

AN INFRARED STUDY OF SOUTHERN DARK CLOUDS

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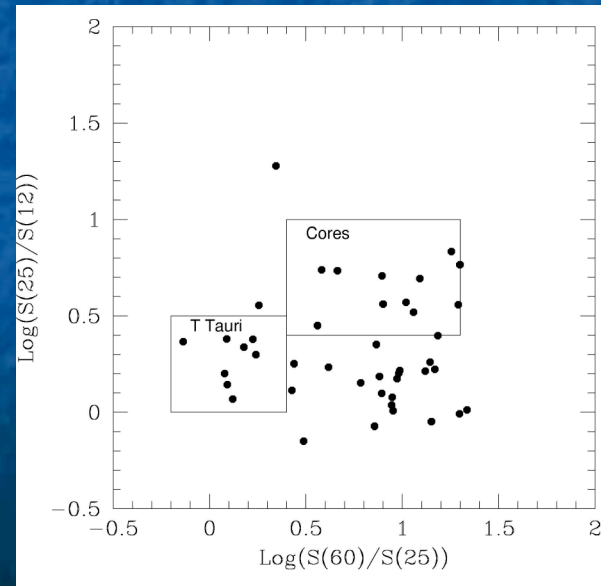
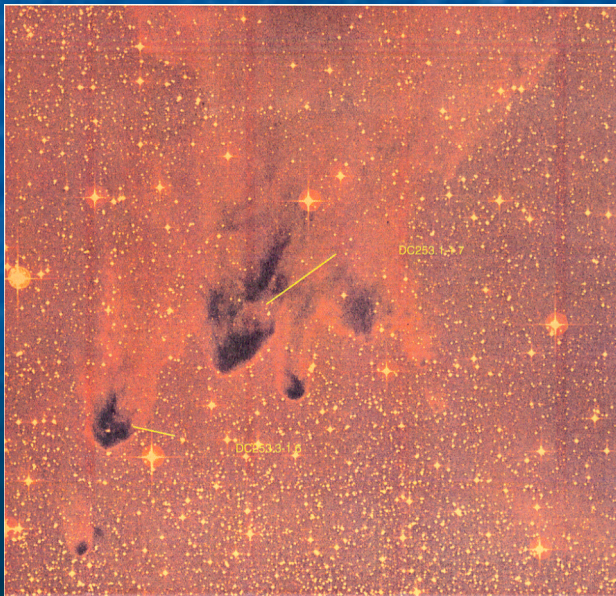


Submm/FIR Astronomy from Antarctica

25-27 June 2007 CEA Saclay France

SOUTHERN DARK CLOUDS

- 1100 Dark Clouds with $\text{Dec} < -33^\circ$ have been found from the analysis of the ESO/SERC southern J survey plates (Hartley et al. 1986 A&AS 63 27)
- 482 southern DCs have characteristics similar to Bok Globules $< 64 \text{ arcmin}^2$, and 42% are associated with IRAS sources (Persi et al. 1990 AJ 99 303)



Characteristics of isolated small DCs

- 169 isolated small DCs (globules) have been surveyed by [Bourke et al 1995 MNRAS 276 1084](#), in NH₃ (1,1) and (2,2).

- Approximately half of the globules have been detected in ammonia with the following mean characteristics:

D=0.21pc; T(K)=13 K; n(H₂)=1310³cm⁻³; M(Msun)=5

- These parameters indicate that small DCs are ideal laboratory to study isolated low-mass star formation

- ~40% of this sample has been observed at 1.3mm continuum by [Henning et. al 1998 A&A 338 223](#)

NIR OBSERVATIONS

Las Campanas Observatory

Telescope: Magellan/ **Baade 6.5m**

Camera NIR PANIC

(1024X1024 HgCdTe Rockwell Hawaii)

Scale=0.125"/pix

Filters: Br γ , H 2 , J, H, K s

Sensitivity limits: J=22.5, H=21.5, K s =19.5 (3 σ)

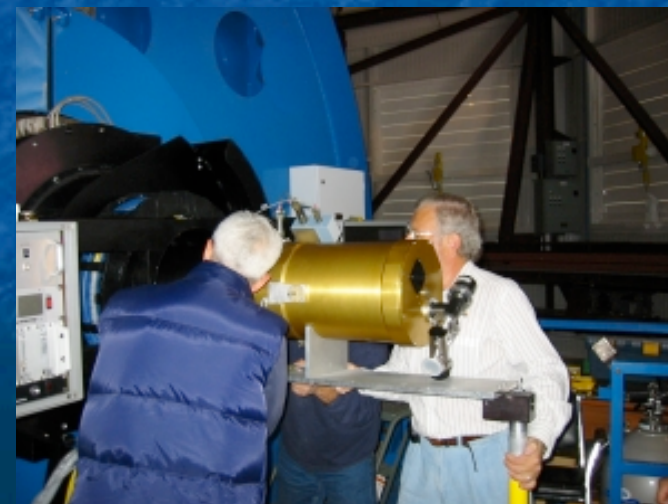
PSF=0.7-0.8" (FWHM)

