Spitzer Legacy Programs on Star and Planet Formation

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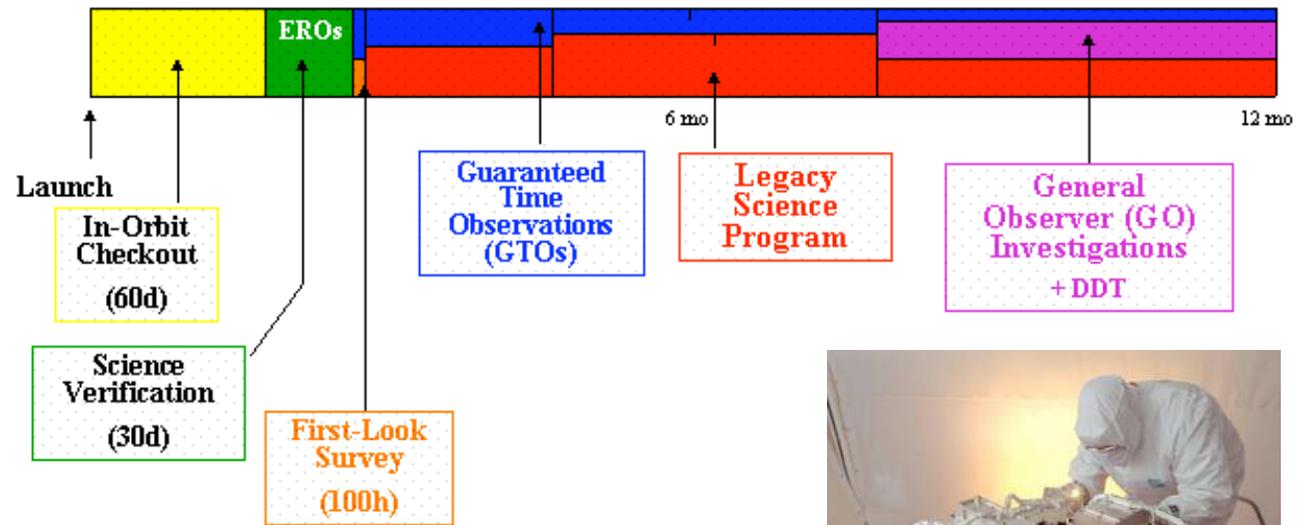## The *c2d* and *FEPS* teams

The Spitzer Space Telescope

EROs

6 mo

12 mo

Launch

In-Orbit Checkout (60d)

Science Verification (30d)

First-Look Survey (100h)

Guaranteed Time Observations (GTOs)

