

星星是如何孵出來的 (Part I)

恆星形成簡介

賴詩萍

廣告時間

“Star and Planet formation” Journal Club

- 時間：隔週週二中午 12:10 pm
- 長度：每次少於一個小時
- 第一次集會：10/3
- 地點：未定（請注意電梯內廣告）
- 目的
 - 輪流報告最新的研究結果
 - 培養學生對這個研究主題的興趣
- 參與老師：江瑛貴，陳惠茹，呂聖元，賴詩萍

星星是如何孵出來的 (Part I)

恆星形成簡介

賴詩萍

星星滿佈的夜空

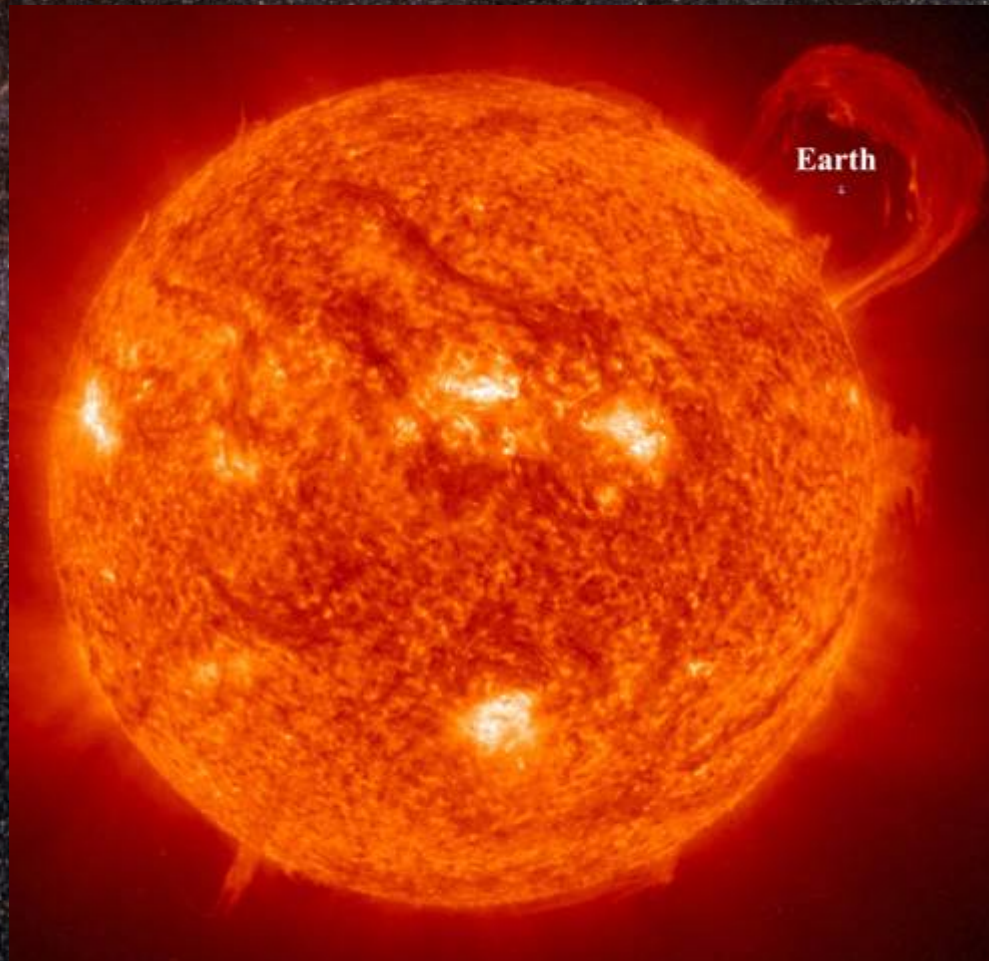


拍攝者：王為豪 博士

Sep 27, 2006

Star Formation

The Sun



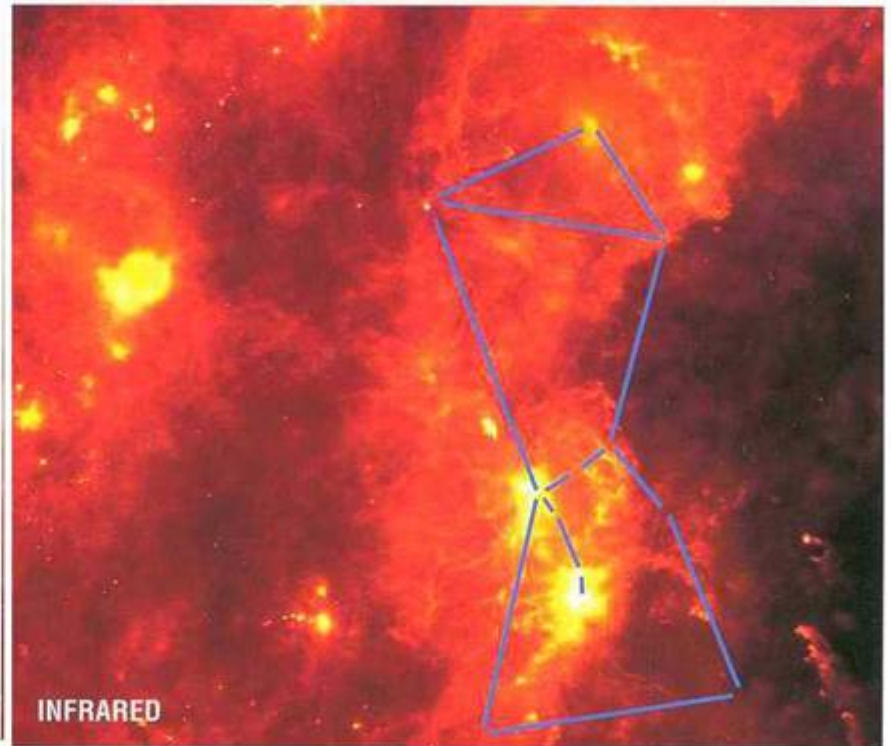
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Star Formation

康德-拉普拉斯 星雲假說

- 康德(1755年) - 原始星雲是由大小不等的固體微粒組成的，“天體在吸引最強的地方開始形成”，萬有引力使得微粒相互接近。
- 拉普拉斯(1796年) - 形成太陽系的雲是一團巨大的、灼熱的、轉動著的氣體，大致呈球狀。由於冷卻，星雲逐漸收縮，星雲的中心部分凝聚成太陽。

