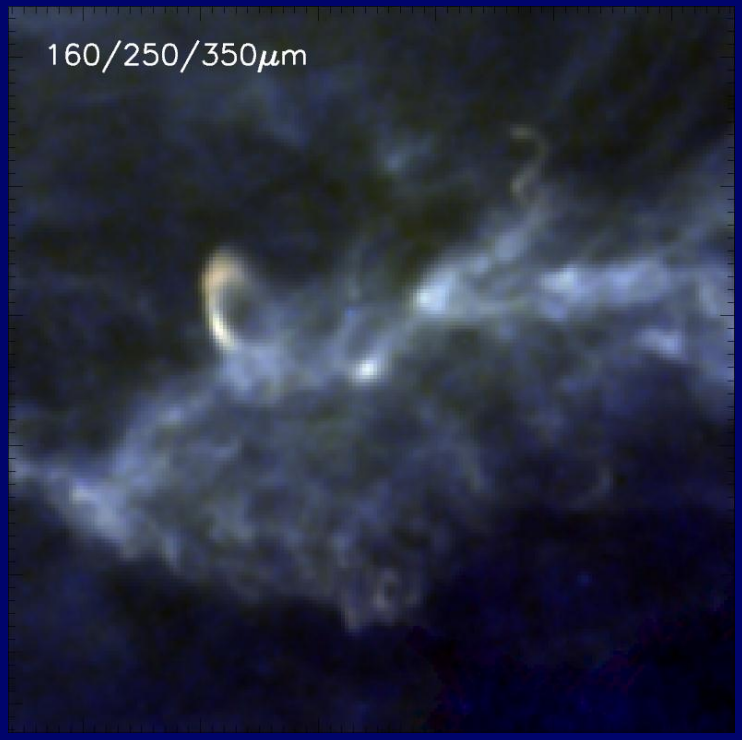
Star & planet formation parallel session – Herschel Conference Wrap-up



Derek Ward-Thompson
University of Central Lancashire

October 18th, 2013

Some quotes of the week:

`Your standard calibrators are variable' – Cernicharo

`I'm an alcoholic, I like methanol' – Pestalozzi

`I was locked out of the hotel' – Oliver

`I've got the water covered' – Bergin

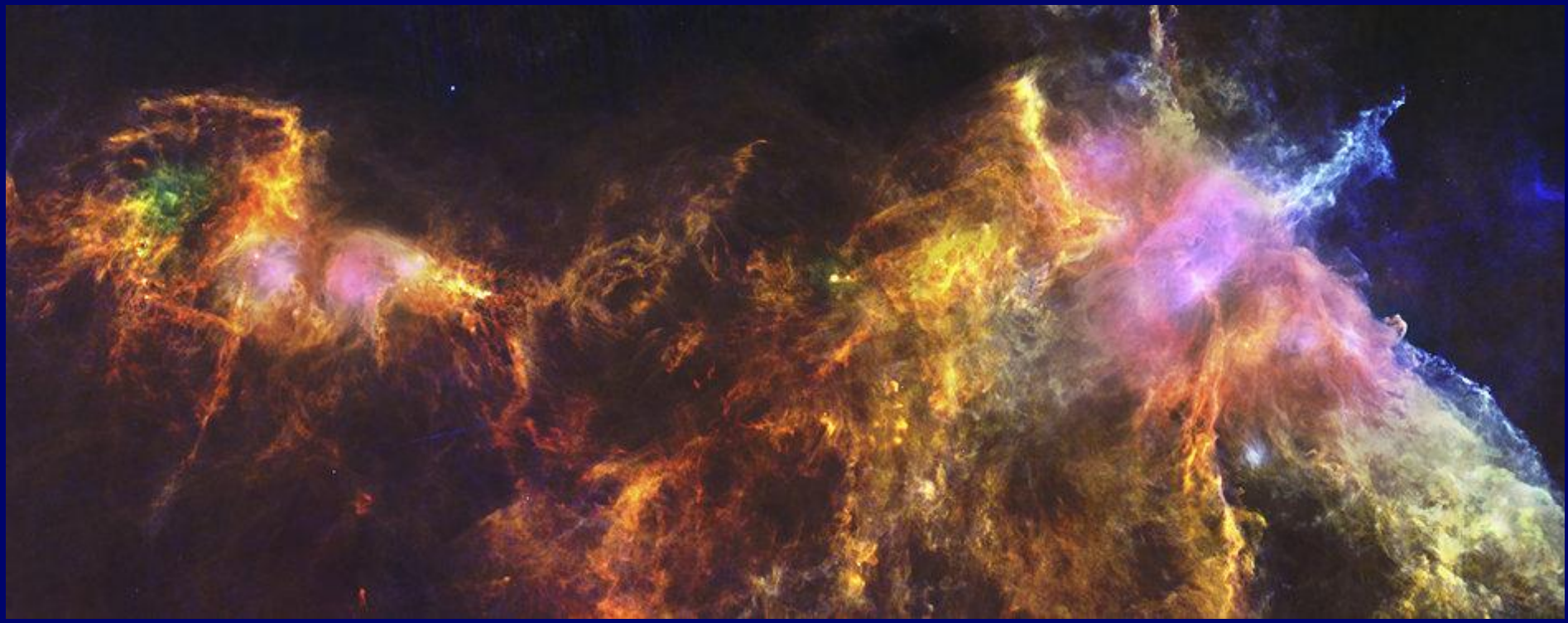
`You'll have to change your research goals' - Eales

`I can go into the Tate Modern and explain stuff' – Bendo

`Andromeda is like the girl next door' – Ford

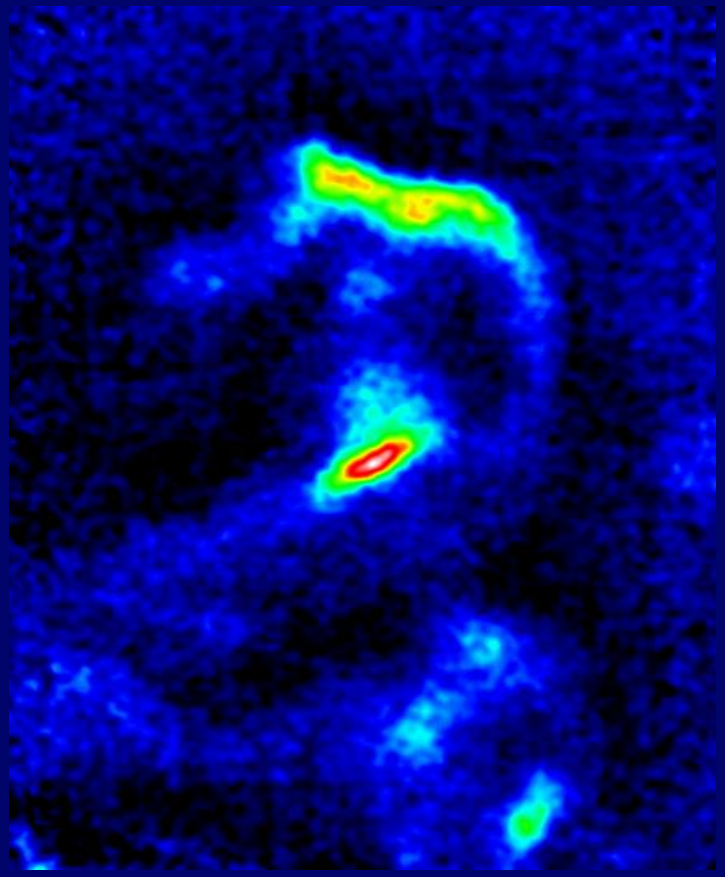
`When water gets cold you can skate on it' – van der Tak