Telescope : 2.5m Du Pont

Camera C-CAM

Scale=0.349"/pix

Filters : J, H, K s



MID-IR OBSERVATIONS

ESO Observatory La Silla Chile

Telescope : **3.6m**

Camera TIMMI2

Scale= **0.20"/pix**

Filters : **8.9, 9.8, 11.9 μ m**

GEMINI-SOUTH Cerro Pachon Chile

Telescope: **8m**

Camera T-ReCS

Array: **320X240 Si:As IBC**

Scale =**0.09"/pix**

Filters: **N, Qa(18.3 μ m)**

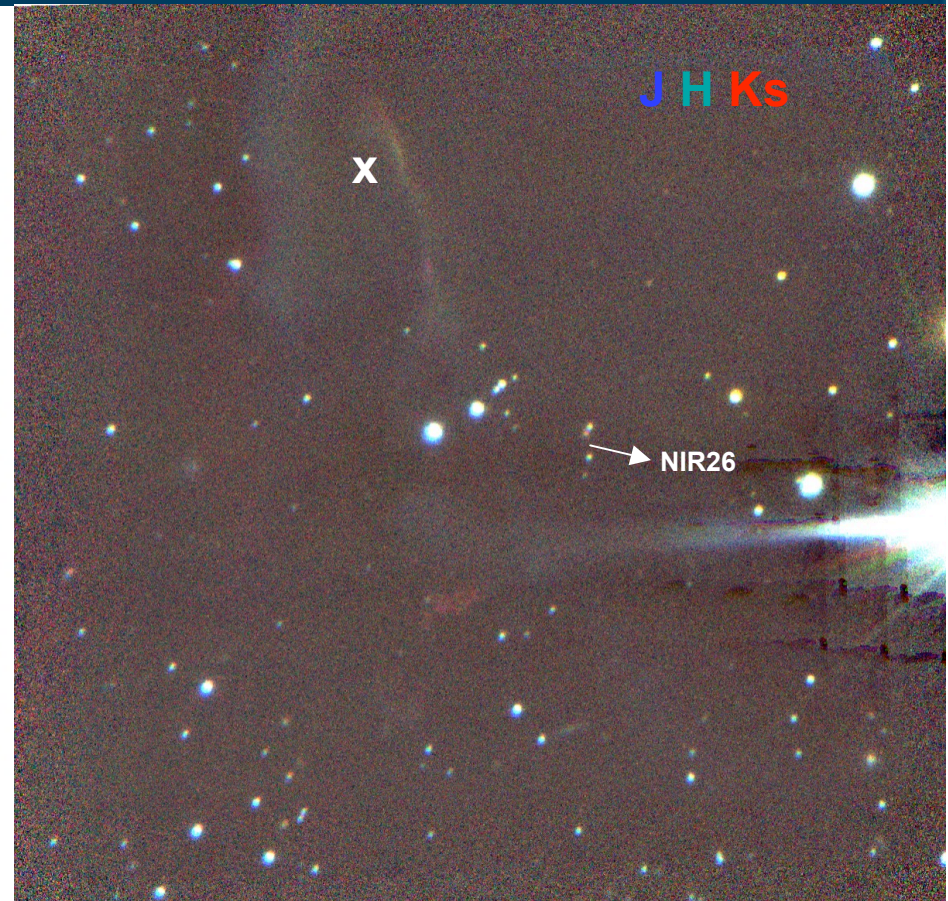
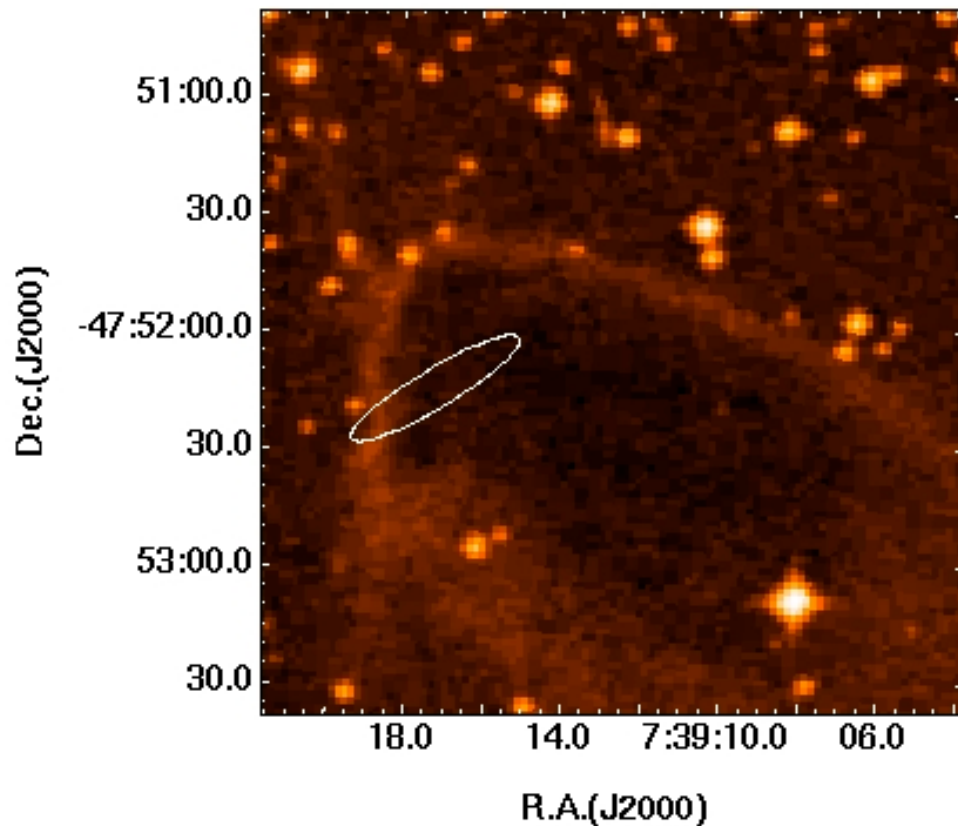
Sensitivity: **N=3.7 mJy: Qa=17.5mJy(3 σ)**

PSF=**0.5-0.6"(FWHM)**



DC260.7-12.4(IRAS07378-4745)

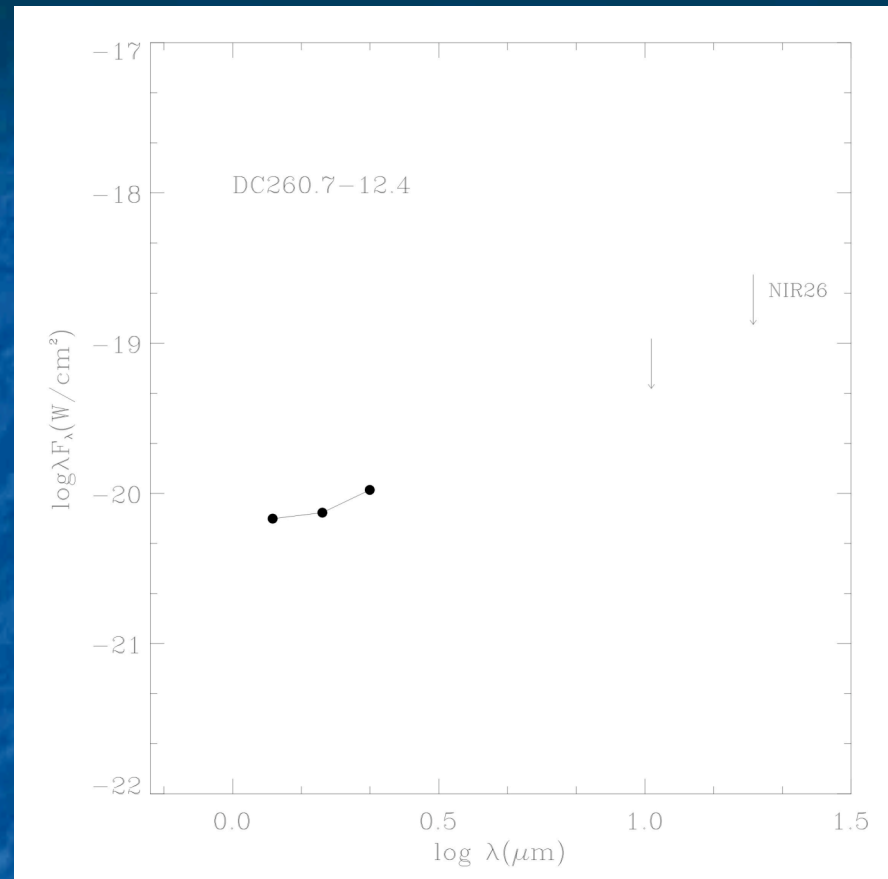
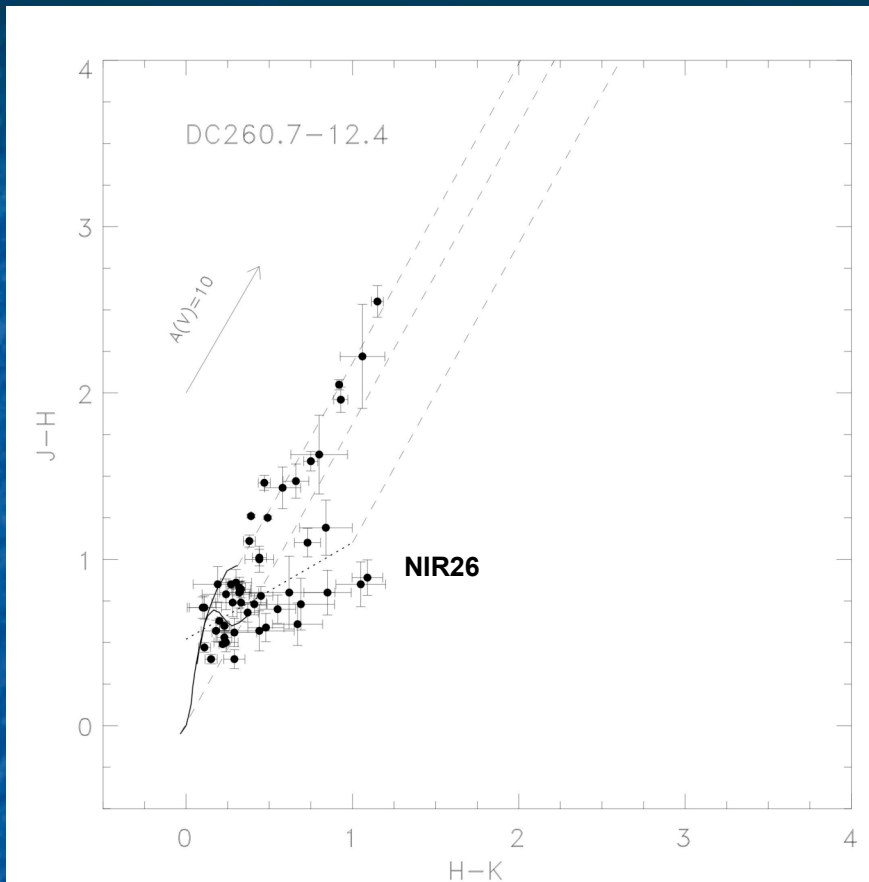
DC260.7-12.4 Optical