The Orion Nebula in Visible and Infrared Light



These views of the constellation Orion dramatically illustrate the over

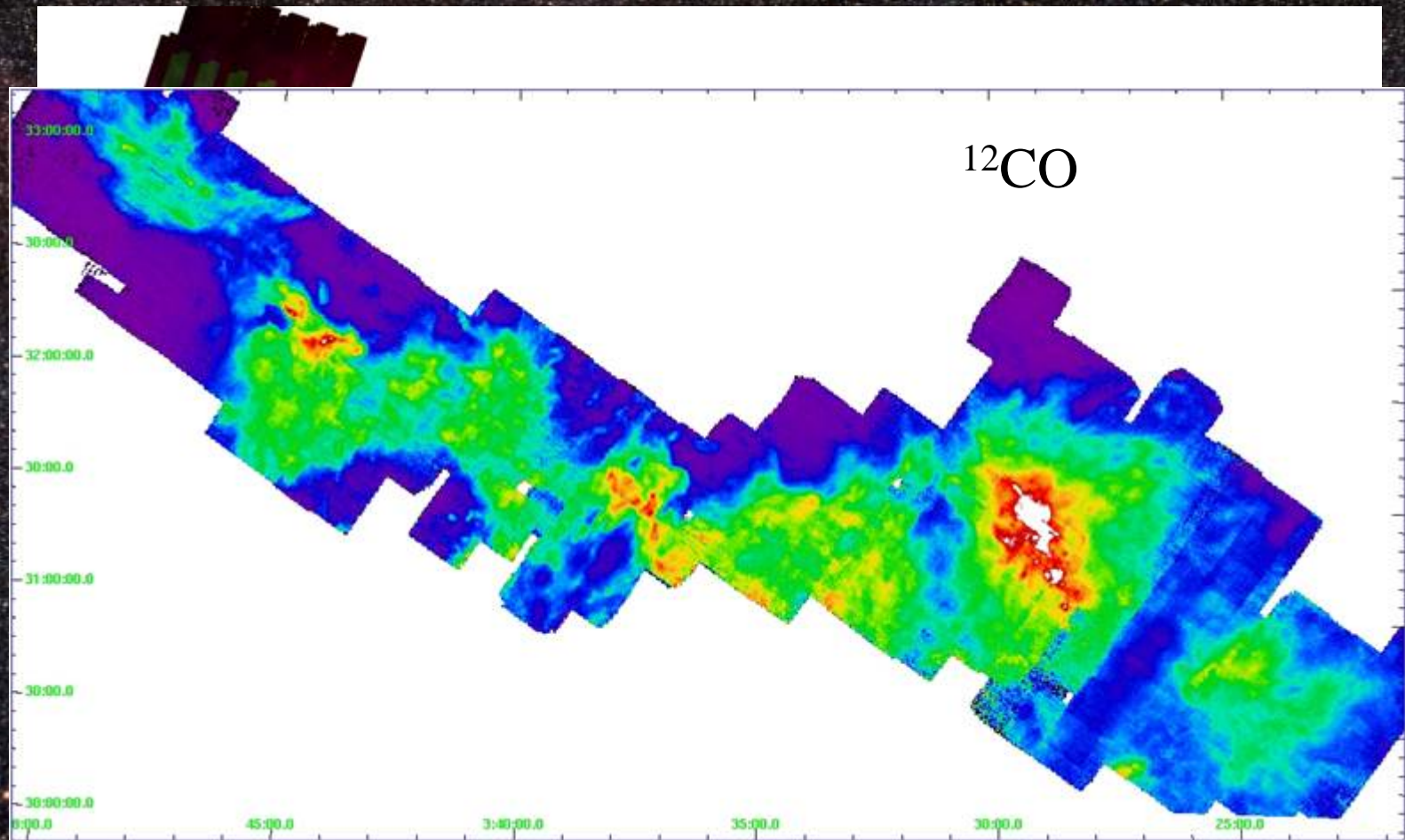
VISIBLE

INFRARED

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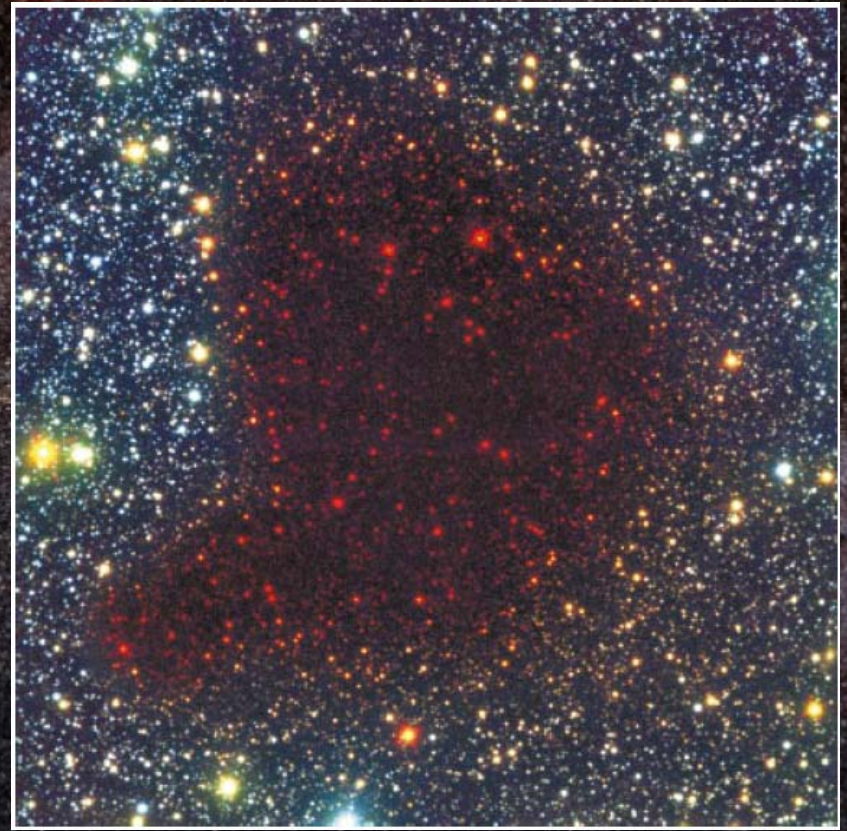
Star Formation