Herschel's view of the Horse-head



Schneider et al; see also HOPS - Megeath et al

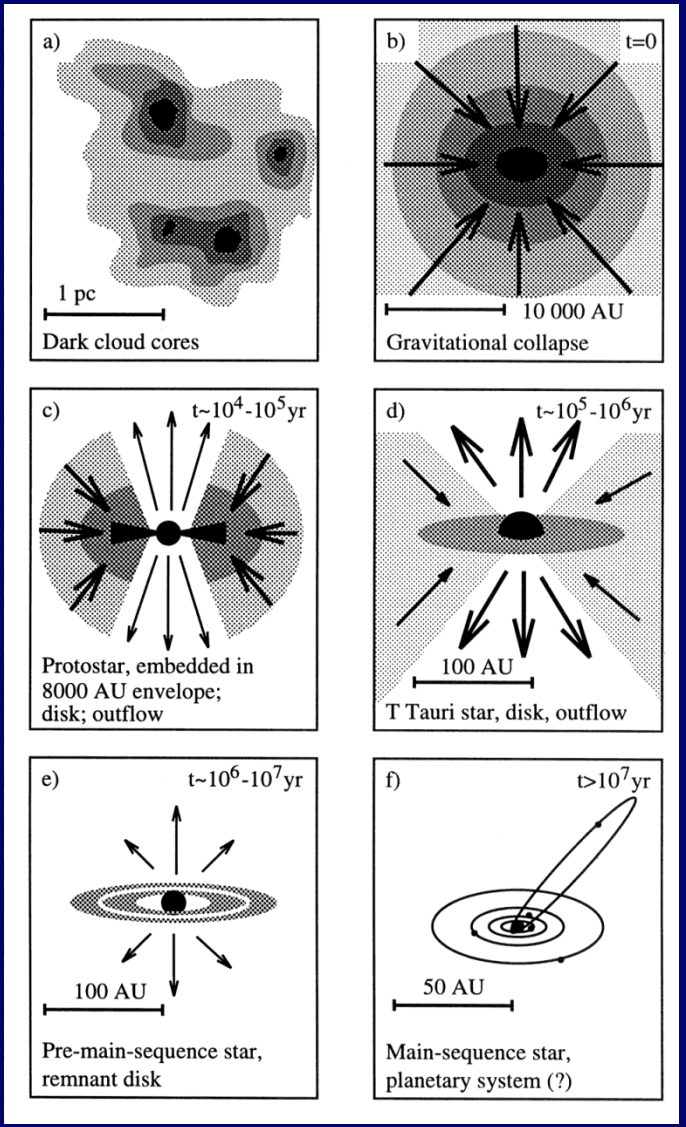
Horsehead Nebula

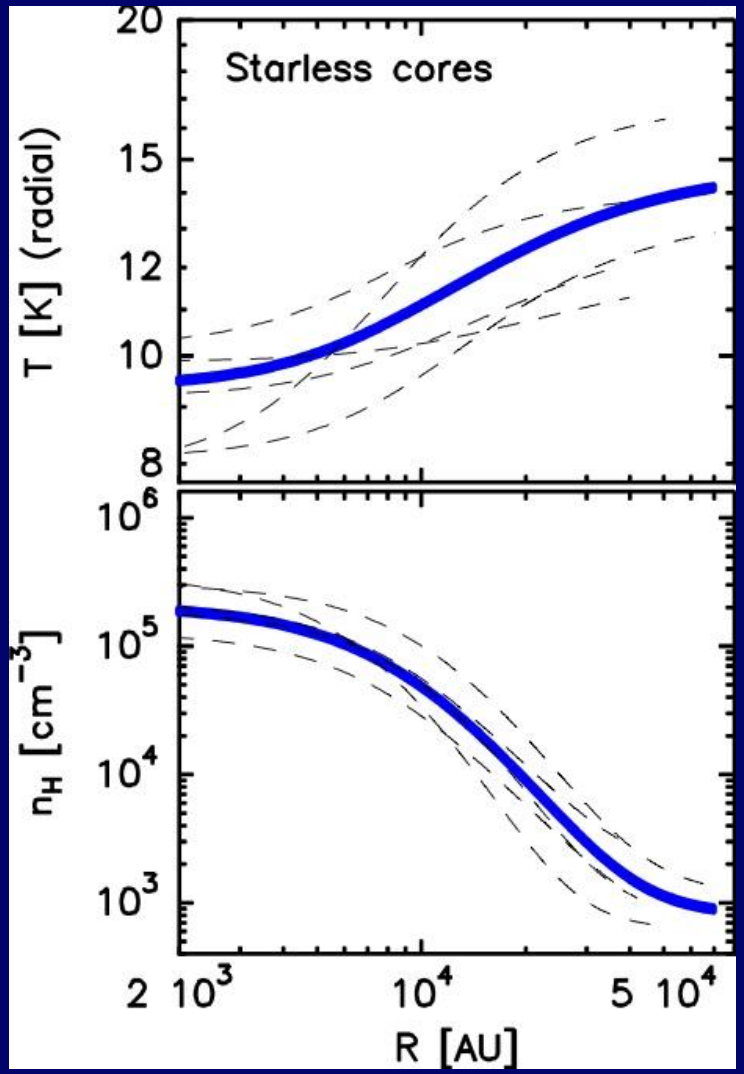


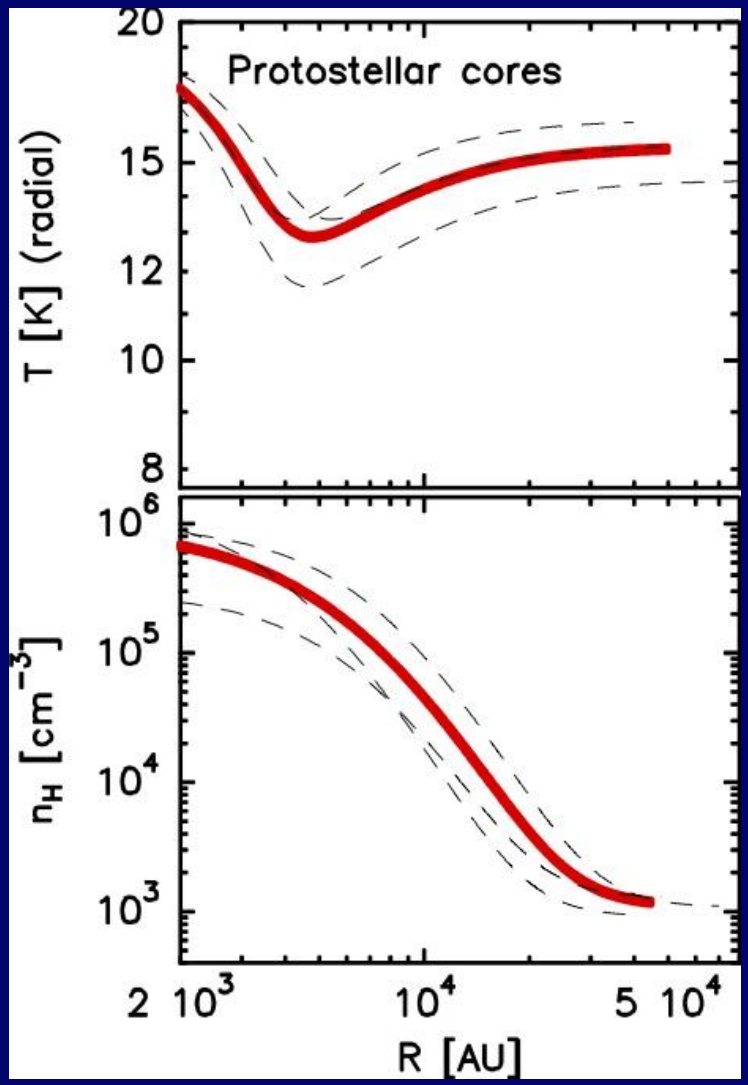
W-T et al

The initial conditions of star formation

Hogerheide et al