Cometary Globule CG3 in the Gum Nebula ([Bhatt 1993 MNRAS 262 812](#))
D=400pc

From IRAS (60,100 μ m) $L_{bol} = 2.57L_{Sun}$; $T_c = 28K$

DC260.7-12.4 (NIR26)



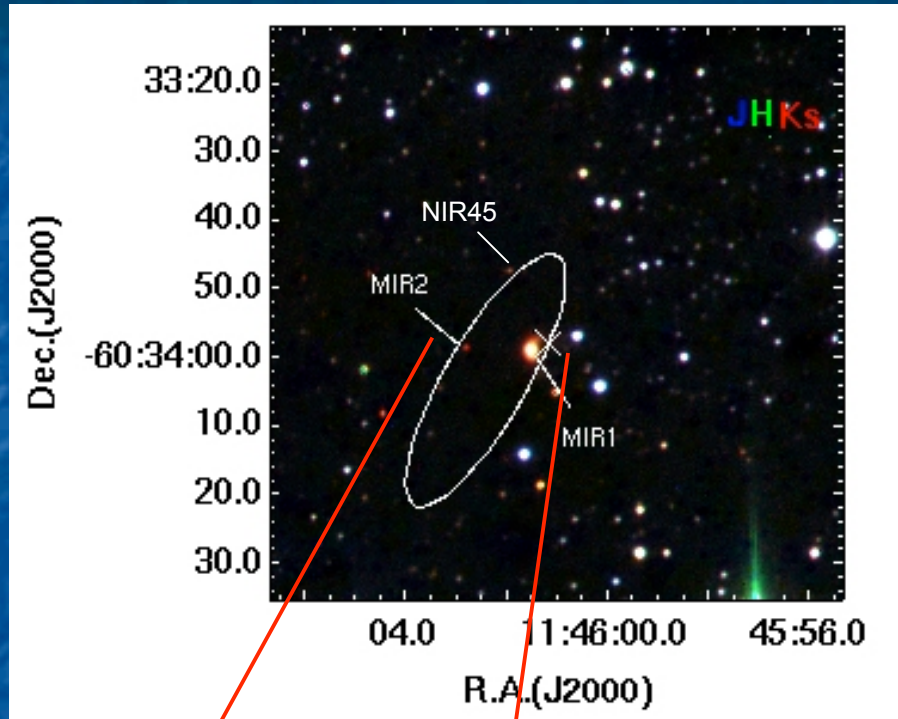
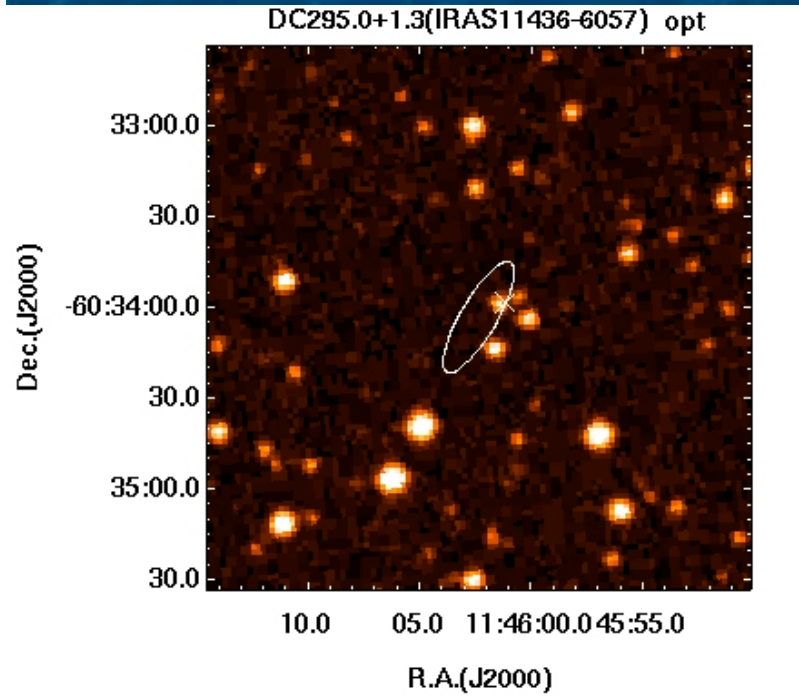
$$A_V = 9.09[(J-H) - (J-H)_0] = 0.36$$

$$DM = 8.01; M_J = 11.27$$

$$\text{Log}(L^*/L_{\text{sun}}) = 1.89 - 0.4(M_J + BC_J)$$

$$L^* = 5 \cdot 10^{-4} L_{\text{sun}}$$

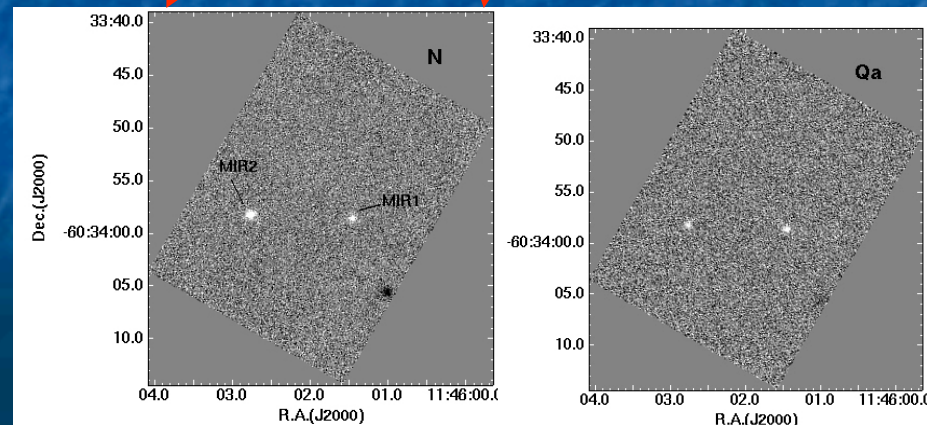
DC295.0+1.3(IRAS11436-6057)