Perseus Molecular Cloud



24, 70, 160

Starless Cores – Barnard 68



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Star Formation

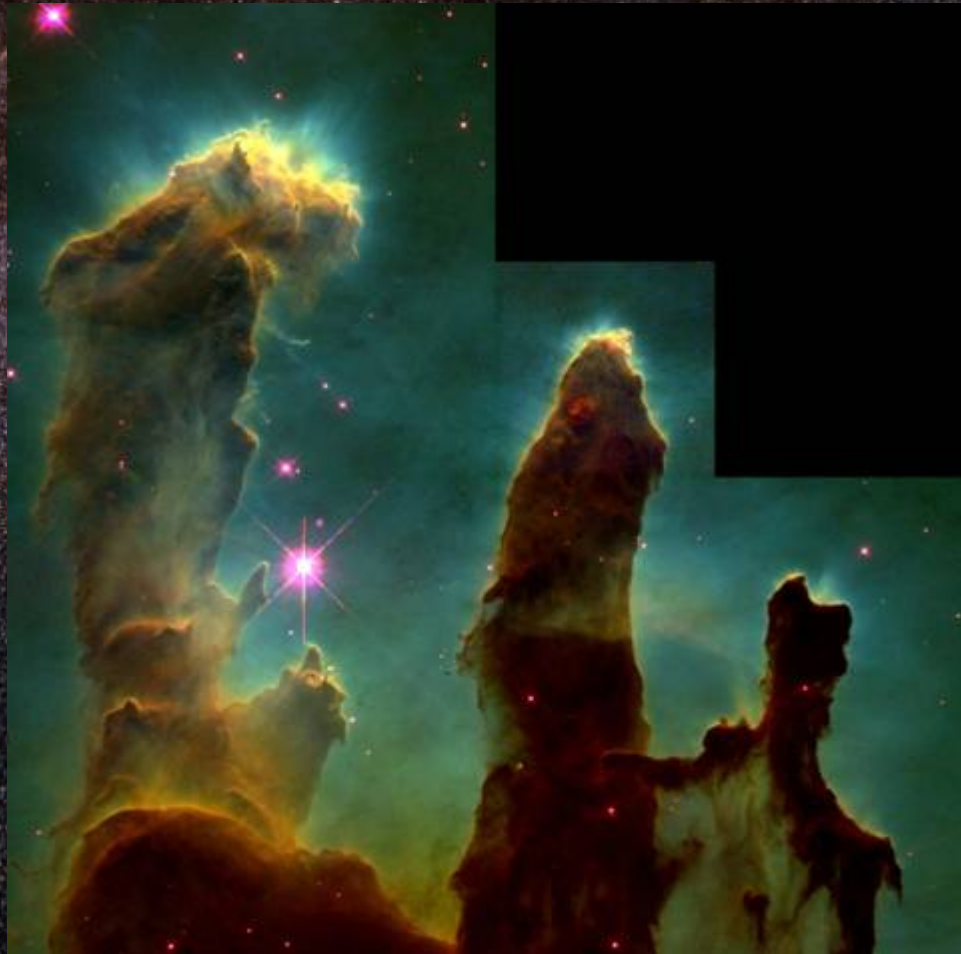
NGC 3603



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Star Formation

Eagle Nebula



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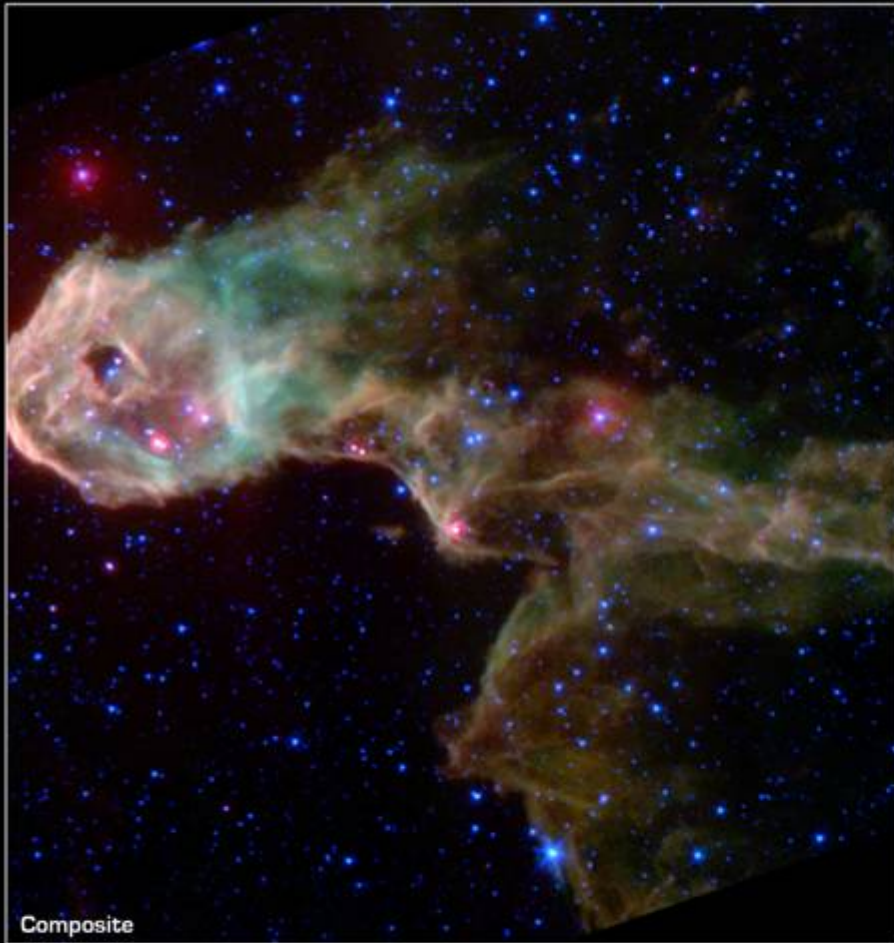
Star Formation