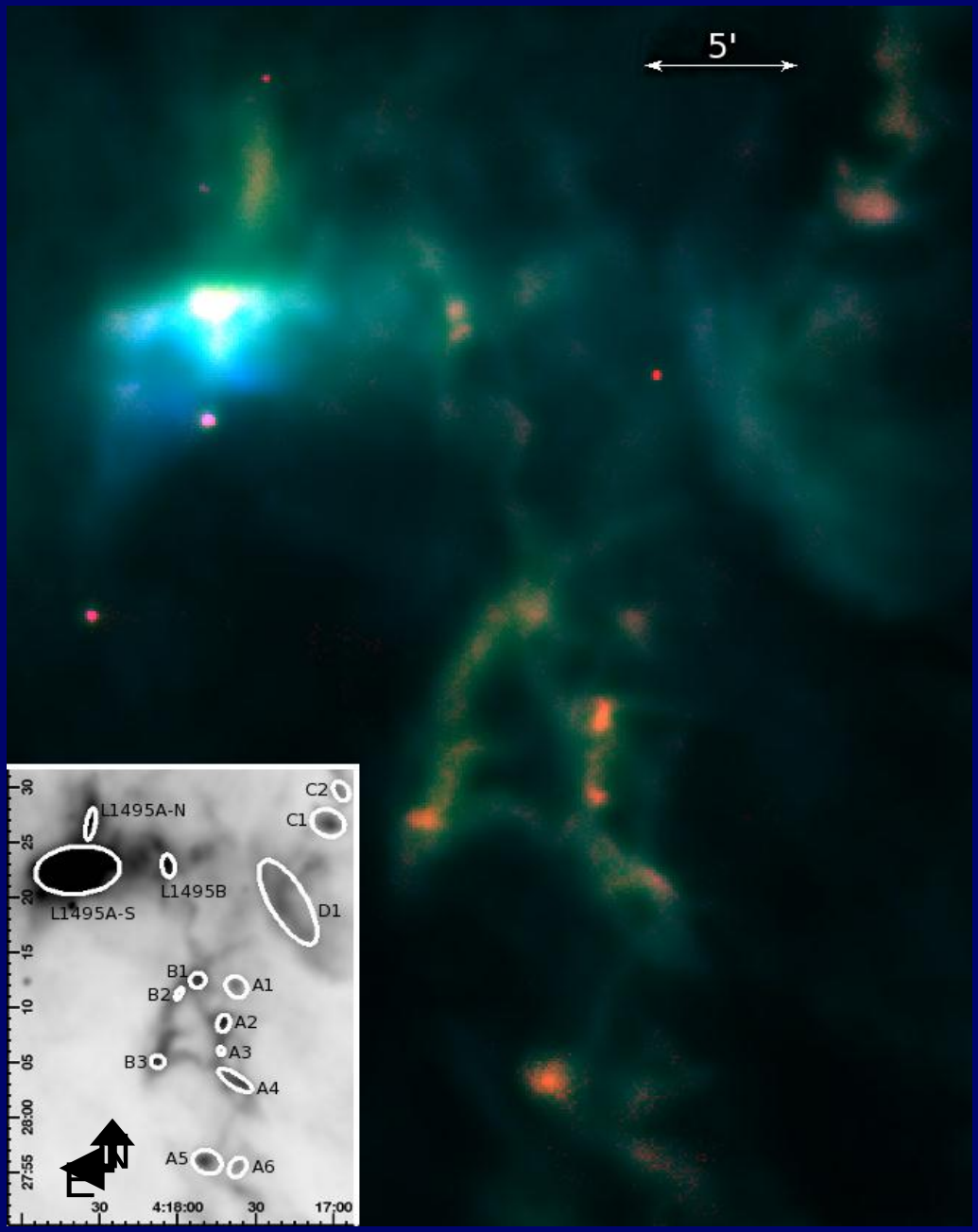






Launhardt et al

L1495



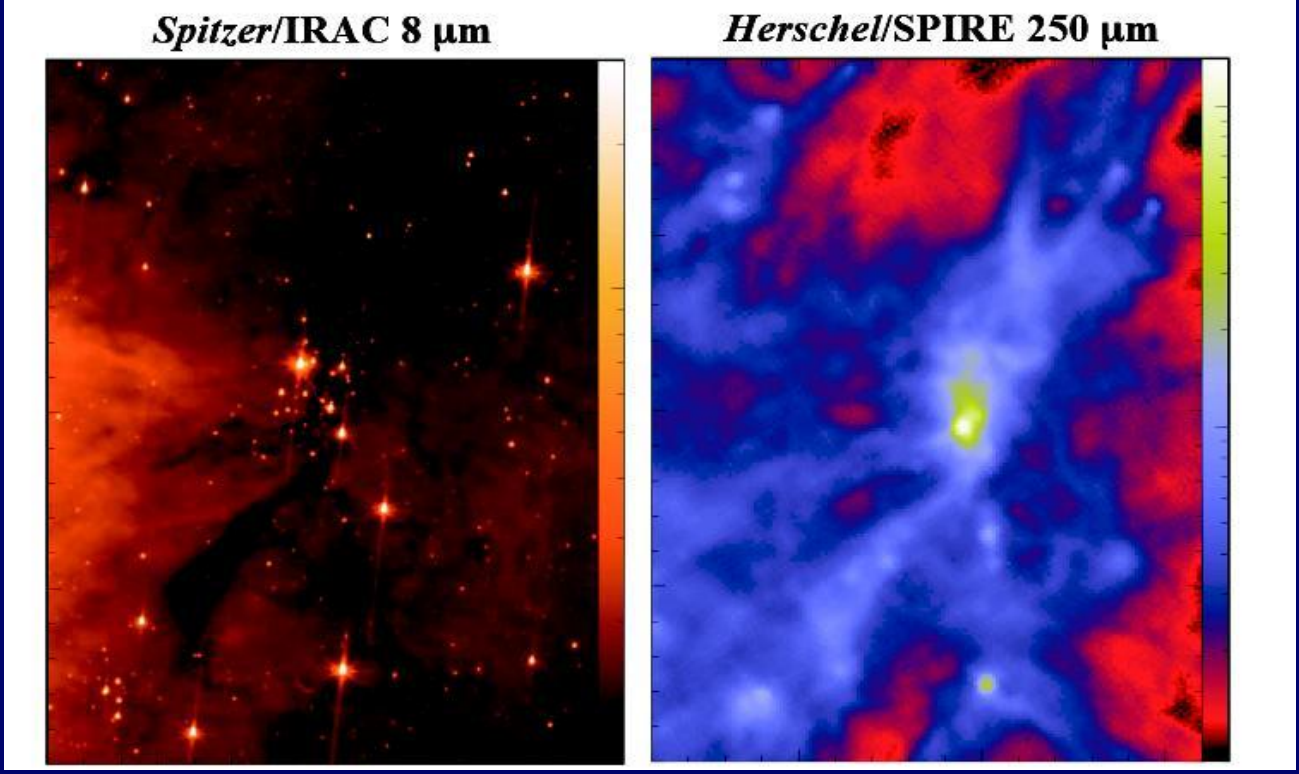
W-T et al

Gould Belt survey (Andre et al)

Konyves et al

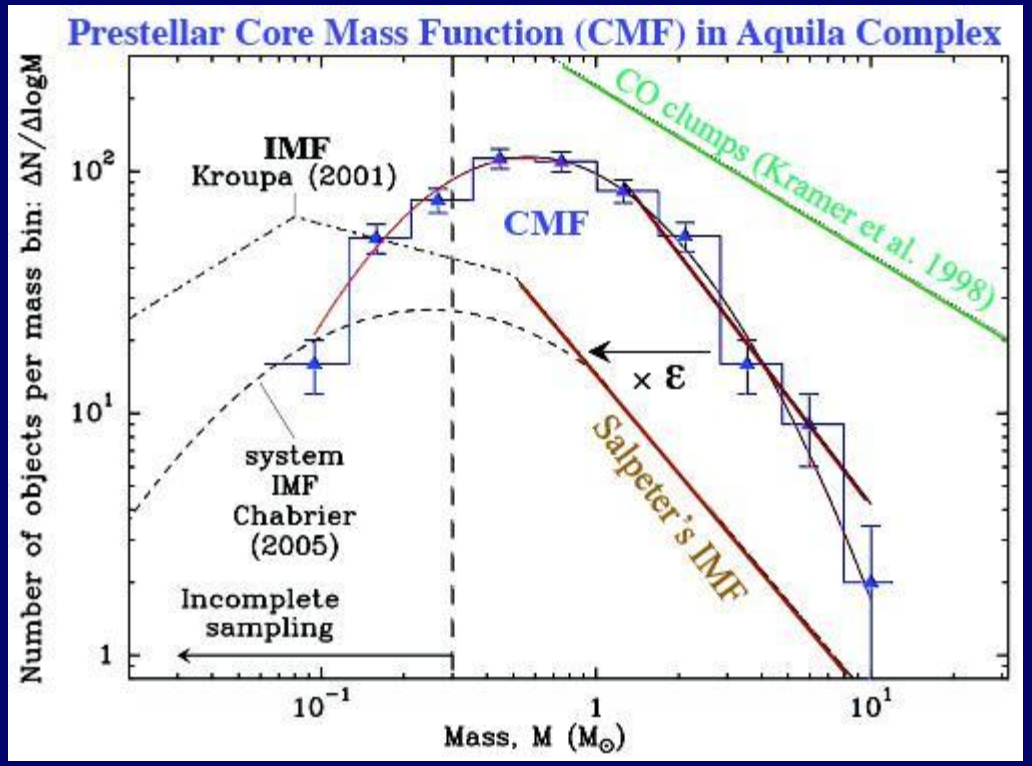
Aquila – 3x3deg – R:500, G:170, B:60um – 15 other such regions in survey