Legacy Science Program

General Observer (GO) Investigations +DDT

August '03
Ø 85 cm
Earth-trailing orbit

MIPS: 24/70/160 μm camera, 51-106 μm spectrograph

IRS: 5-38 μm spectrograph, R~60-600

IRAC: 3.6/4.5/5.8/8.0 μm camera

Legacy Programs of Star Formation

From Molecular Cores to Planet-Forming Disks (Cores to Disks, c2d). PI Evans

➔Complete database of nearby (<350 pc) low-mass & substellar star formation

• map 5 large clouds + ~135 cores: IRAC + MIPS

• photometry of ~190 stars: IRAC + MIPS

• spectroscopy of 200 disk sources: IRS

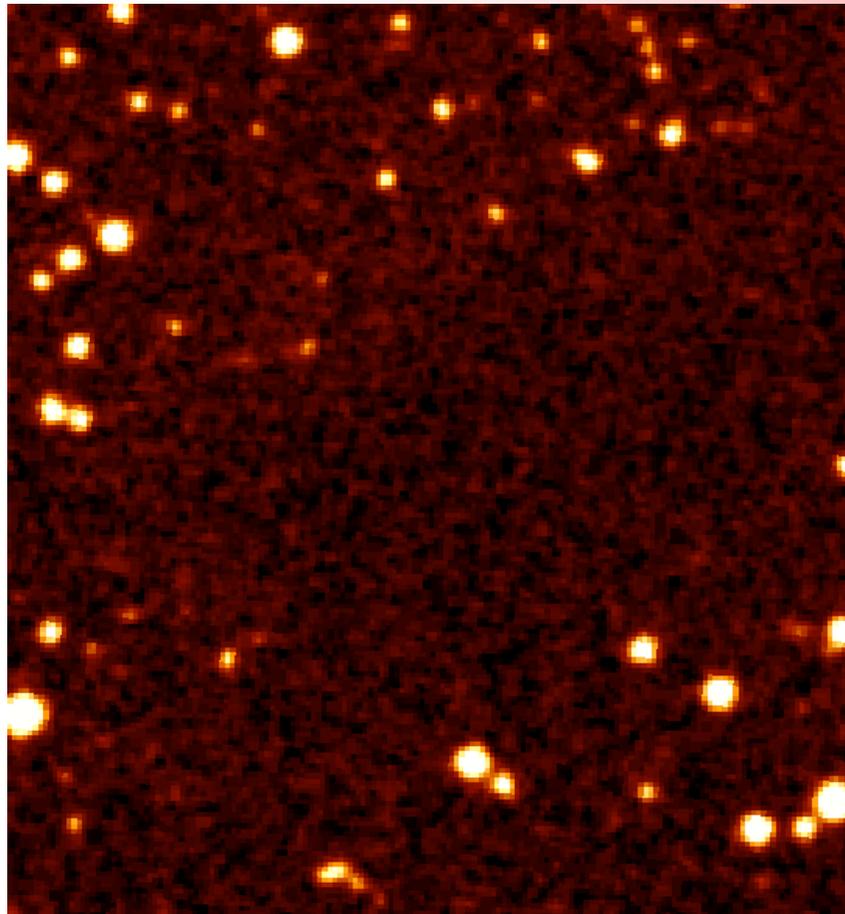**Formation and Evolution of Planetary Systems (FEPS). PI Meyer**

➔Characterize properties and evolution of disks

• IRAC + MIPS photom. of 300 stars

• ages 3 Myr … 3 Gyr

• IRS search for H_2

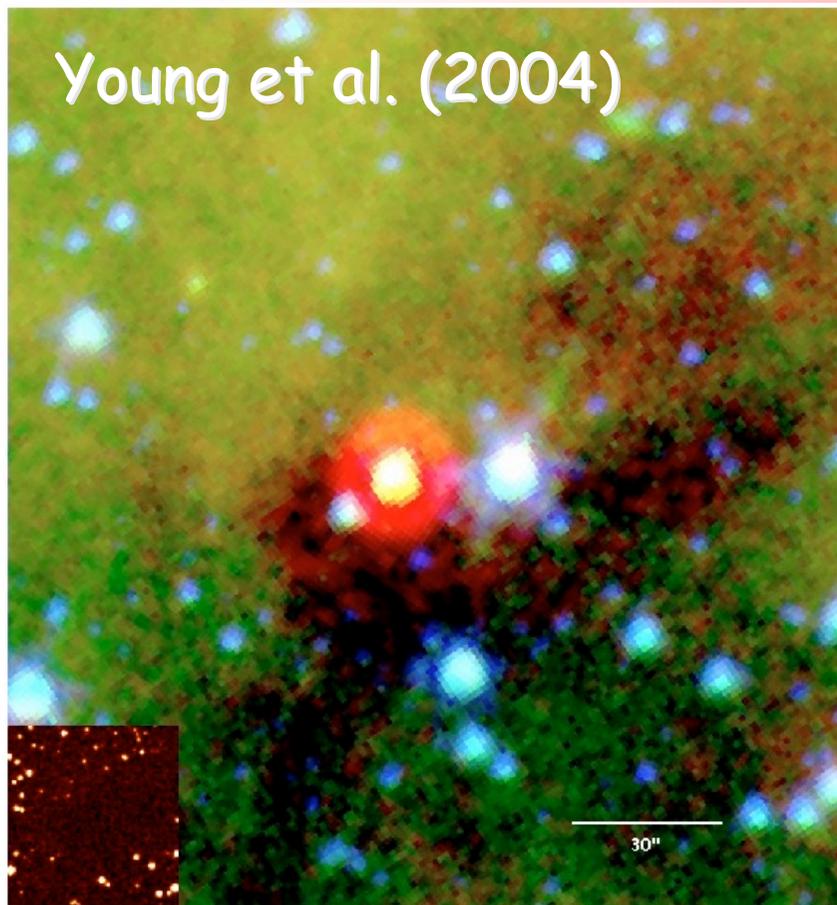# The *starless* core L1014

Lynds 1014

d~200 pc (?)