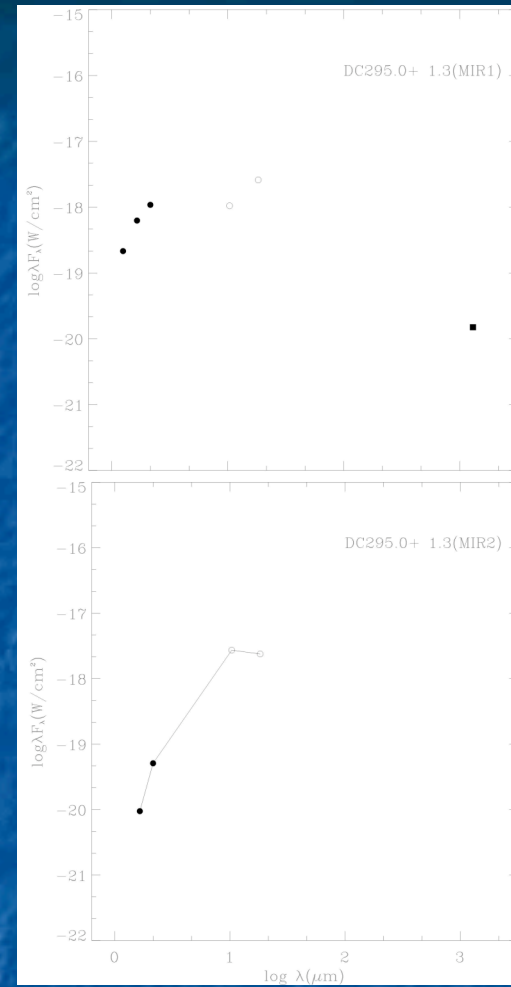
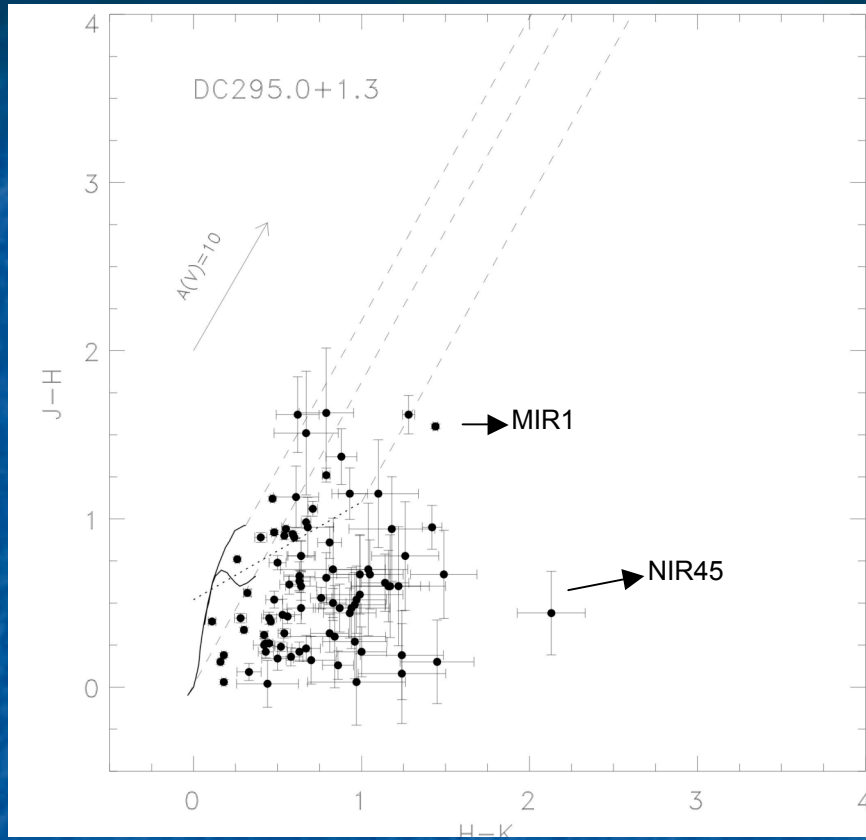
- Near Carina source at $d=1.3$ Kpc

- $L_{\text{bol}} = 68 L_{\text{sun}}$ from IRAS and 1.3mm (Henning & Launhardt 1998 A&A 338 223)