N44C in Large Magellanic Cloud

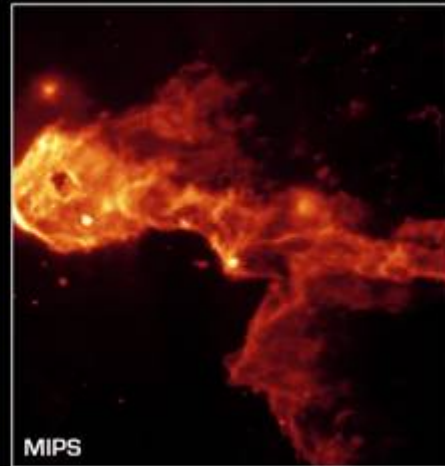


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Star Formation



Composite



MIPS



IRAC

Dark Globule in IC 1396

Spitzer Space Telescope • MIPS • IRAC

NASA / JPL-Caltech / W. Reach (SSC/Caltech)

ssc2003-06b



Embedded Outflow in HH 46/47

Spitzer Space Telescope • IRAC

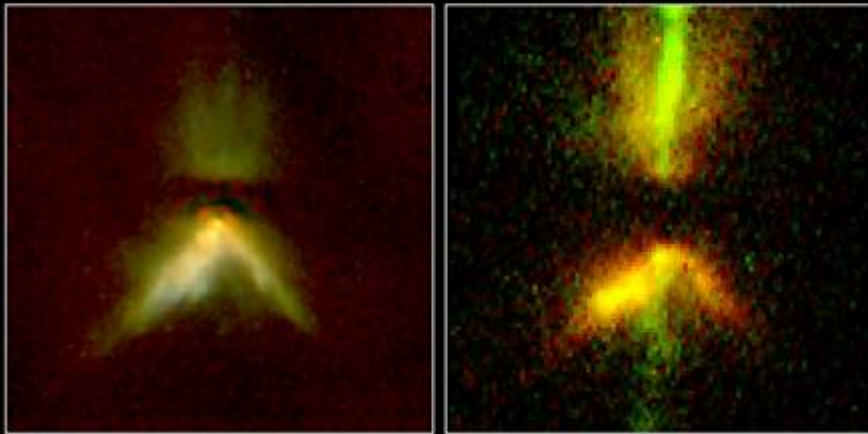
Inset: visible light (DSS)

NASA / JPL-Caltech / A. Noriega-Crespo (SSC/Caltech)

ssc2003-06f

Disks and Outflows

DG Tau B



NICMOS

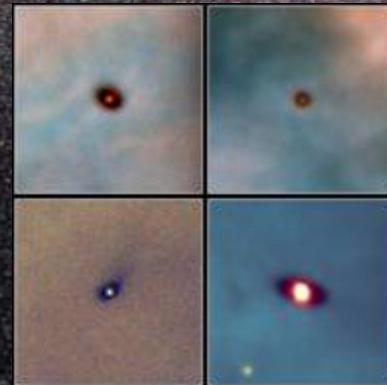
WFPC2



Edge-On Protoplanetary Disk
Orion Nebula

HST · WFPC2

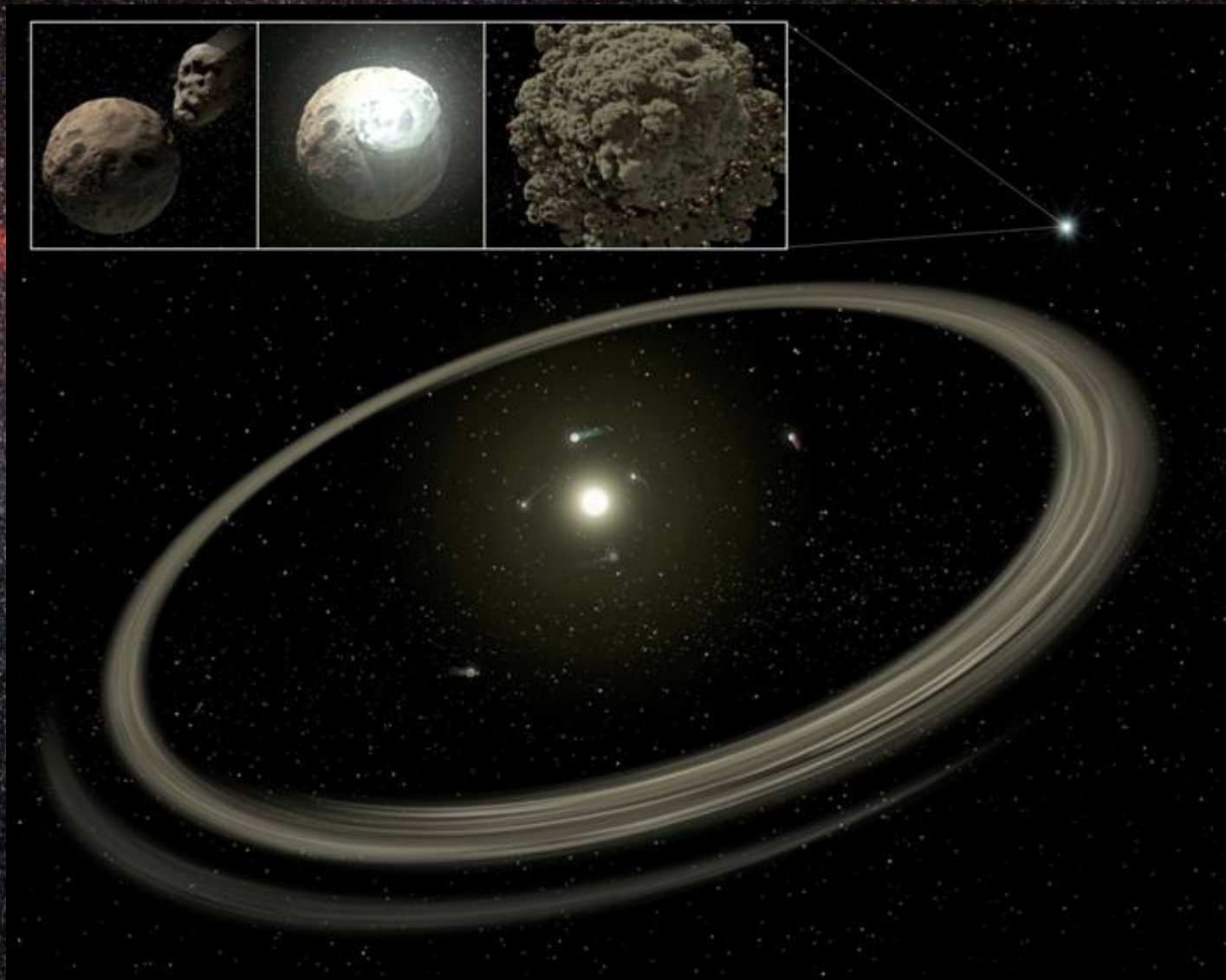
PRC95-45c · ST ScI OPO · November 20, 1995
M. J. McCaughrean (MPIA), C. R. O'Dell (Rice University), NASA