No detected IR or mm point source

(DSS)

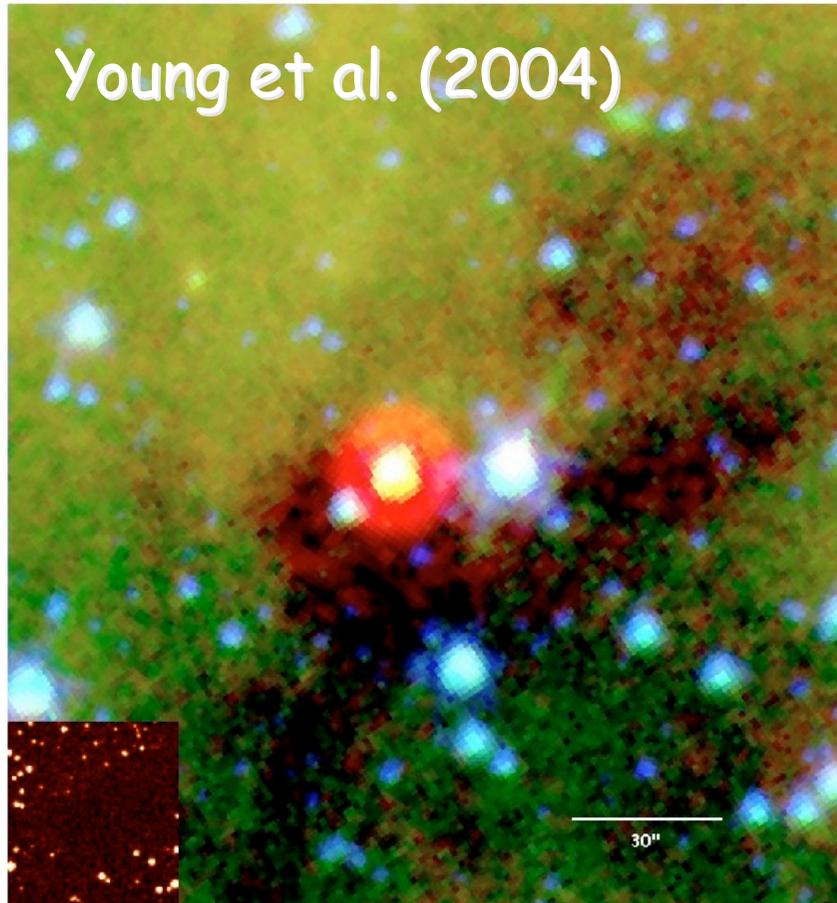# The *starless* core L1014

not so

Young et al. (2004)
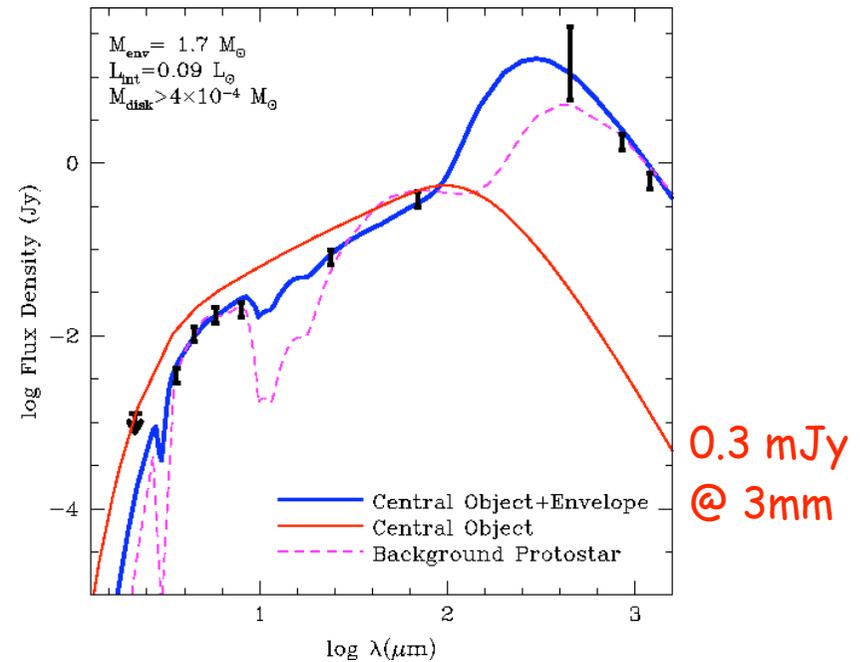
Blue/green/red=
3.6/8.0/24 μm

➔ Central point source
➔ Coincides with submm peak
➔ *Not* a background star
➔ but could be background protostar

not so
The *starless* core L1014

