cm to submm view of disks

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Quest for Disk/Torus

- **Non Thermal Line:**
  SiO masers in Orion: Wright et al. 1995; Greenhill et al. 1998
  CH_3OH masers towards UCHII regions: Norris et al. (1998); Walsh et al.
  H_2O masers in Cepheus A: Torrelles et al. 1998
  OH maser: Slysh et al. IAU227, Edris et al. 2005
  H Recom Maser: MWC349

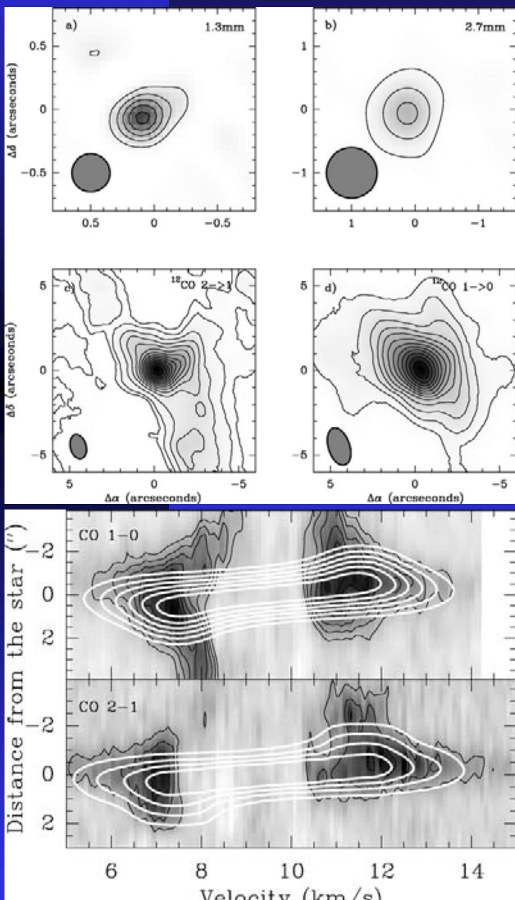
- **Thermal Continuum:**
  IRAS18566: Zhang et al. 07; Araya et al. 07
  G192.16-3.82: Shepherd et al. 2001 (3 and 7 mm).
  G10.6, G28: Sollins et al. 2004, 2005 (cm continuum).

- **Thermal Line (NH_3, CH_3CN, $HCOOCH_3$, SO_2, $C^{18}O$, CS. $H_{13}CN$, H Recom Line):**
  Ceph A: Patel et al. 05; Jimenez-Serra et al. 07
  AFGL5142: Hunter et al. 99, Zhang et al. 01, 07
  G192.16-3.82: Shepherd et al. 98; Shepherd & Kurtz 99
  IRAS 20126+4104: Cesaroni et al. 96,99,05; Zhang et al. 98, 99
  IRAS18089-1704, Beuther et al. 04; 18566+0408: Zhang et al. 07
  G28.20-0.05: Sollins et al. 05; G29..96-0.02: Beuther et al. 07
  G24.78+0.08/G31.41+0.31: Beltran et al. 04, 05, 06
  G10.6: Keto 2002 (H Recom line); Sollins et al. 04, 05