Protoplanetary Disks
Orion Nebula

HST · WFPC2

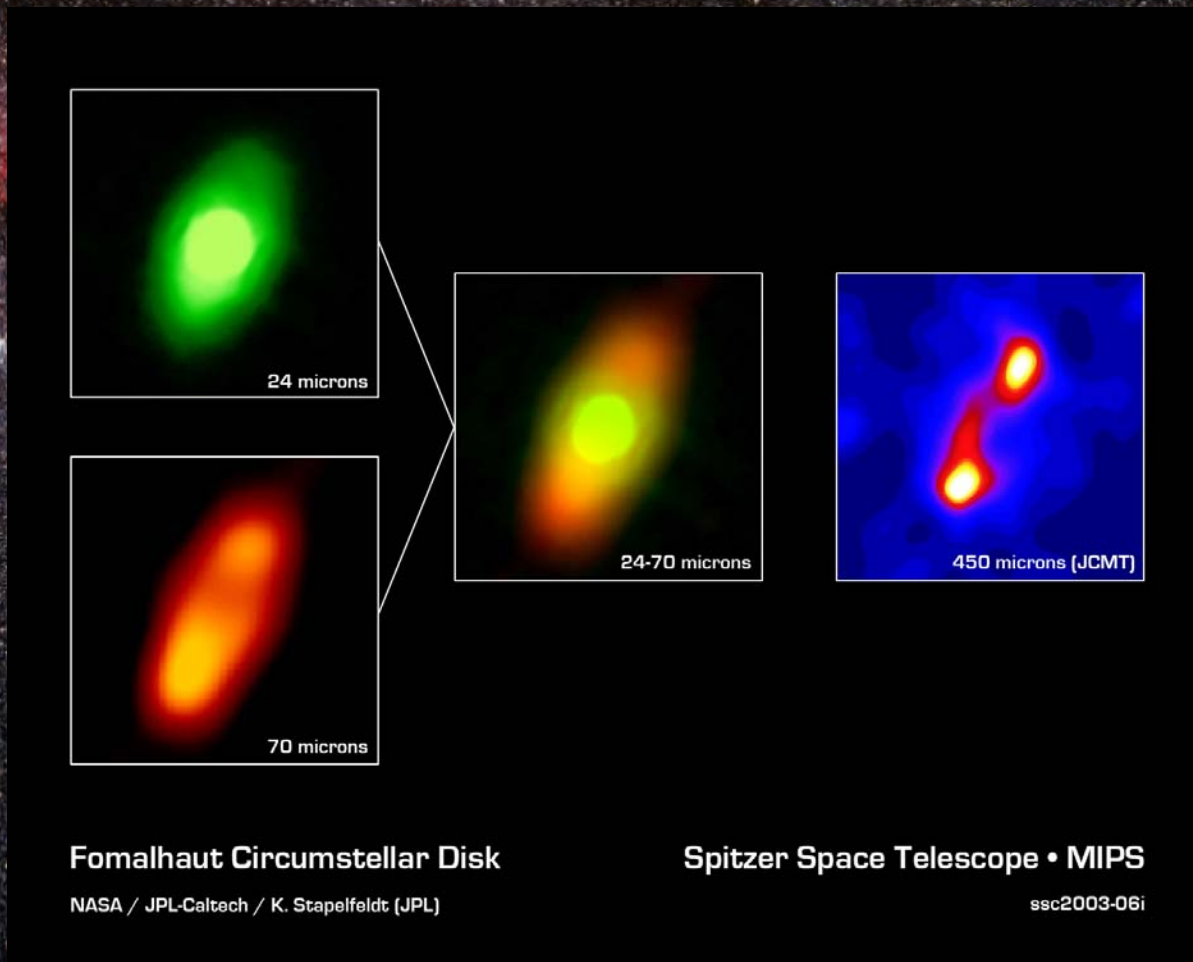
PRC95-45b · ST ScI OPO · November 20, 1995
M. J. McCaughrean (MPIA), C. R. O'Dell (Rice University), NASA



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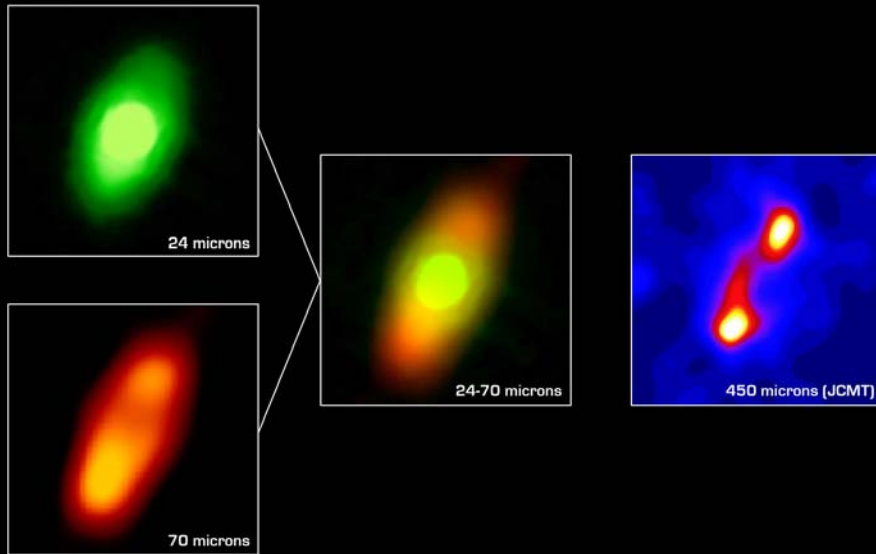
Star Formation

Seeing dust in holes



Stapelfeldt et al. 2004, ApJS

Seeing dust in holes



Fomalhaut Circumstellar Disk

NASA / JPL-Caltech / K. Stapelfeldt (JPL)