A young cluster forming



Konyves et al

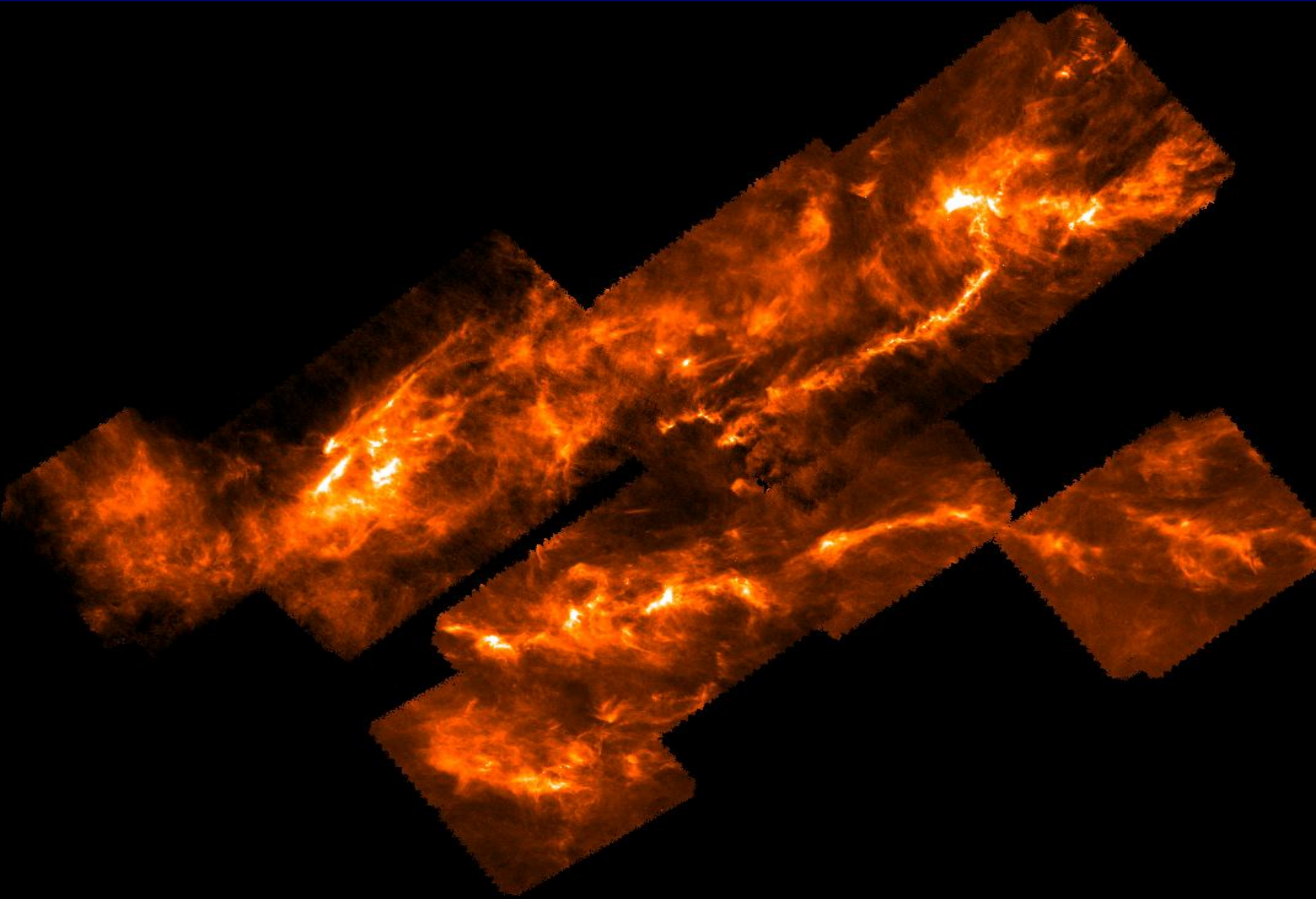
Prestellar/Starless CMF in Aquila



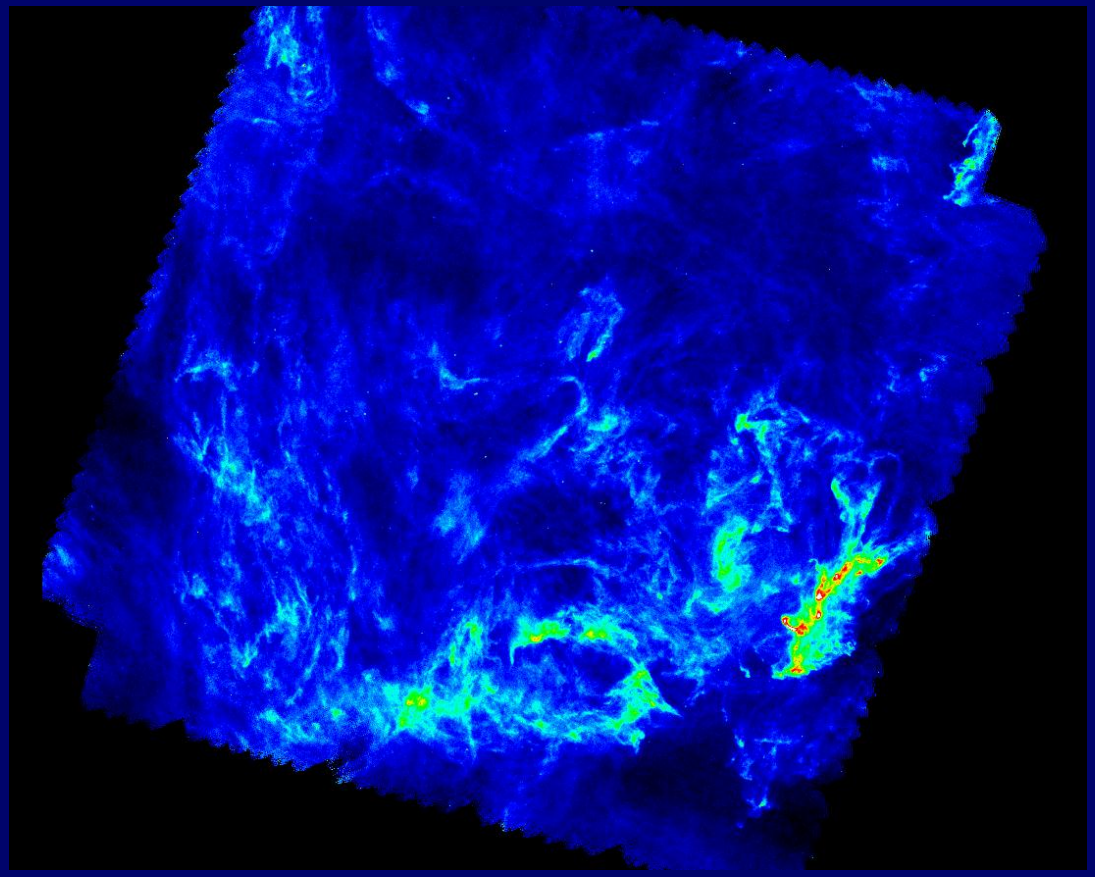
Konyves et al; Andre et al

Kirk et al

Taurus

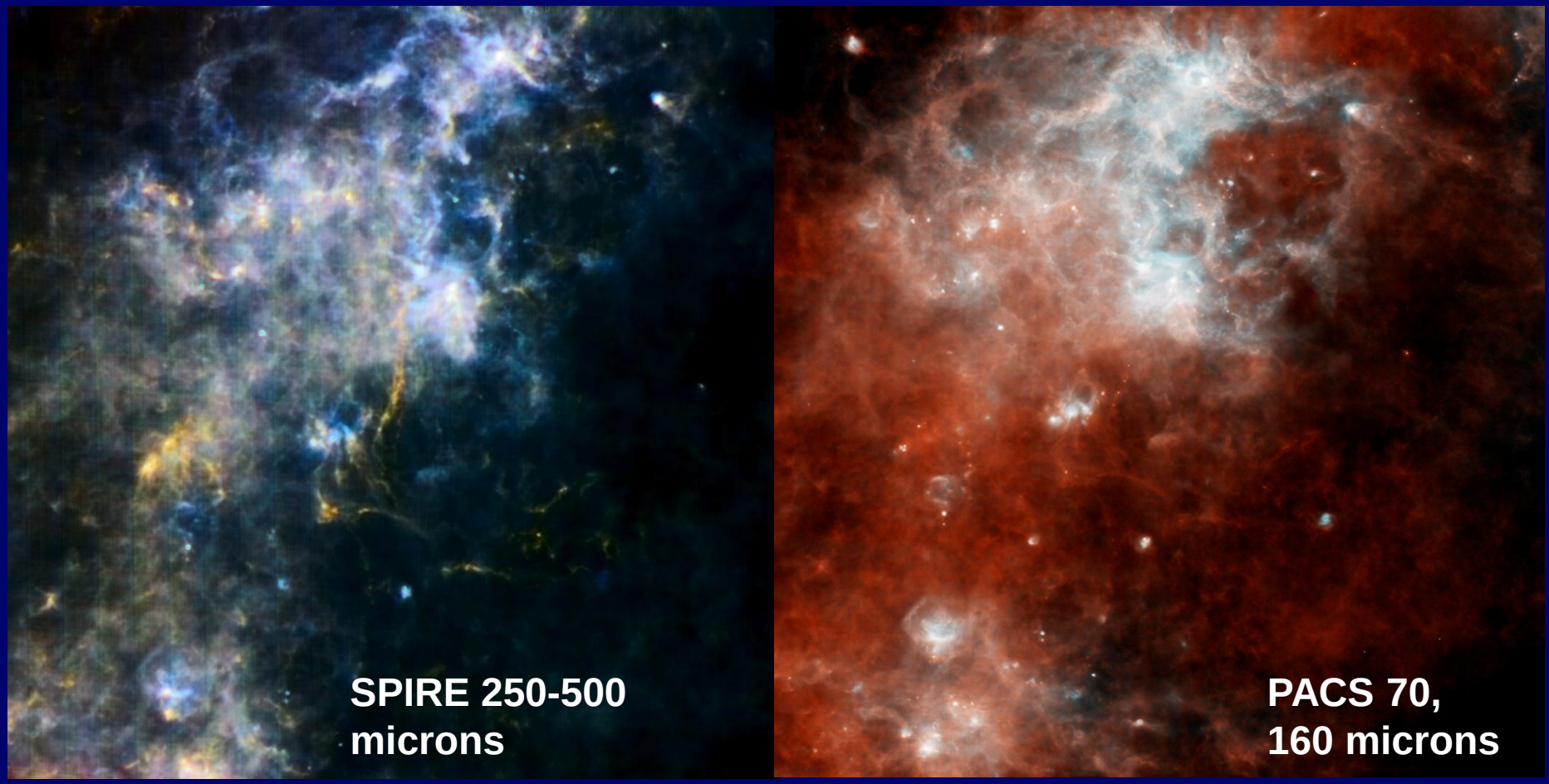


Polaris



W-T et al
Miville-Deschenes et al

Herschel Infrared Galactic Plane Survey

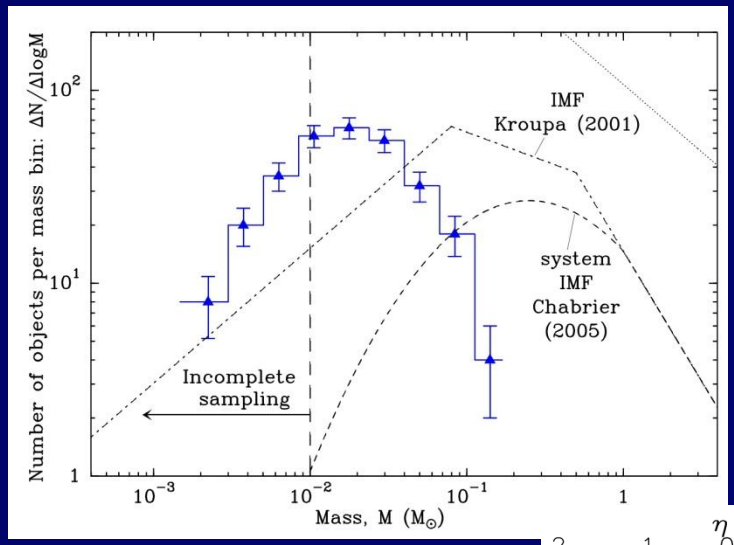


Molinari et al; Pestalozzi et al

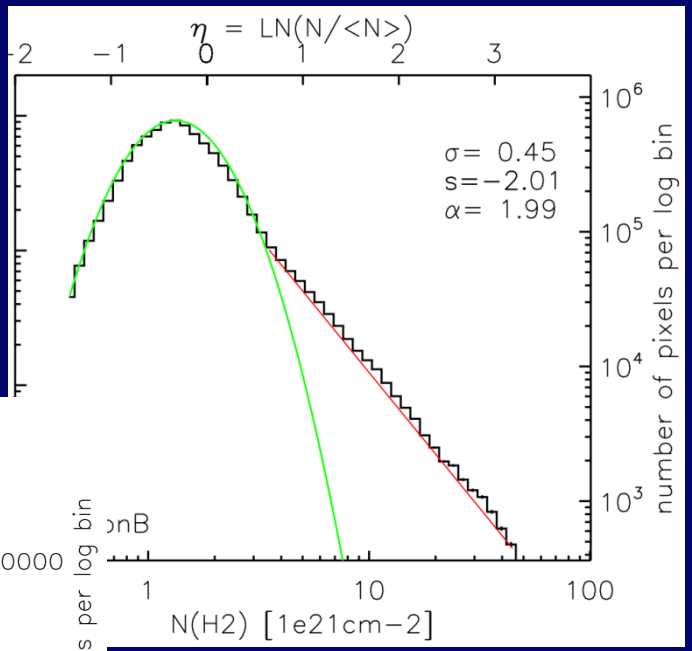
Galactic centre loop

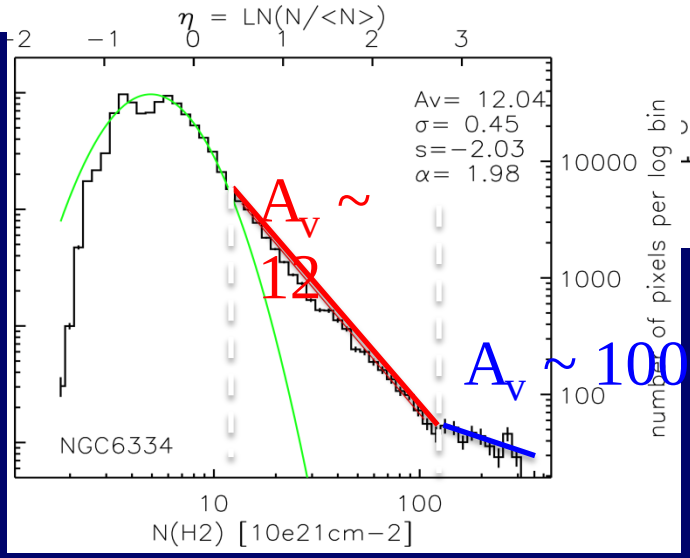
Molinari et al

CMF/PDF mimics IMF