Reviews:
Zhang 2005
Cesaroni et al. 06; 07

Disks in Be Stars

PdBI



R Mon, B0

M_*=8 Msun

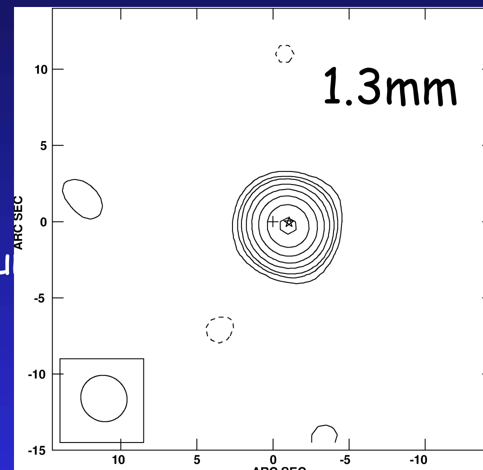
M_{disk}=0.007-0.014Msu

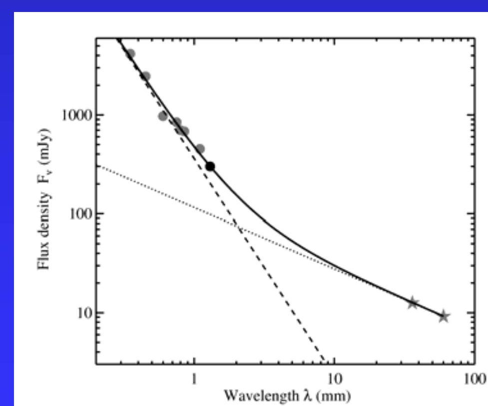
Rdisk~150 AU

Keplerian motion
in CO 2-1, 1-0

Fuente et al. 03,06
Alonso-Albi et al. 07

SMA





MWC 297, B1.5

M_*=10 Msun

M_{disk}=0.07 Msun

Rdisk ~ 80AU

No detactable compact
CO 2-1

Dust mass requires
a flattened disk to
be optically visible

Manoj et al. 2007

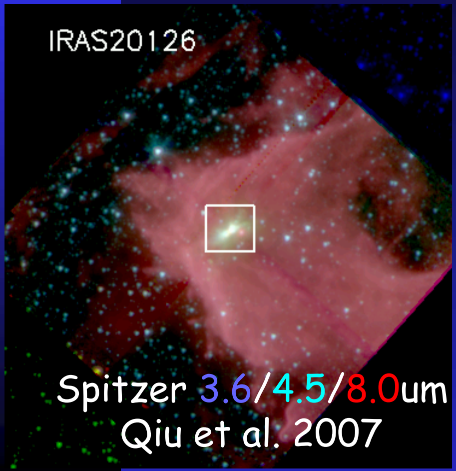
IRAS20126+4104

SED: 1.3x10^4 Lsun

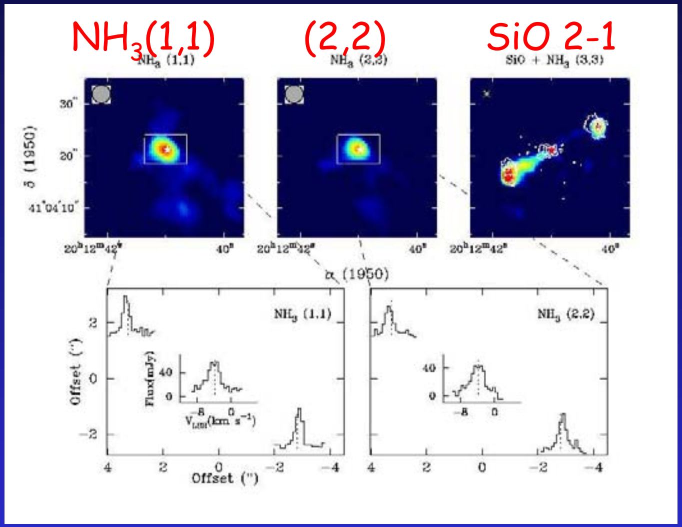
M_*=7-15 Msun

D=1.7kpc

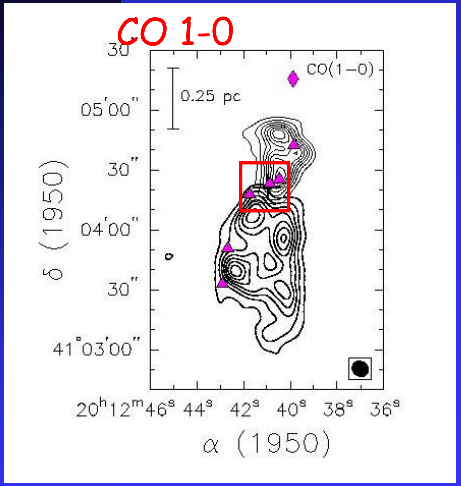
Evidence:
Keplarian-like rotation
Flattened Structure
Jet-like outflow