Spitzer Space Telescope • MIPS

ssc2003-06i

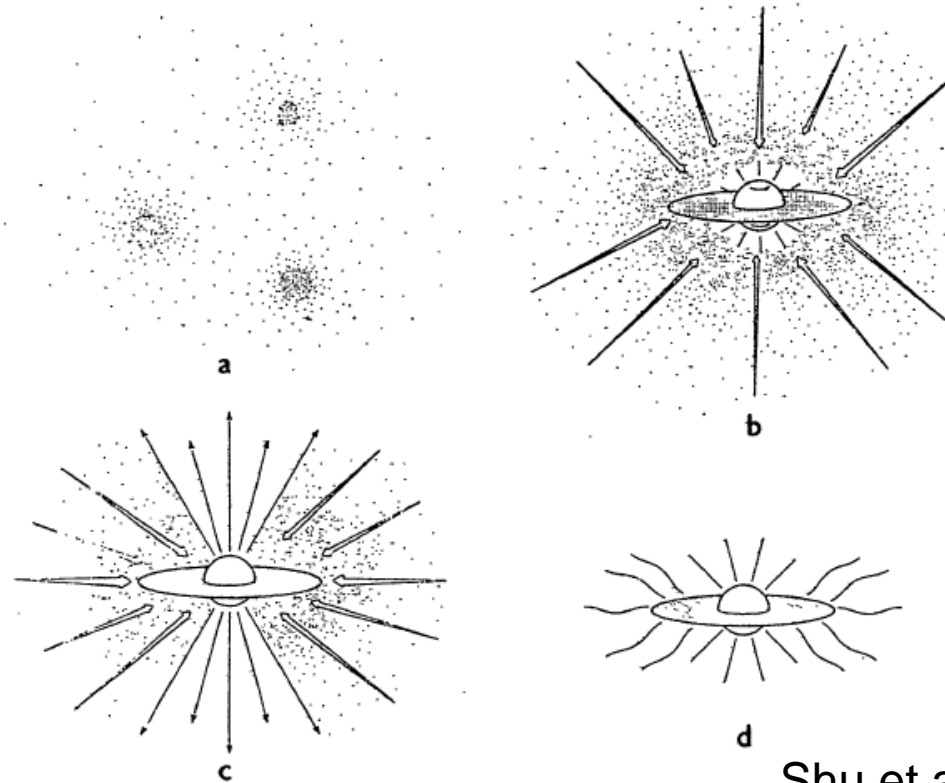


Stapelfeldt et al. 2004, ApJS

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Star Formation

Star formation standard model (star formation paradigm)

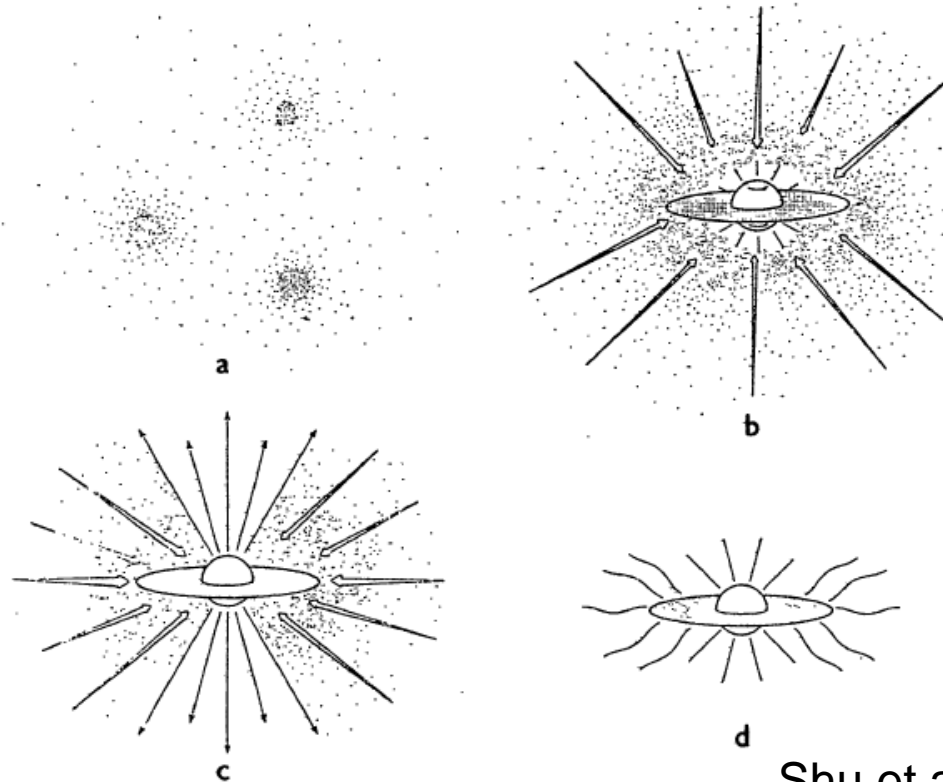


Shu et al. 1987

Figure 7 The four stages of star formation. (a) Cores form within molecular clouds as magnetic and turbulent support is lost through ambipolar diffusion. (b) A protostar with a surrounding nebular disk forms at the center of a cloud core collapsing from inside-out. (c) A stellar wind breaks out along the rotational axis of the system, creating a bipolar flow. (d) The infall terminates, revealing a newly formed star with a circumstellar disk.

Star formation standard model (~~star formation paradigm~~)