- $M_{\text{gas}} = 2.9 M_{\text{sun}}/\text{beam}$



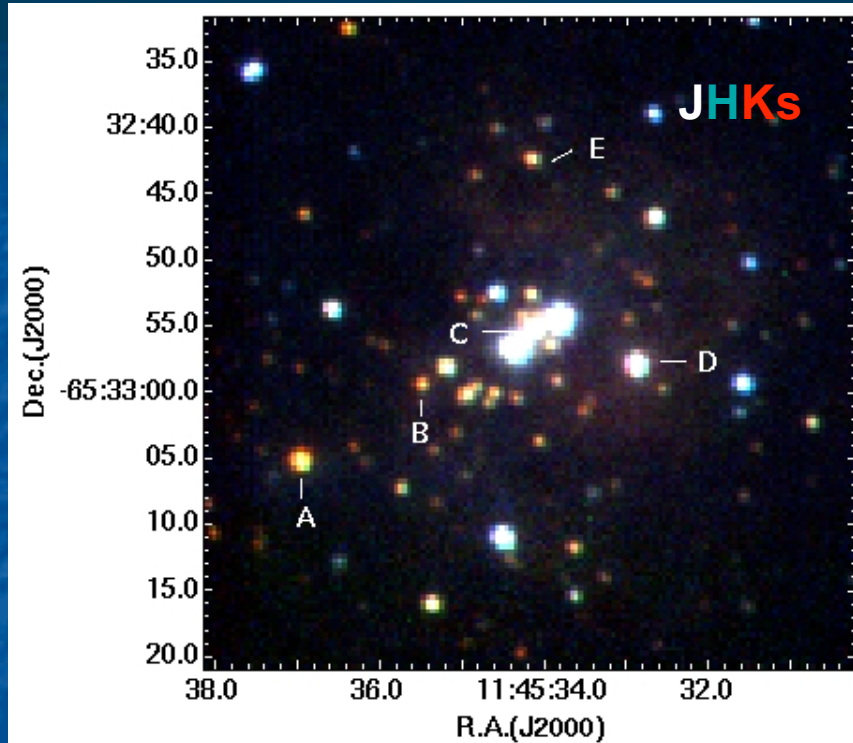
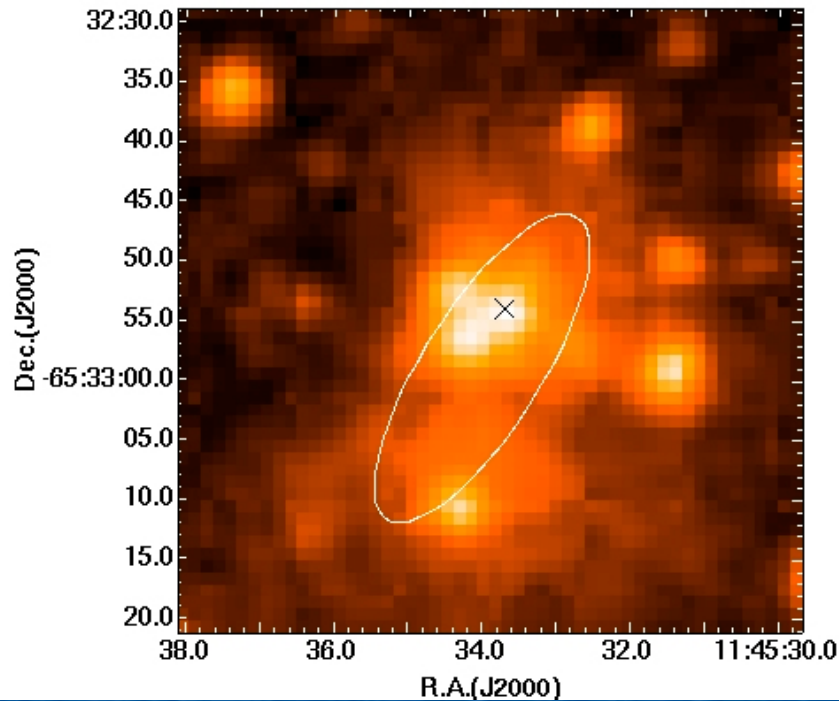
DC295.0+1.3



Source	L_{IR} / L_{sun}	$\alpha(IR)$
MIR1	17	0.3
MIR2		1.8

DC296.2-3.6(IRAS11431-6516)

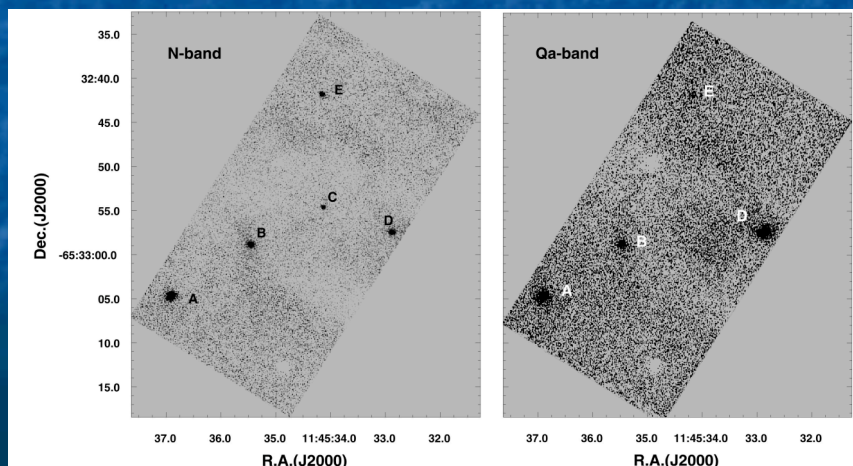
DC296.2-3.6 Red



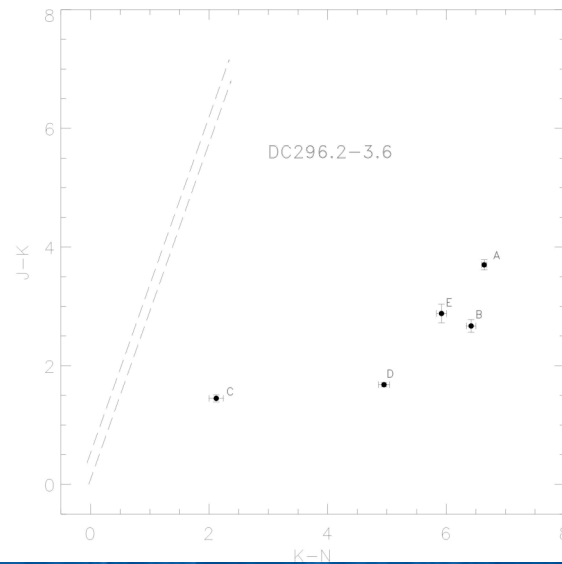
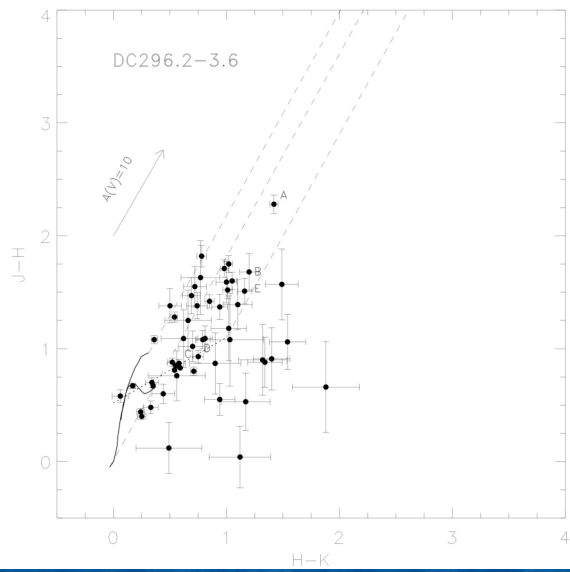
- Located in the far Carina arm at $d=3.6\text{Kpc}$ (Brand & Blitz 1993 A&A 275 67)

- $L_{\text{bol}}=1.3 \cdot 10^4 L_{\text{sun}}$ from IRAS and 1.3mm (Henning & Launhardt 1998 A&A 338 223)