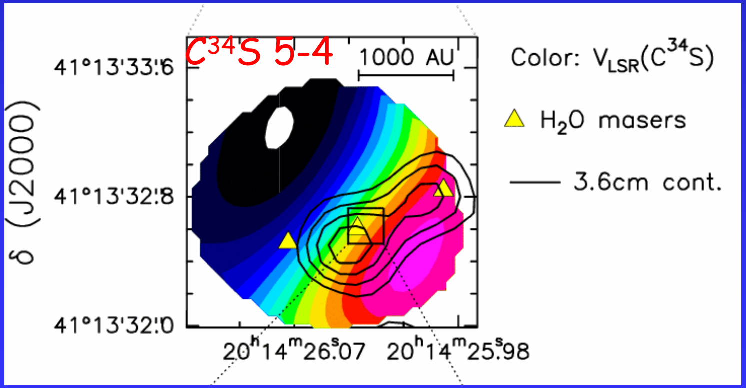
Spitzer 3.6/4.5/8.0um
Qiu et al. 2007



Zhang et al. 98, 01



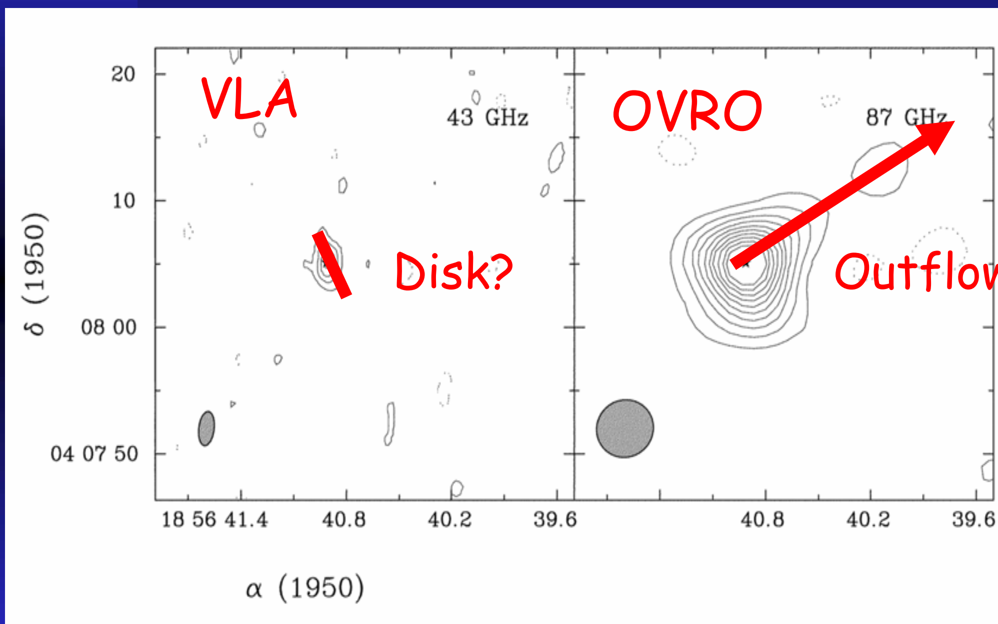
Shepherd et al. 99



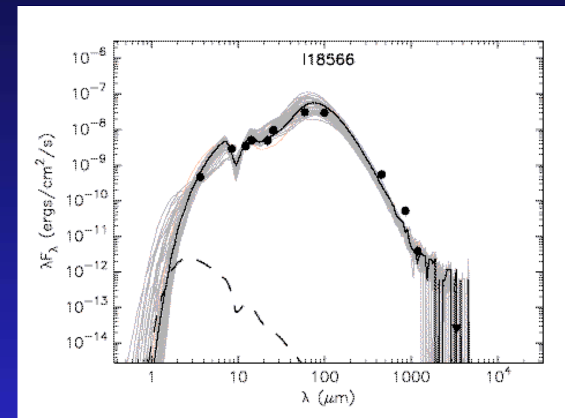