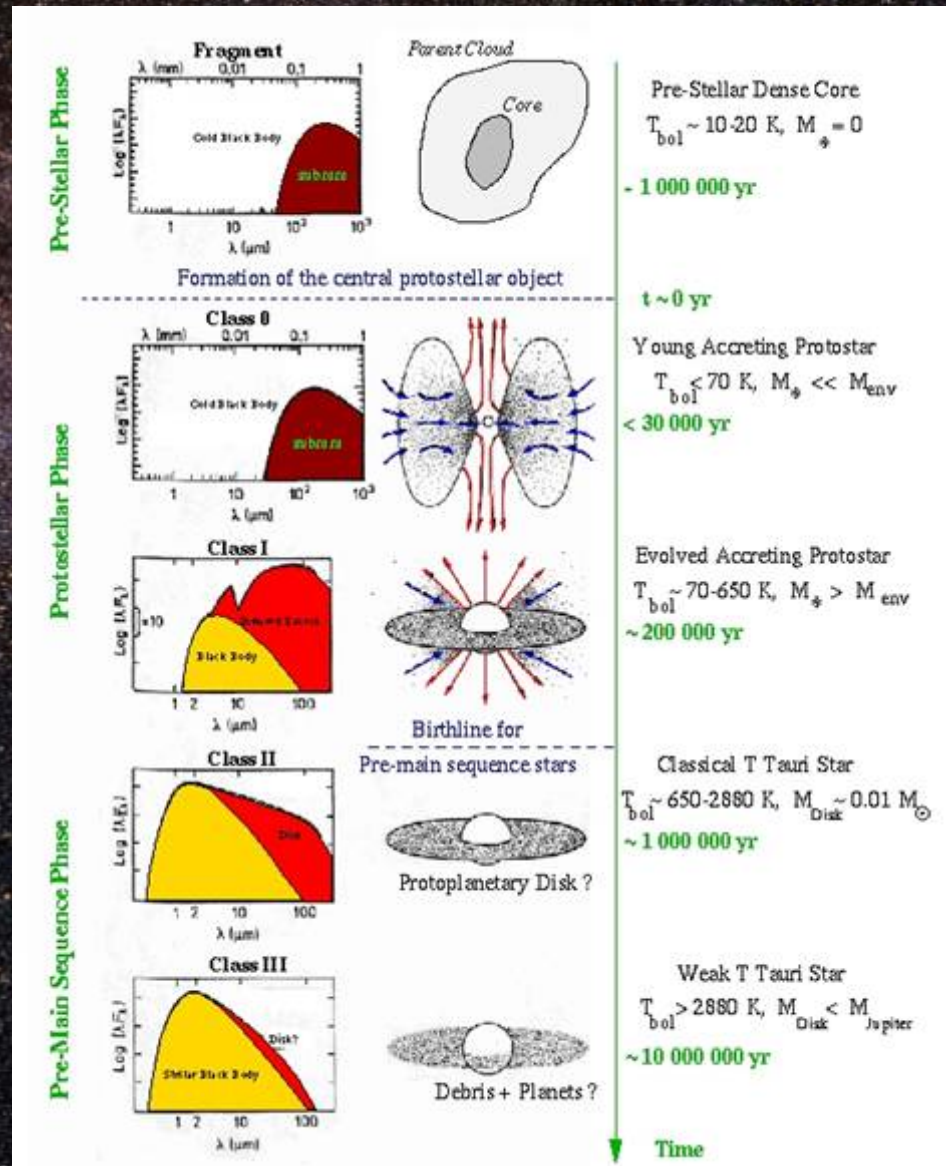
Cartoon



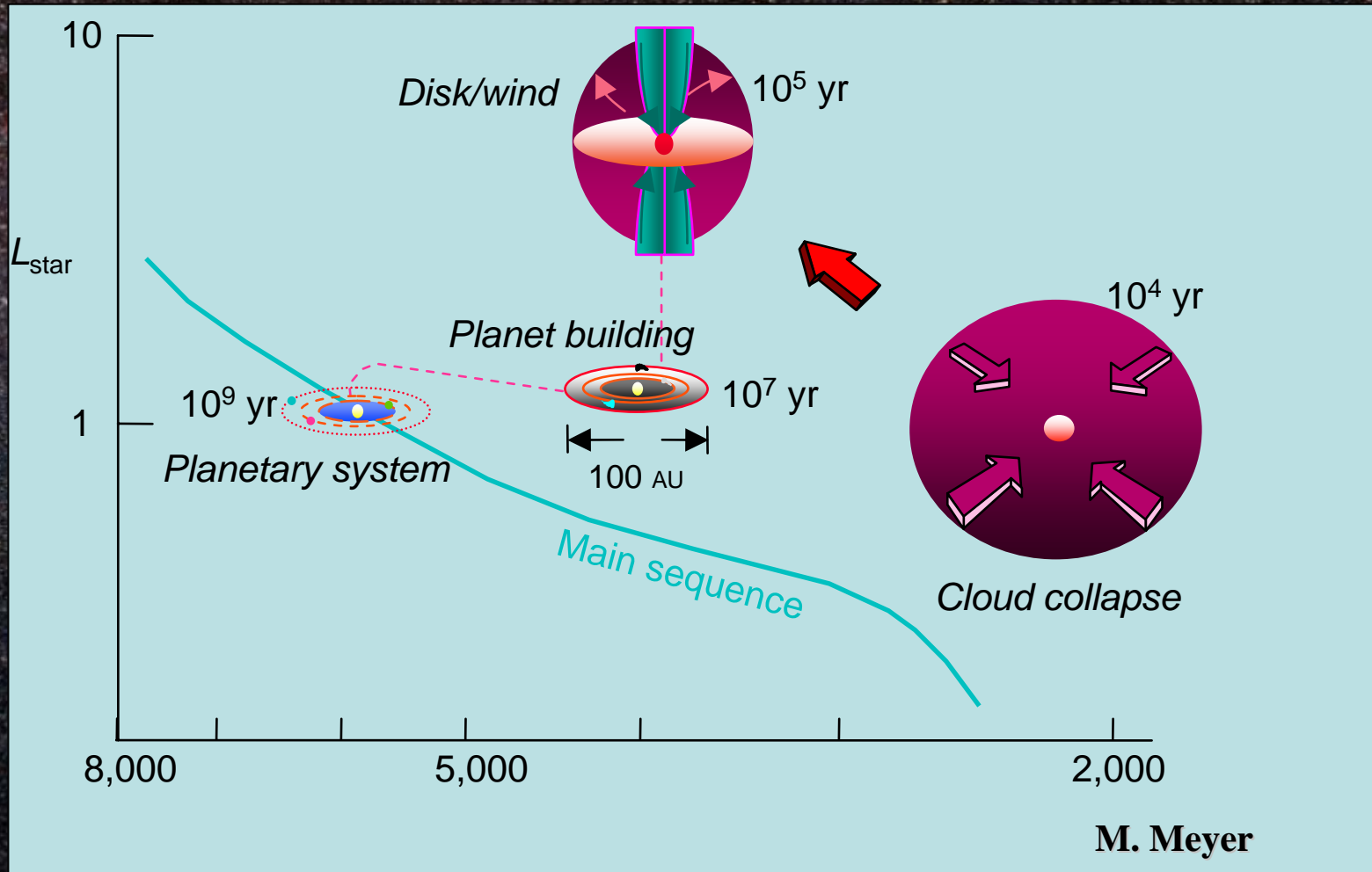
Shu et al. 1987

Figure 7 The four stages of star formation. (a) Cores form within molecular clouds as magnetic and turbulent support is lost through ambipolar diffusion. (b) A protostar with a surrounding nebular disk forms at the center of a cloud core collapsing from inside-out. (c) A stellar wind breaks out along the rotational axis of the system, creating a bipolar flow. (d) The infall terminates, revealing a newly formed star with a circumstellar disk.