Andre et al





A_v ~ 12

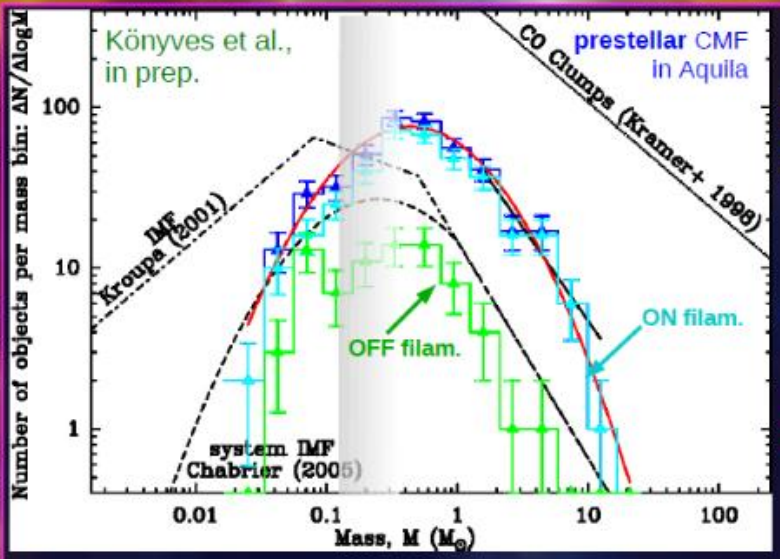
A_v ~ 100

Motte et al
Henning et al

Schneider et al

HGBS: AQUILA

CORE MASS FUNCTION (CMF)



Differential mass function of ~400 prestellar cores in the entire Aquila field.

Lognormal fit peaks at ~ 0.4–0.6 $M_\odot$

fitted power-law: $dN/d\log M \propto M^{-1.16\pm0.26}$

André et al. 2010
Könyves et al. 2010

In Aquila, the prestellar cores with ON- / OFF-filament position do not seem to show evidence of different peaks in the CMF.

⇨ This feature can be environment dependent...