Cesaroni et al. 97,99,05

IRAS18566

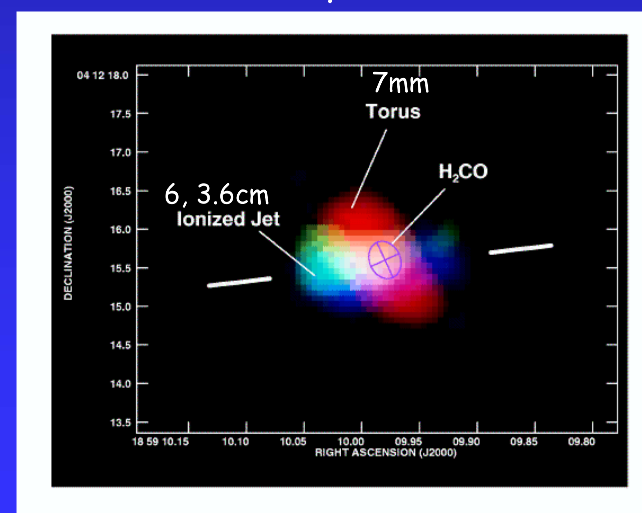
8×10^4 Lsun
M_*=20 Msun
D=6.7kpc



Zhang et al. 2007

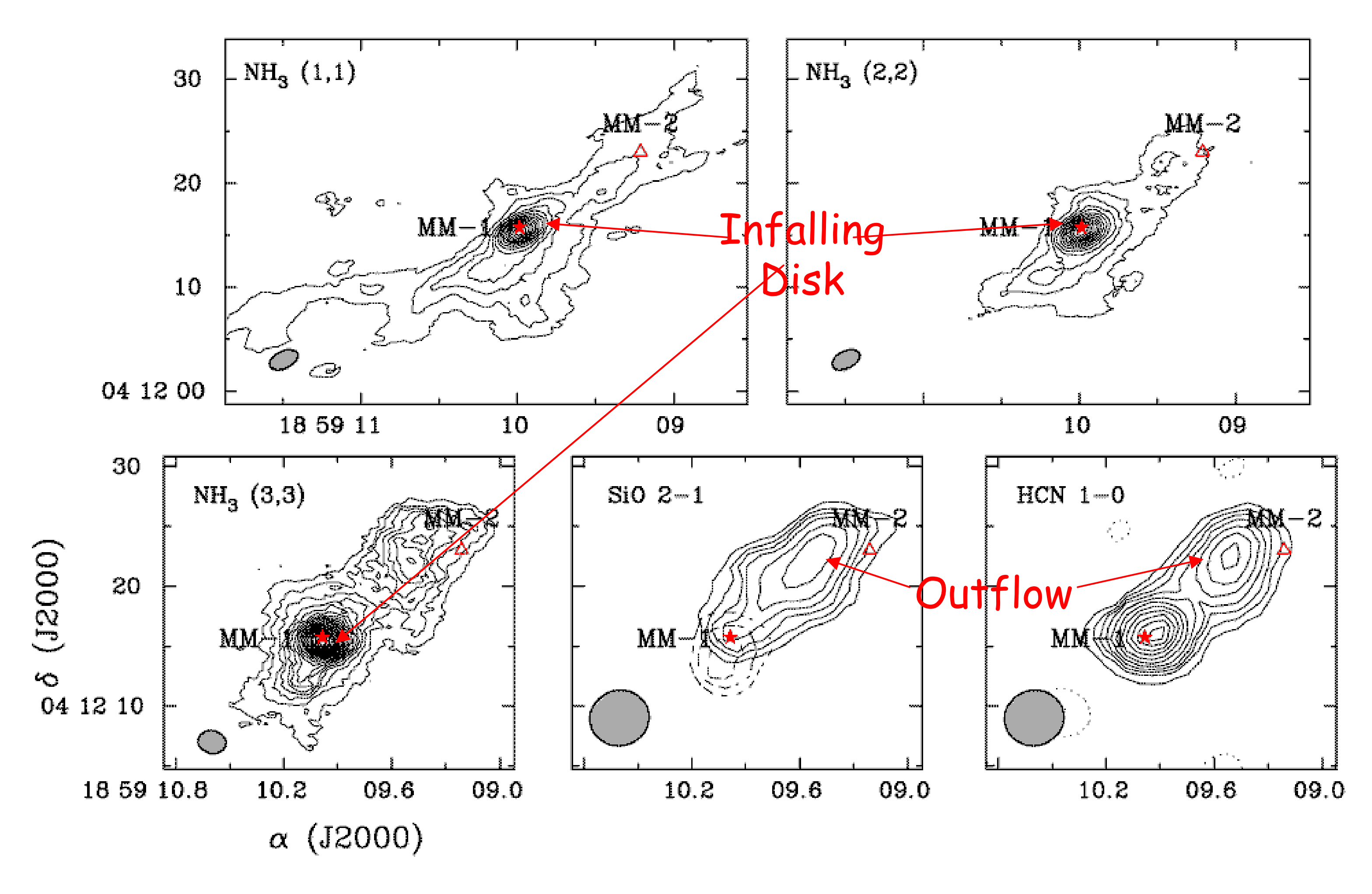


Robitaille et al. 07
Whitney et al. 03



Araya et al. 07

IRAS18566



NH3 (1,1)
NH3 (2,2)
NH3 (3,3)
SiO 2–1
HCN 1–0
MM–1
MM–2
Infalling Disk
Outflow
30
20
10
04 12 00
18 59 11
10
09
04 12 10
18 59 10.8
10.2
09.6
09.0
δ (J2000)
α (J2000)