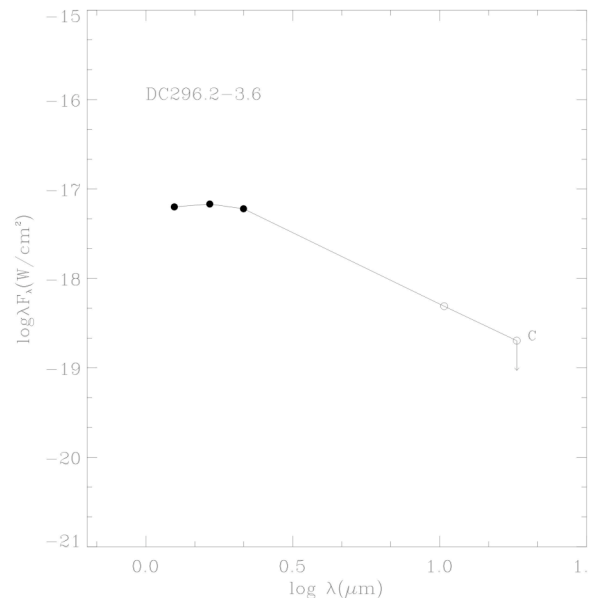
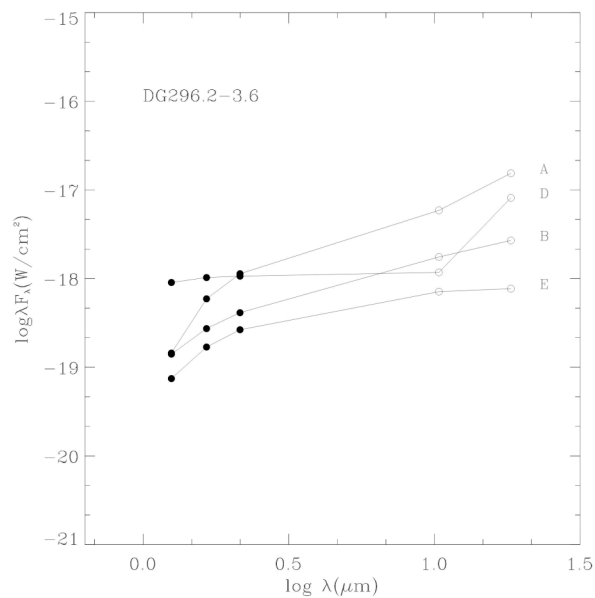
- $M_{\text{gas}}=37 M_{\text{sun}}/\text{beam}$



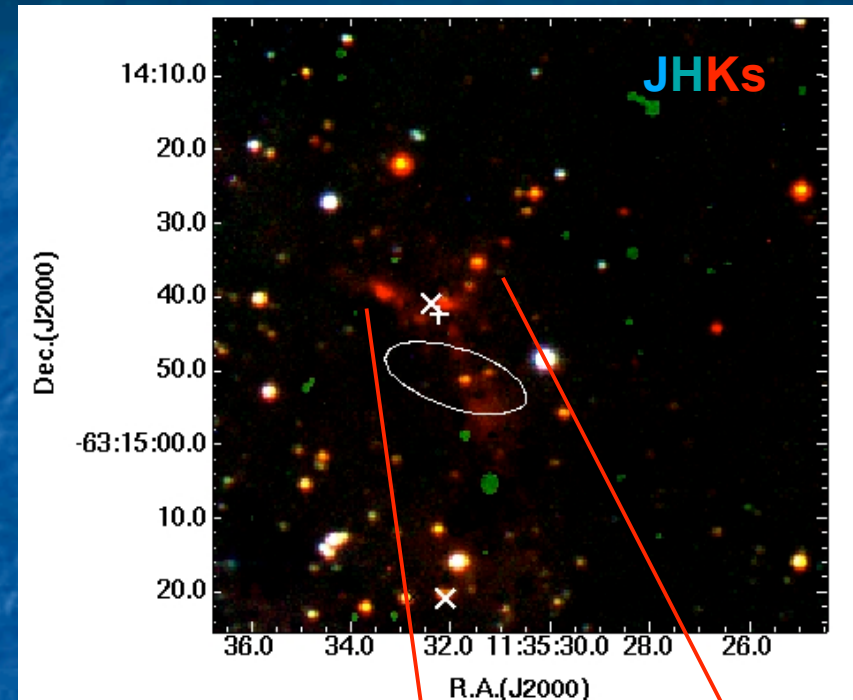
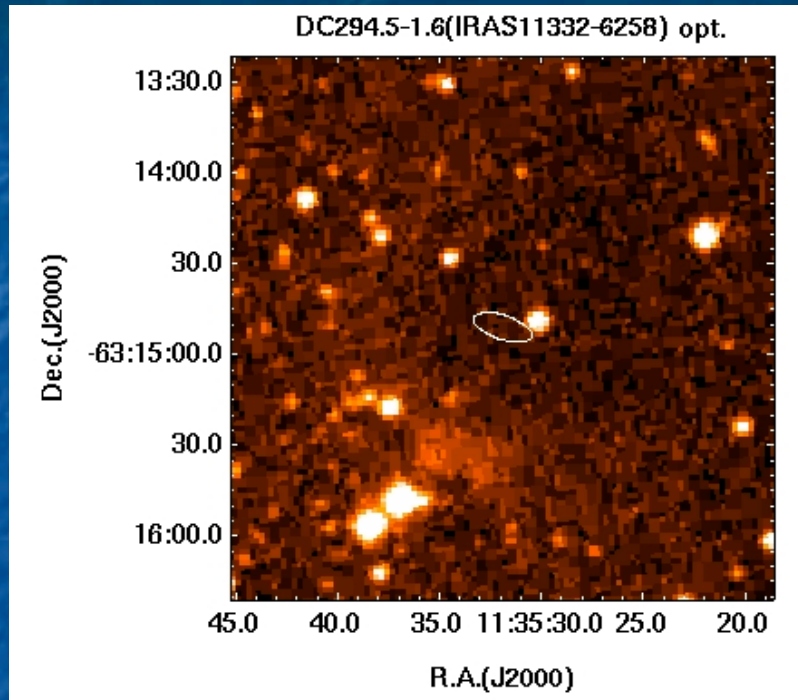
DC296.2-3.6



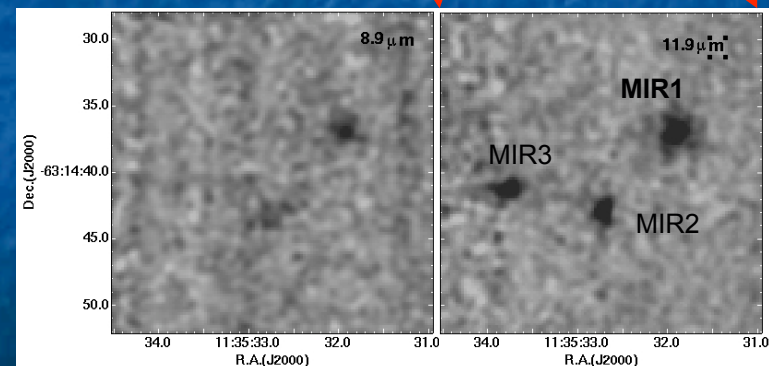
Source	L_{IR}/L_{sun}	$\alpha(IR)$
A	46	1.05
B	12	0.92
C	3	-1.59
D	14	0.06
E	6	0.63