Konyves et al

HGBS: AQUILA

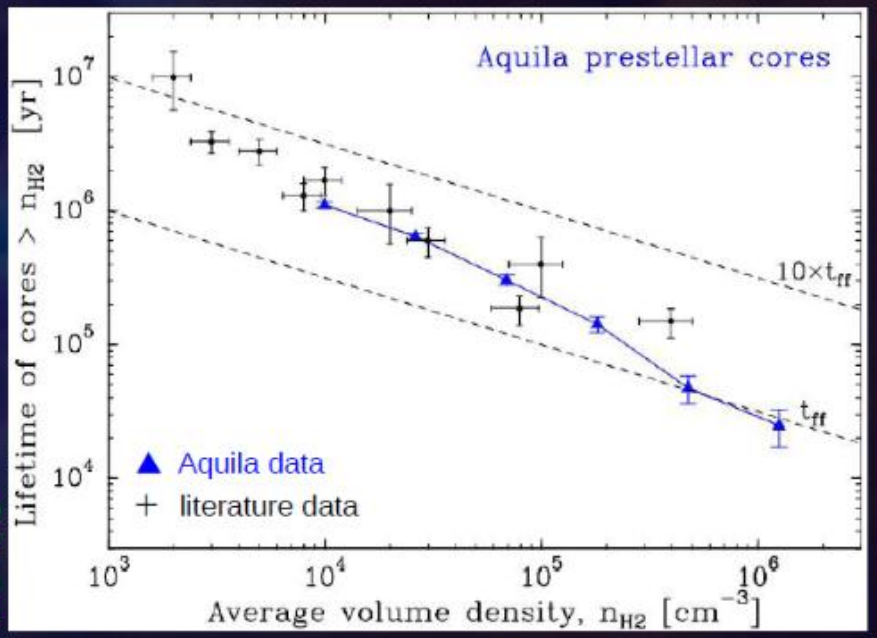
LIFETIME ESTIMATES

Core lifetime estimates

Based on number ratios:

- ~400 *Herschel* prestellar cores (t ~ 1 Myr)
- ~200 *Herschel* Class0/ClassI protostars (t ~ 0.5 Myr)
- ~800 *Spitzer* (Class II, YSOs) (t ~ 2 Myr, Evans et al. 2009)

Jessop & Ward-Thompson 2000
Ward-Thompson et al. 2007
André et al. PPVI
Könyves et al. in prep.



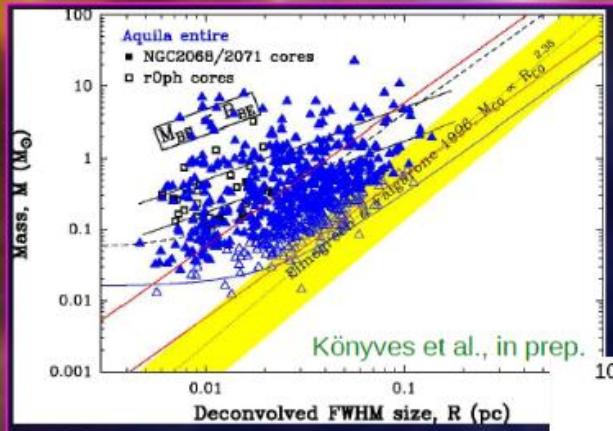
Estimates of Aquila core lifetimes lie between two "extreme" timescale evolutionary models.

Literature estimates for observed core timescales of various data-sets gave similar constraints (Jessop & Ward-Thompson 2000, Ward-Thompson et al. 2007, references therein).

Konyves et al

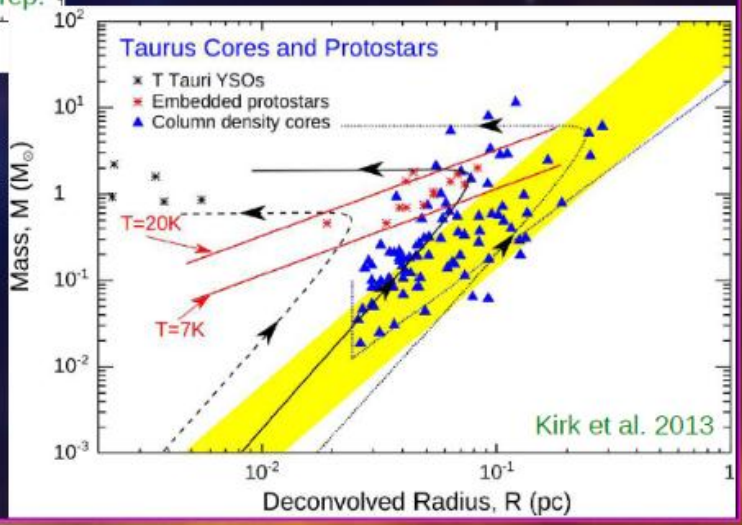
HGBS: AQUILA

MASS-SIZE DIAGRAM



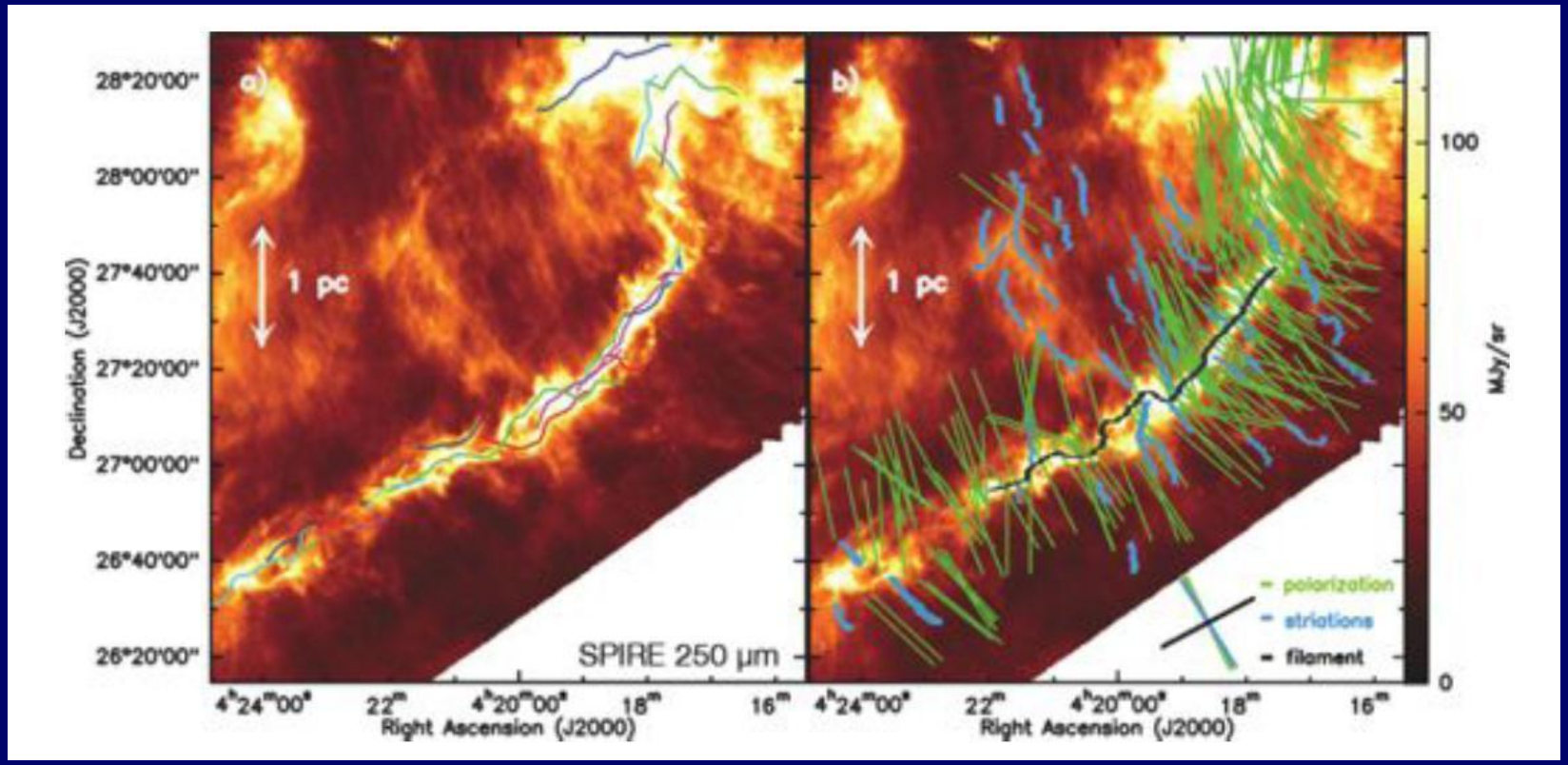
Aquila: Mass vs. size diagram comparing the locations of ~400 candidate prestellar cores (▲), and the rest starless cores (△) (André et al. 2010, Könyves et al. 2010).

Taurus: mass-size diagram appears to serve as an evolutionary diagram (André et al. PPVI).