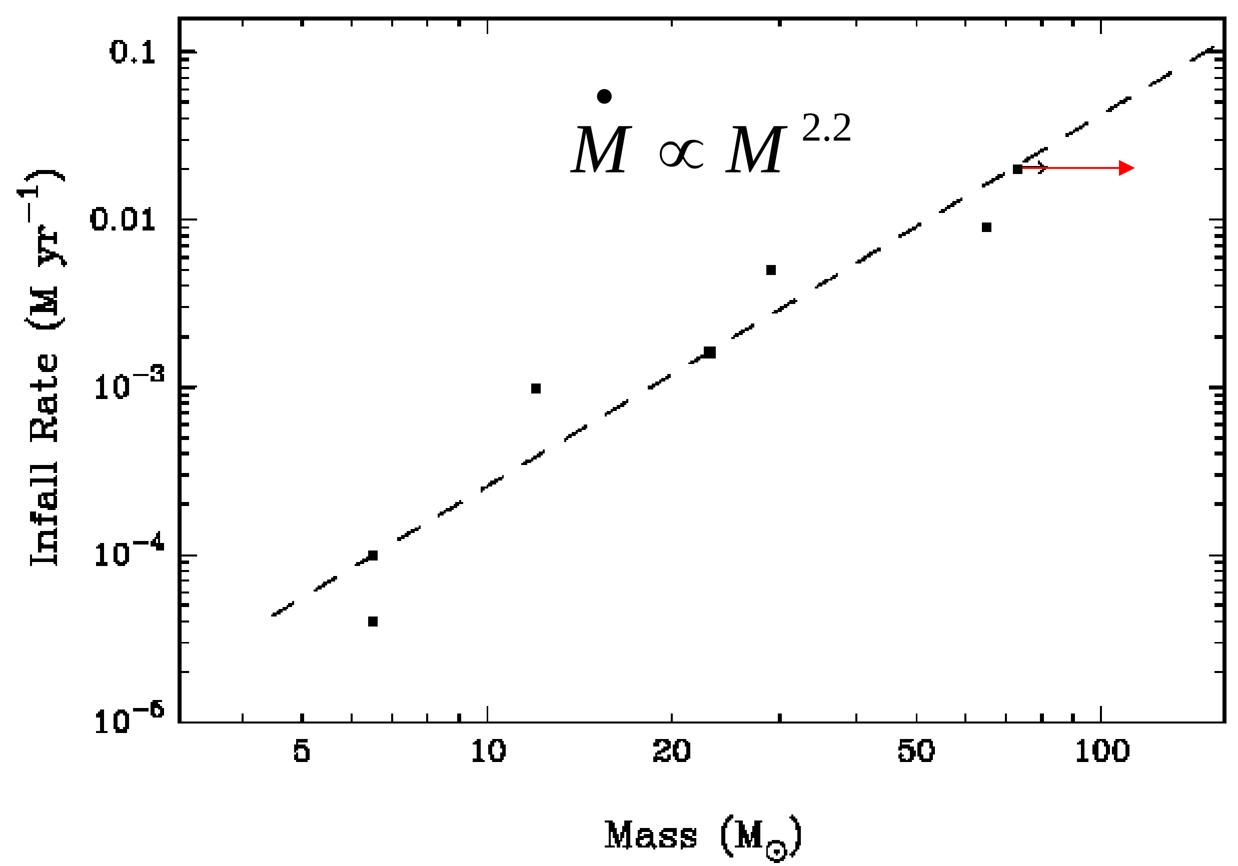
"Disk" Parameters

	Lum (L_{sun})	Disk Mass (M_{sun})	Disk Size (AU)	Infall Rate (M_{sun}/yr)	
G192	$3x10^3$	15	1000	$\sim 1x10^{-4}$	
GL4152	$3x10^3$	4	1800	$4x10^{-5}$	
I20126	$1.3x10^4$	5	1600	$9.8x10^{-4}$	
I18566	$8x10^4$	60	8000	$1.6x10^{-3}$	?
G28.20*	$1.8x10^5$	20	6000	$5x10^{-3}$	?
G24	$7x10^5$	160	6000	$9x10^{-3}$	?
G10.6*	$9x10^5$	300	12000	$2x10^{-2}$	?