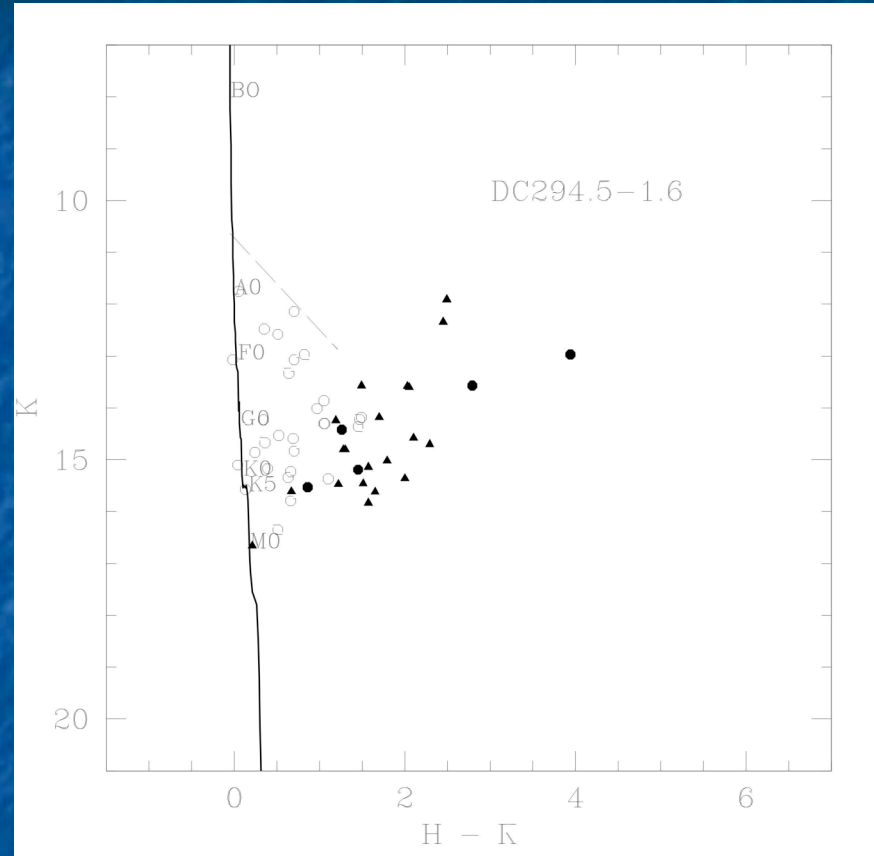
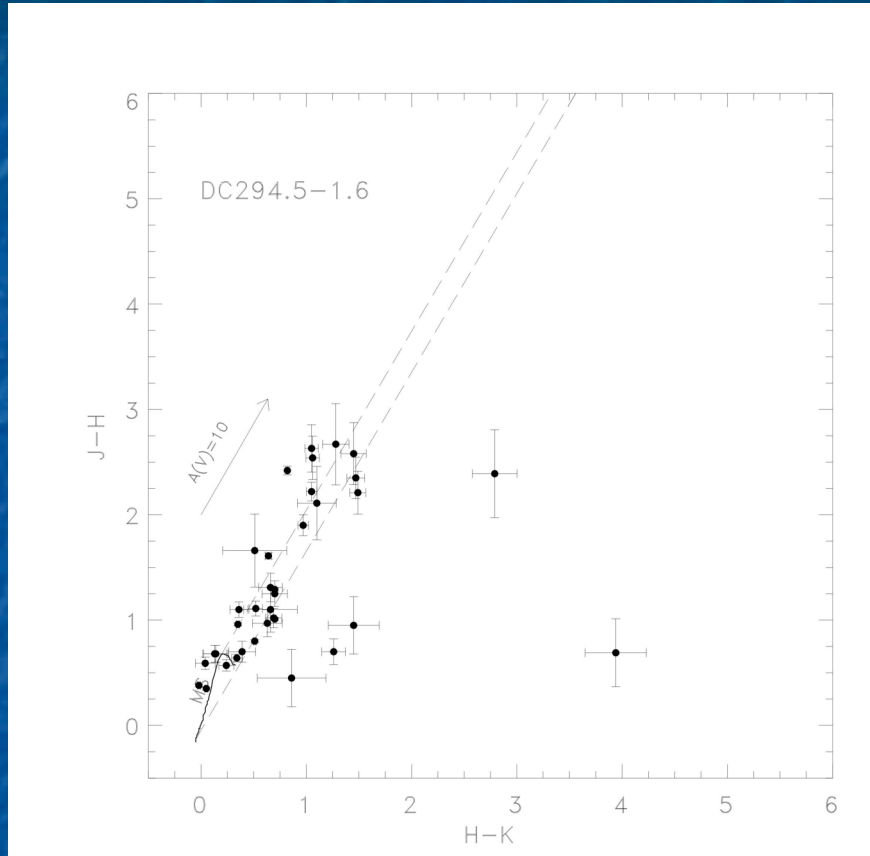
DC294.5-1.6(IRAS11332-6258)



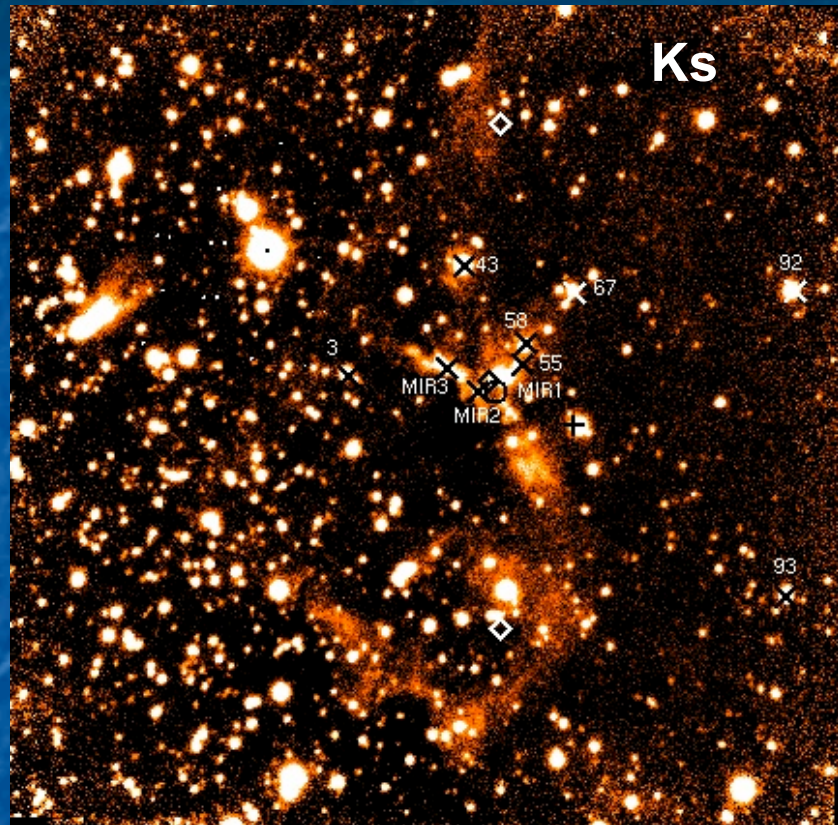
- Detected a 6.67 GHz Methanol maser (Walsh et al.1998)
- 1.2mm emission detected with SIMBA (Faundez et al.2004)
- $D=1.9$ Kpc; $L_{bol}=5.3 \cdot 10^3 L_{sun}$
- $M_C=1.3 \cdot 10^2 M_{sun}$; $T_d=30K$