Young et al. (2004)

Envelope: 1.7 M⊙
Central L~0.09 L⊙
SED requires (sub)star + disk

M_{env}= 1.7 $M_\odot$
L_{int}=0.09 $L_\odot$
M_{disk}>4×10^{-4} $M_\odot$

0.3 mJy
@ 3mm

Central Object+Envelope
Central Object
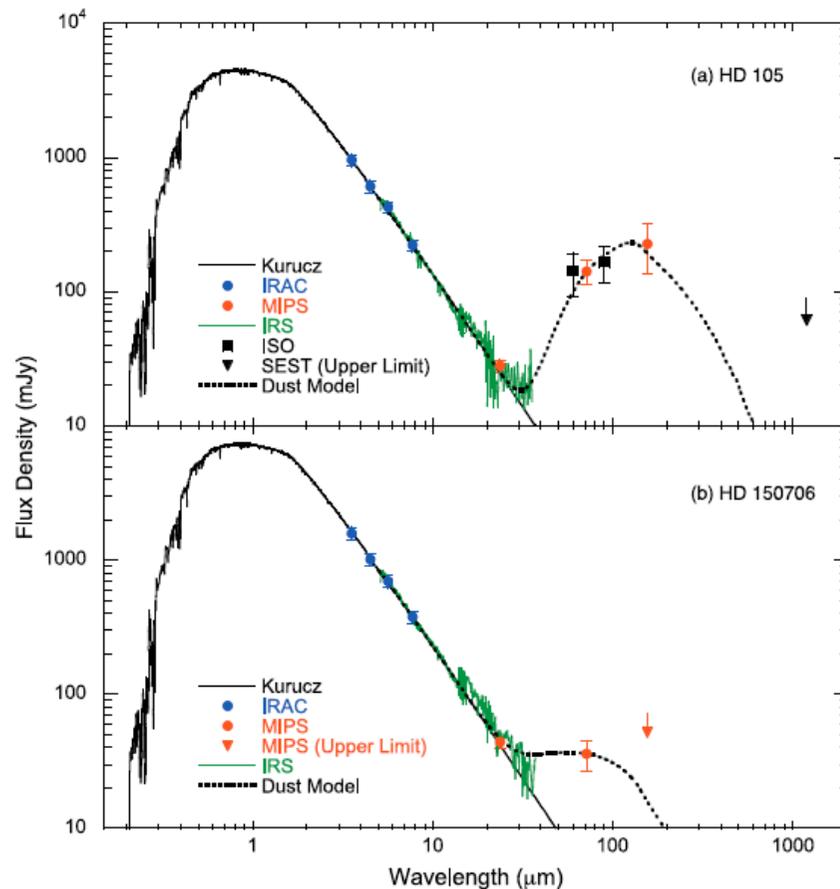Background Protostar

Mapping L1689 with IRAC

R/G/B=3.6/4.5/8

c2d + IRAC/GTO: Allen et al. (in prep.)