* Seen in both molecular and ionized gas

Modeling Infall/Accretion Rates

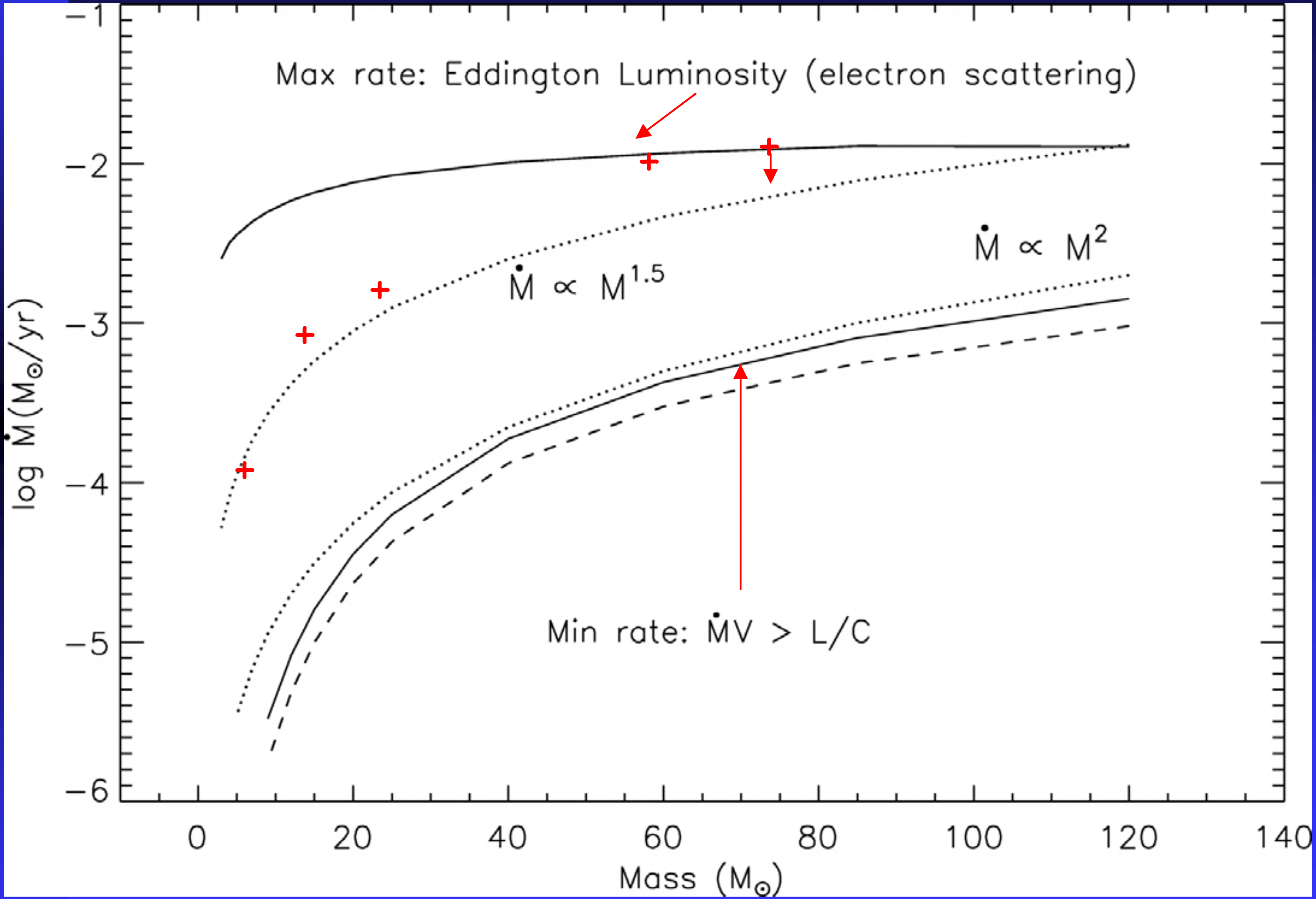
Luminosity -> Stellar Mass of a single star
Beech & Mihalas 1994



