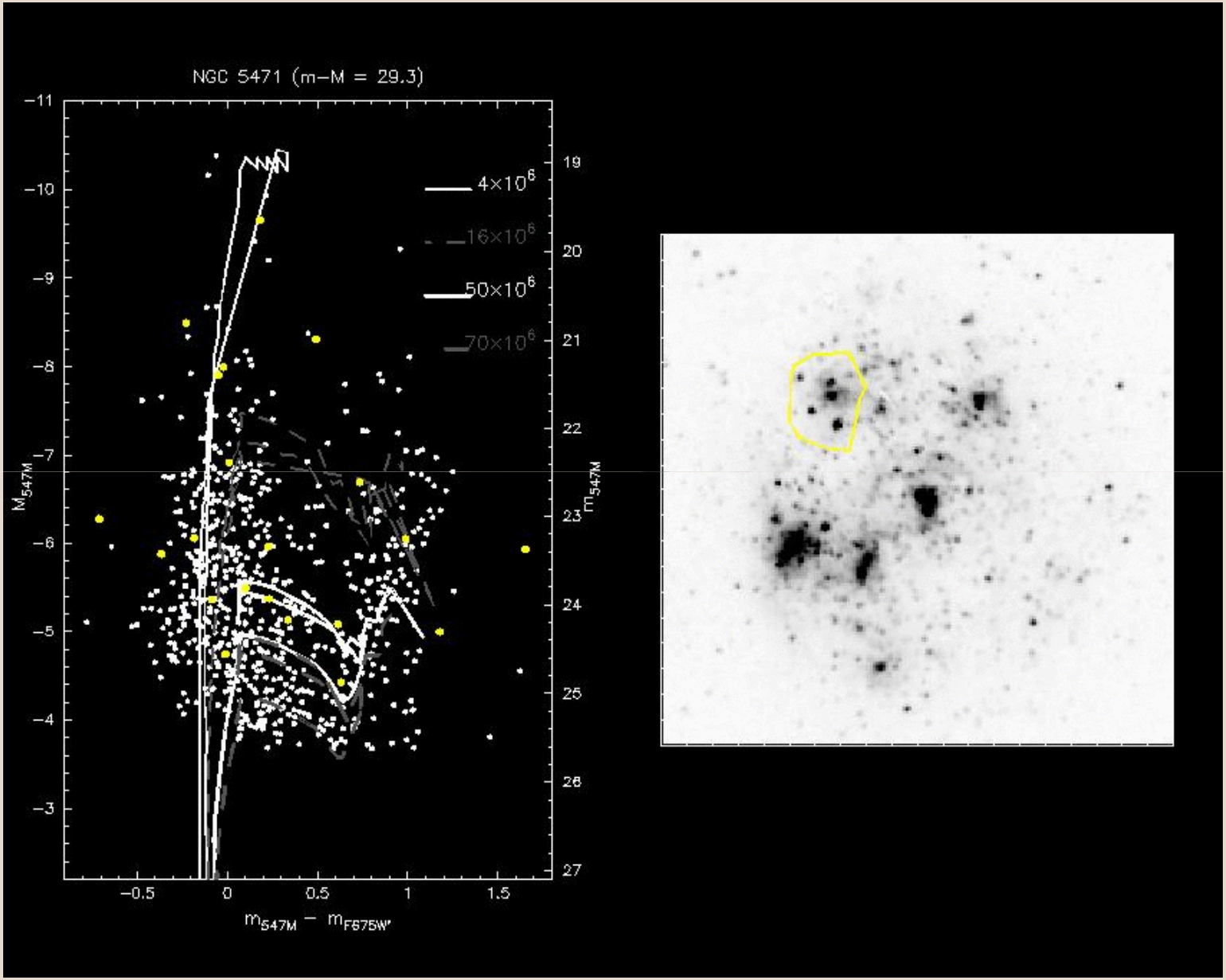



**Isochrones generated by M. Cerviño**

# III. Stellar Study



# III. Stellar Study

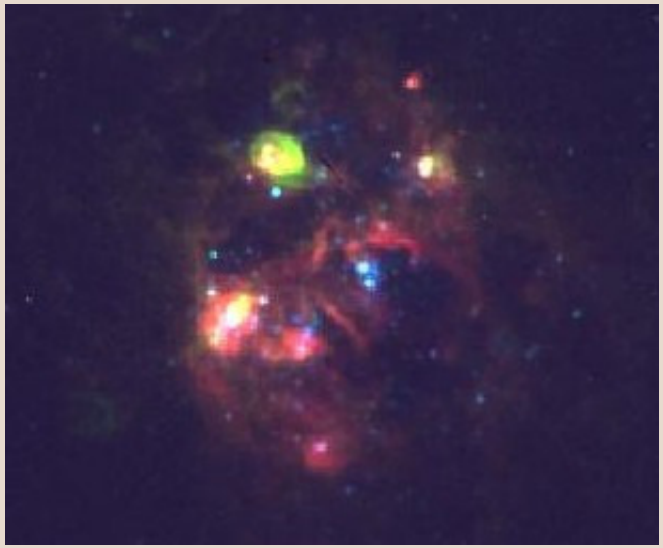


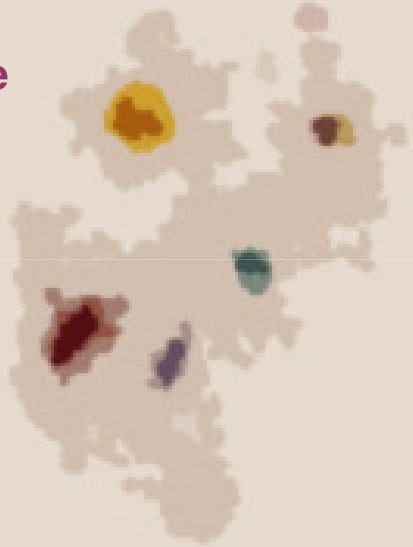
# IV . Conclusions

* **Ages < 5 Ma:** cluster has the highest ionizing power → dense luminous HII region.

* **5-10 Ma:** fast stellar winds and SNR have swept up the ISM into a shell with visible cavity around the cluster.

* **Ages > 10 Myr:** cluster is surrounded only by diffuse gas.





Integrated analysis: general trend of decreasing age and increasing Ha EW with increasing color excess.

From the HST/WFPC2 photometry, it has been found that star formation has been going in NGC 5471 for the last 70 Ma.

Importance on multiwavelength analysis → CMD + code analysis

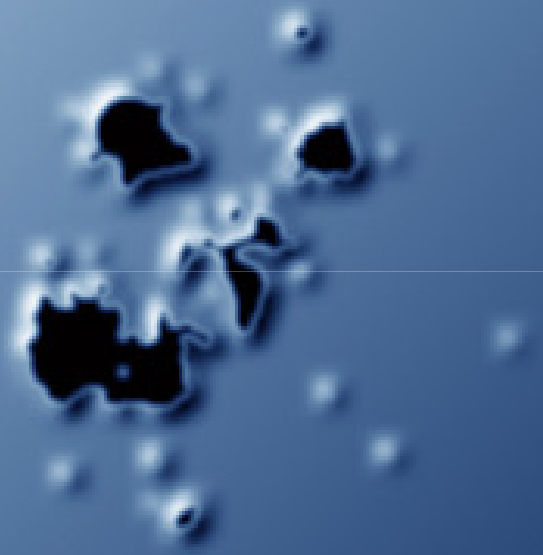
Deeper study & more bands

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