Michiel Hogerheijde • ALMA Community Day • 24 September 2004 • Garching (D)

Young stars with and without disks

HD105:
- confirms earlier ISO detection
- evidence for grain growth
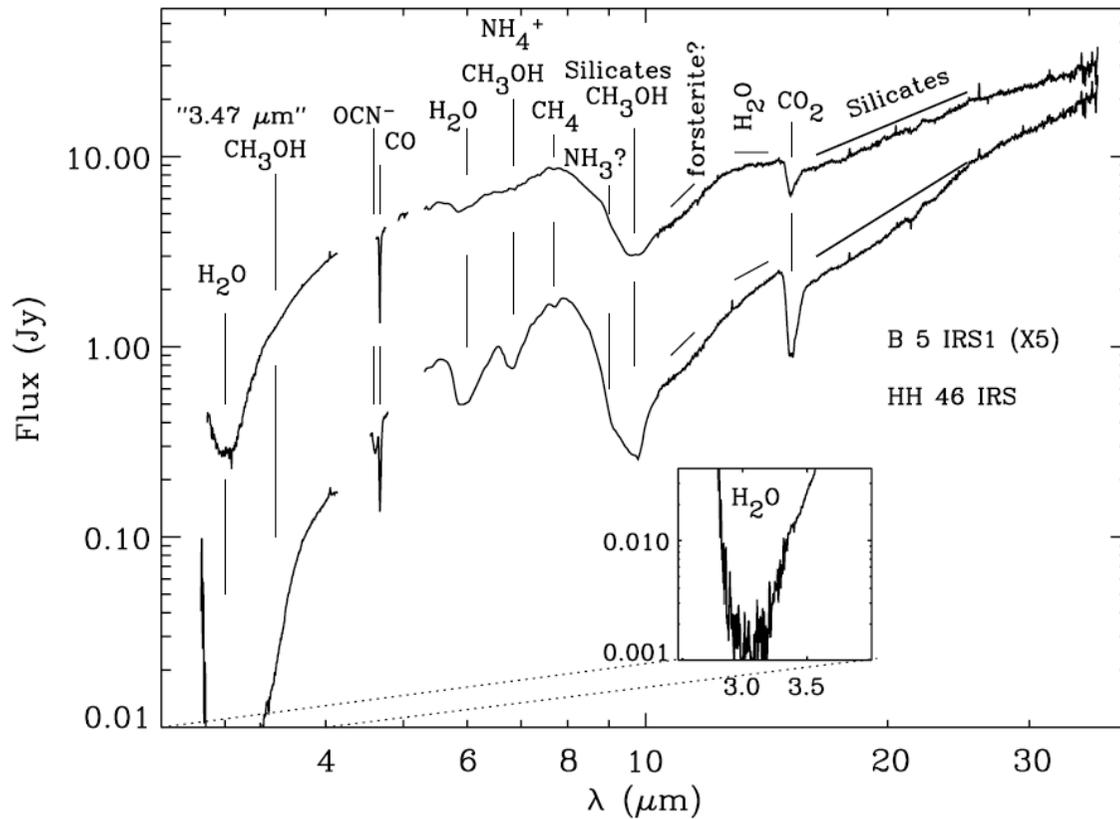- evidence for disk clearing < 45 AU

HD150706:
- *only* detection out of 4 without previous detections
- intermediate age
➔ variety in disk initial conditions and evolution

Meyer et al. (2004)

Ices around low-mass protostars

B5 IRS1

HH 46 IRS

- deep ice absorption
- tracing envelopes
- no thermal processing >50 K
- some processing < 50 K

➔ probe evolution of material evolving into protoplanetary system.

Boogert et al. (2004)

Spitzer & ALMA

- Several Spitzer programs (Legacy and GTO) offer a rich database of objects for ALMA star & planet-formation studies

- ALMA provides high angular resolution complement to Spitzer
  - Find *disks* around (sub)stellar objects like L1014
  - Study complete sample of *Class I and II* objects in regions like L1698
  - Image *structure* in disks around young stars like HD105 and HD150706