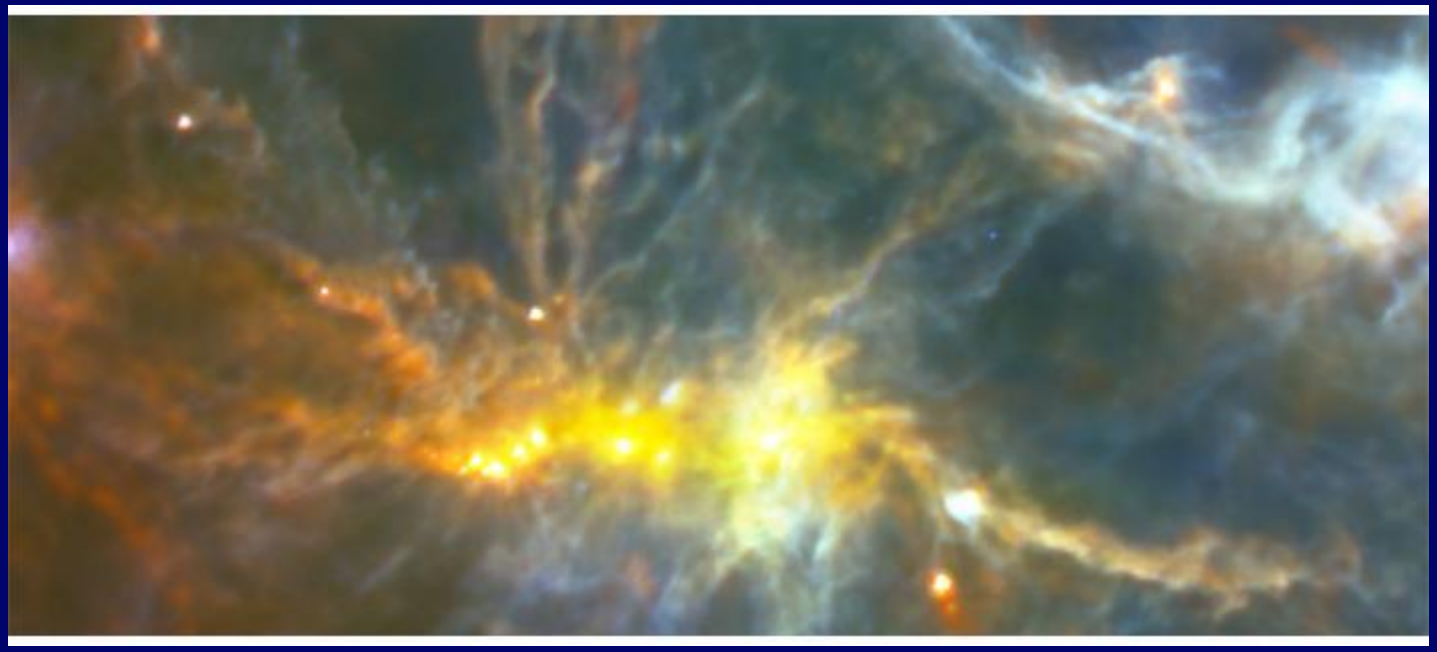
Konyves et al

Filament growth



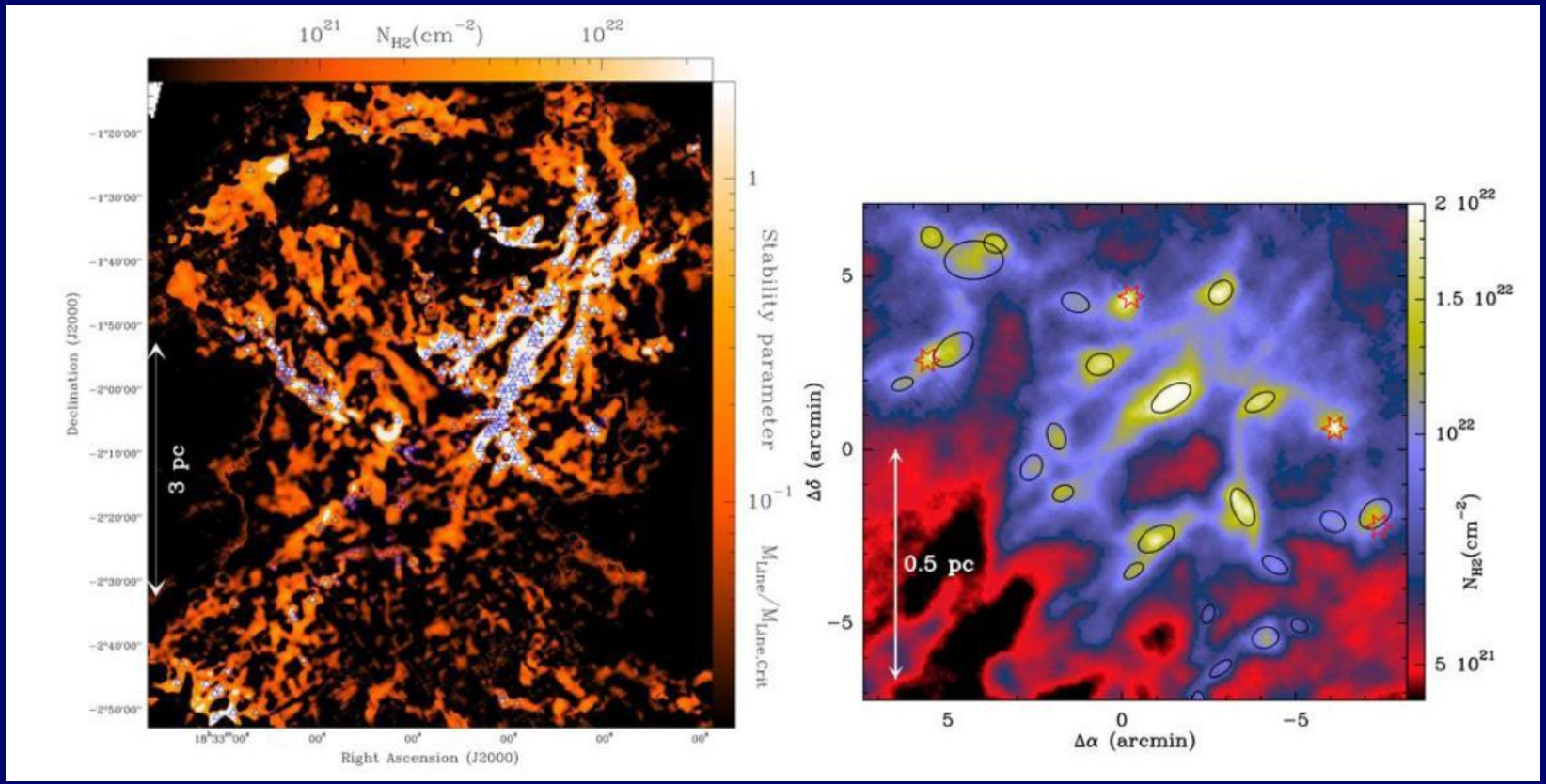
Andre et al; Palmeirim et al

Filaments everywhere!