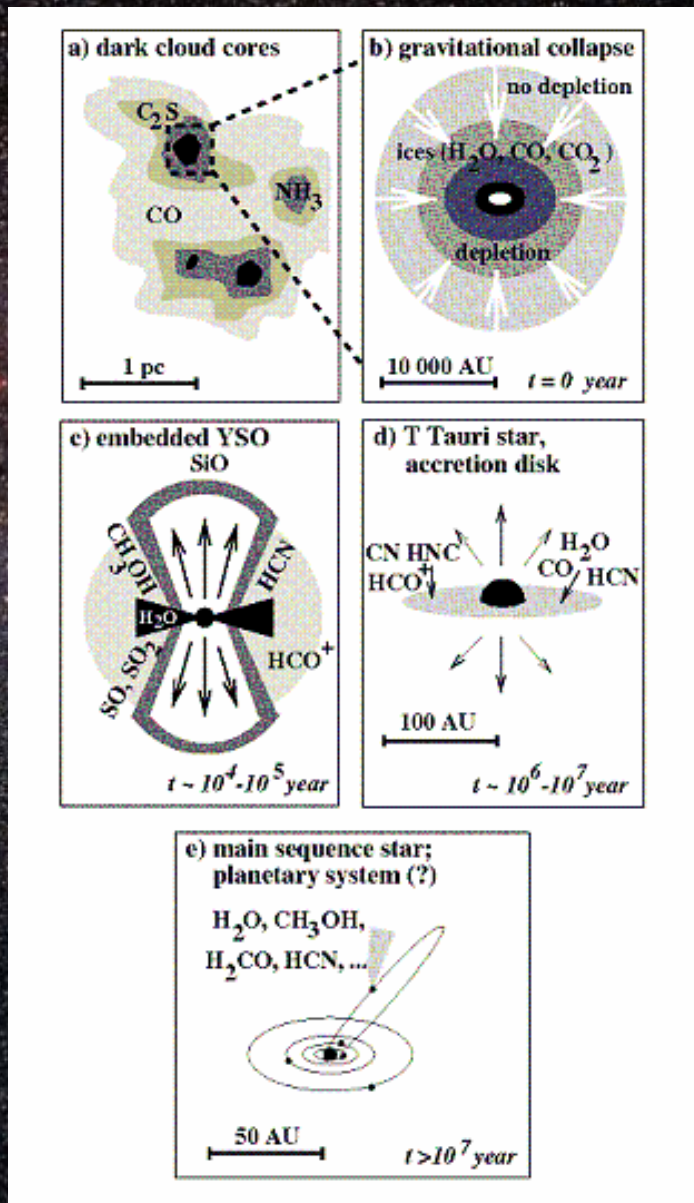
The Standard model (current version)



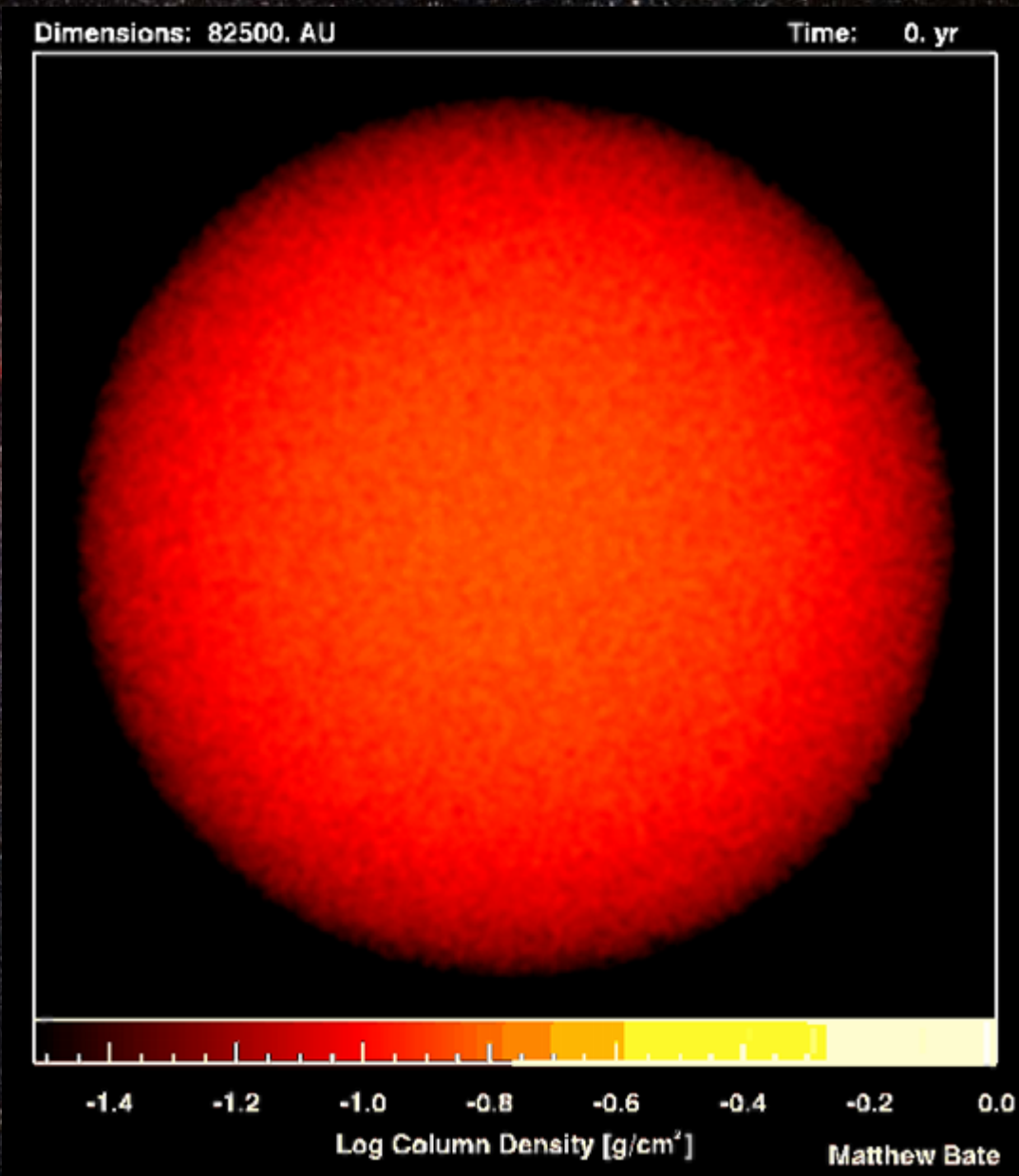
Pre-main Sequence Evolution



Chemical Evolution



Van Dishoeck & Hogerheijed, Cretell, 1999



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Star Formation