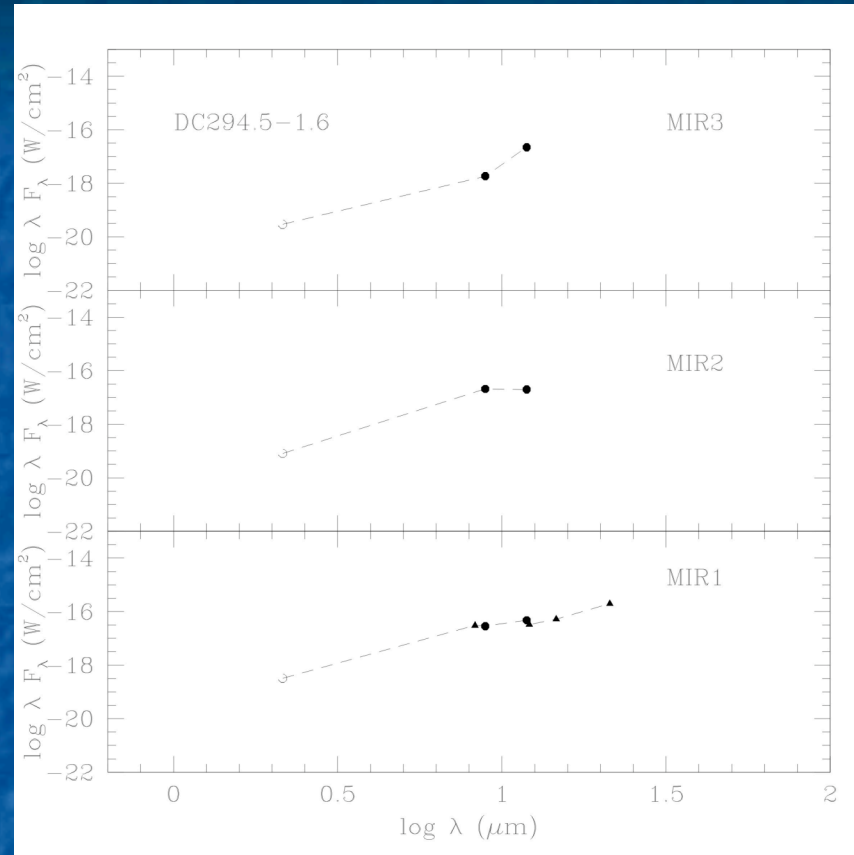
DC294.5-1.6



DC294.5-1.6

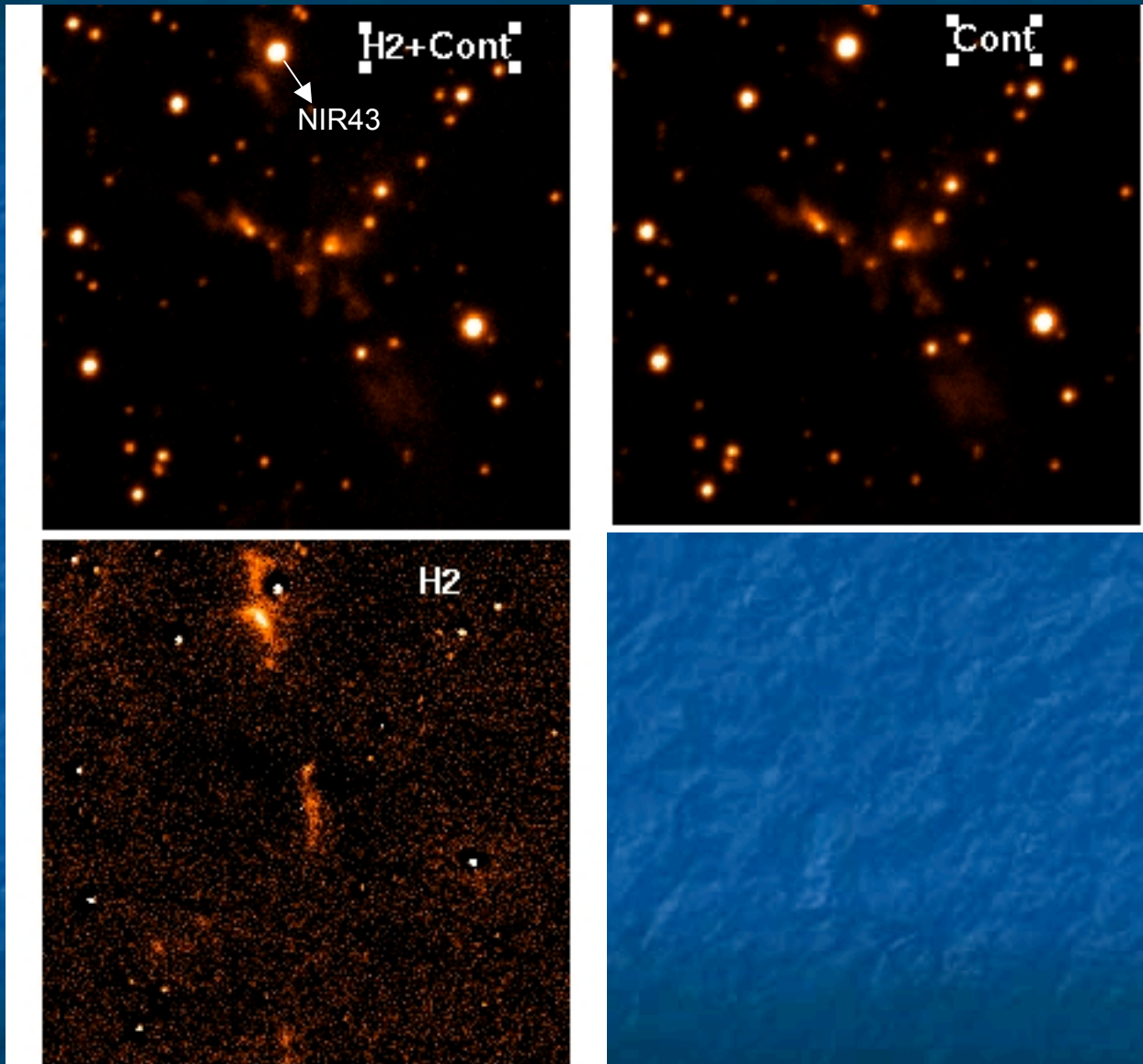


NIR43: $H-K_s=2.5$



MIR1: $L_{IR} = 1.43 \cdot 10^3 L_{SUN}$; $\alpha(IR) = 2.91$

DC294.5-1.6(H2 KNOTS)



SUMMARY

1. The southern hemisphere DCs reported by Hartley et al. are not an homogeneous set of star forming regions. They include:
2. Very young cometary globules with no associated IR sources (i.e. DC 260.7-12.4)
3. High massive star forming regions (i.e. DC 294.5-1.6)
4. Association of classical T-Tauri type stars . DC 296.2-3.6 could be similar to ρ Oph put at a distance of 3.6 Kpc
5. Observations at 200 and 400 μ m with a 12m antenna at DomeC (beam 8'' and 3.4'' respectively) compared with near, and mid-IR observations of southern DCs, are fundamental to understand the nature of the YSOs and to detect the possible circumstellar disks around these objects.