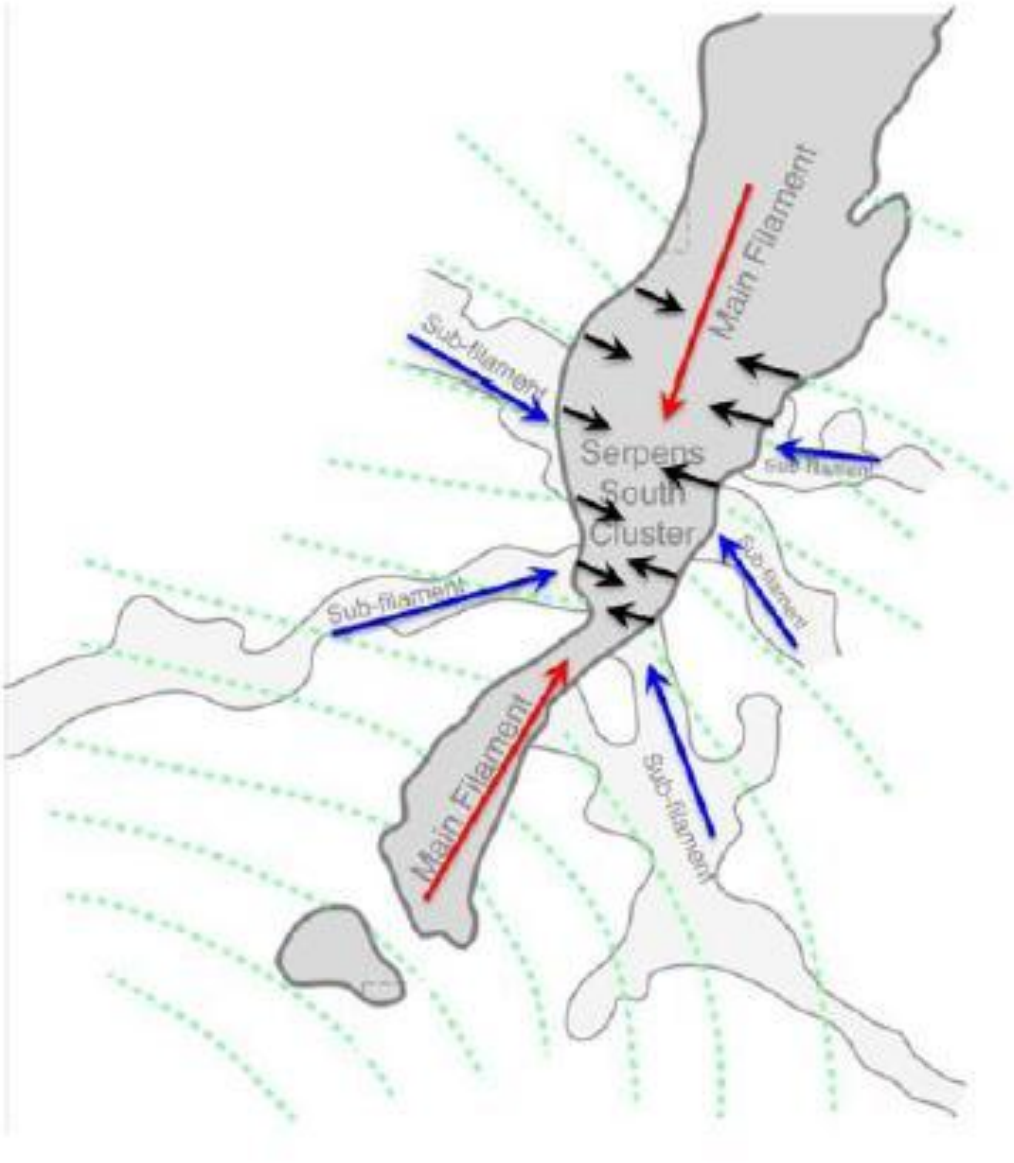


Schneider et al

Cores form on filaments

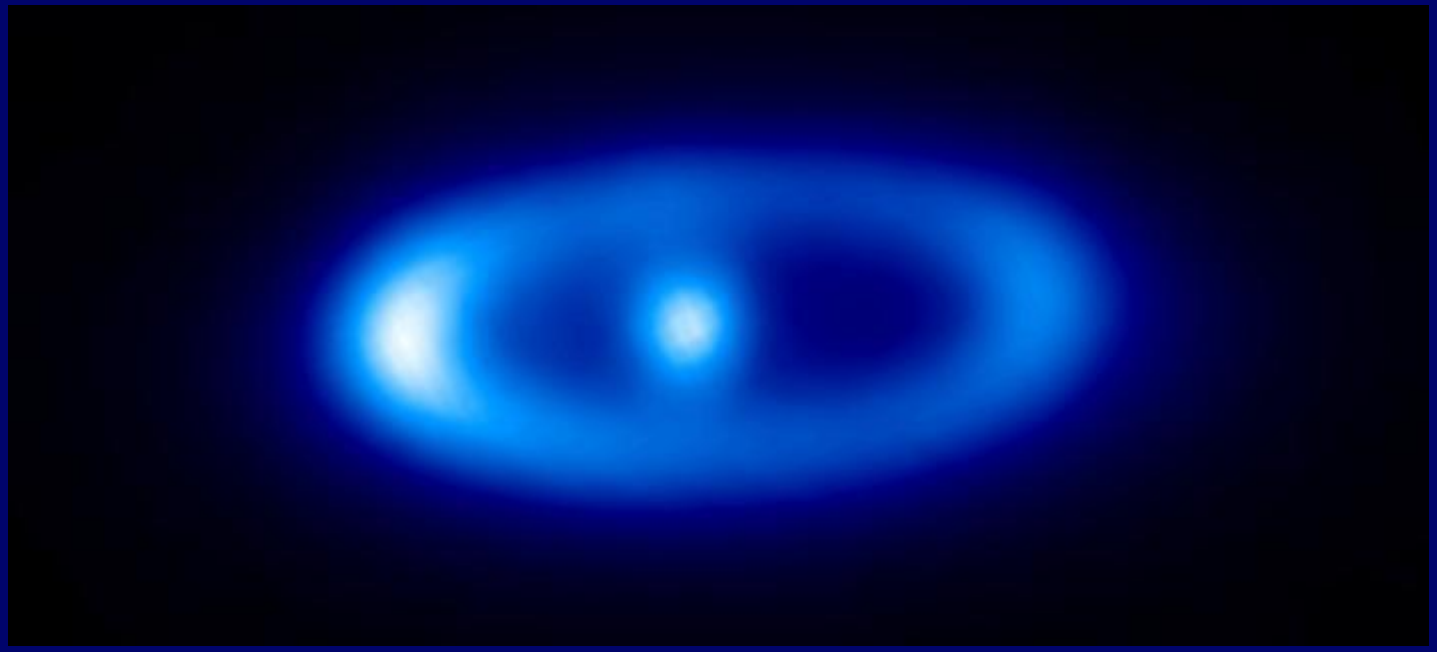


Konyves et al


Main Filament
Sub-filament
Serpens South Cluster
Sub-filament
Sub-filament
Sub-filament
Main Filament
Sub-filament

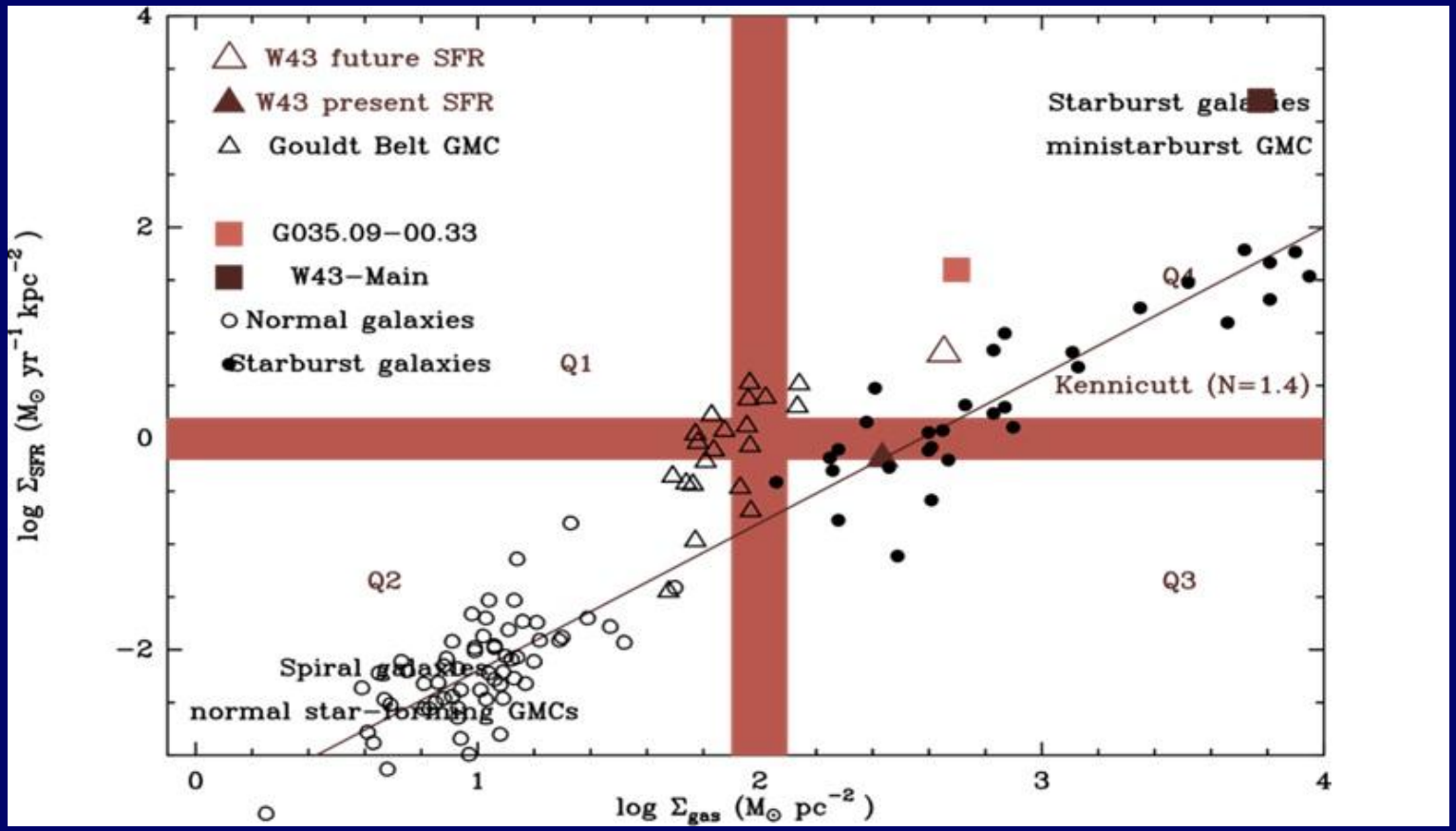
Andre et al

Fomalhaut – PACS 70um



Acke et al; Sibthorpe et al; Phillips et al; Donaldson et al

Towards a unified model…



Motte et al

Conclusions

- A new paradigm has emerged from Herschel
- Clouds rapidly become filamentary
- Filaments form cores
- CMF/PDF mimics IMF
  - Log-normal - turbulence
  - Power-law - gravitation
  - Second power-law – compression(?)
- Towards a unified model of star formation…..