Similar relation seen in low-mass stars
Natta et al. 04;
Muzerolle et al. 05

Physical?
Monolithic Collapse
vs.
Competitive Accretion

NO problem with Radiation Pressure

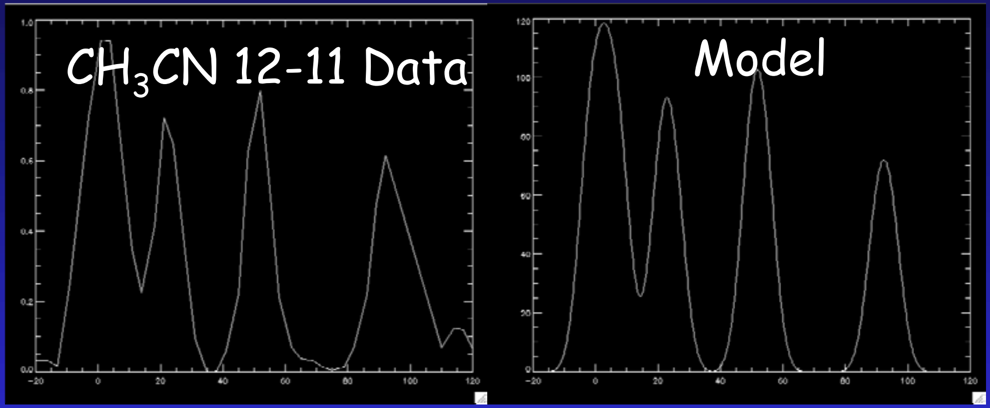


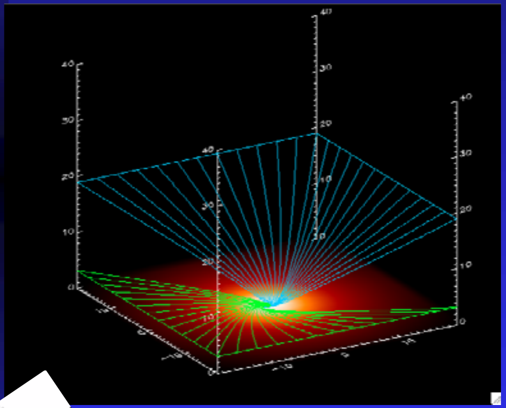
Larson & Starrfield 1971
Kuhn 1974
York & Krugel 1977
Wolfire & Cassinelli 1987
Osorio et al. 1999

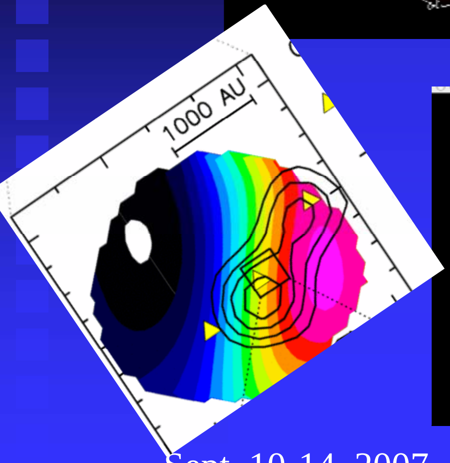
Keto 2003

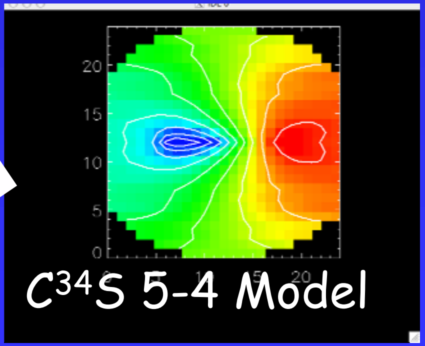
Modeling Kinematics (IRAS20126)

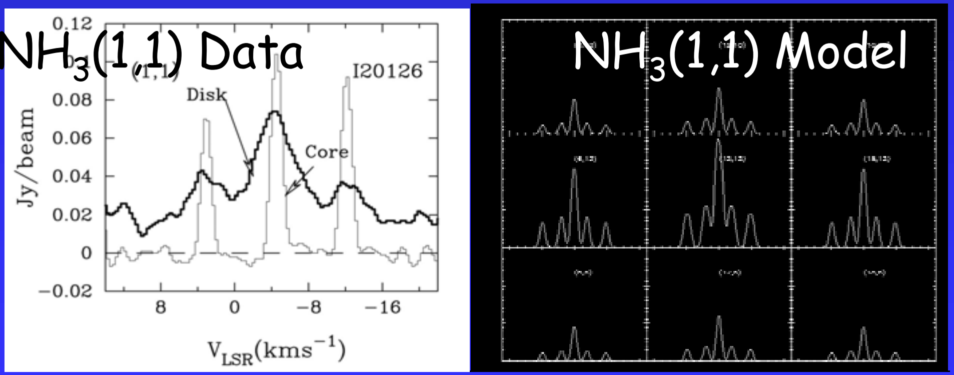
Input: Ulrich 1976
ω, M_*, dM/dt, T
Model: Radiative transfer (Keto 04)











Zhang, Keto et al. in preparation

Summary/Future work

- Kinematical evidence of disks/Tori in massive stars;
- Infall/accretion appears to scale as M_*^2;
- Radiation pressure does not hinder infall.

- Seeking more disk examples;
- How disk form and evolve over time;
- Detail modeling of data.

Related Talks & Posters:

Beltran; Bik; Greenhill; Keto; Mardones; Steinacker

Chini; De Buizer; Fallscheer; Jiang; Linz; Schreyer; Torrelles