2007.2.1 PM (~10 min?)

光赤天連シンポジウム

将来計画とサイエンス

惑星形成と惑星探査

コメント

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注：「2010年代の光赤外天文学」サイエンス（2005年3月）の議論も思い出そう

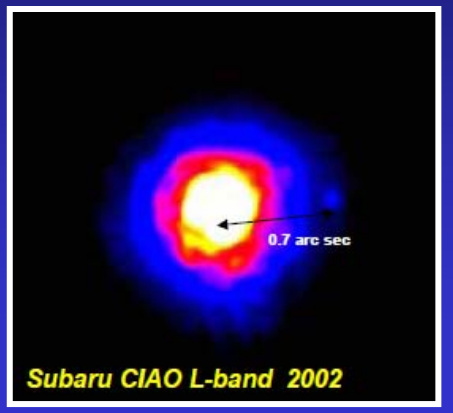
惑星系形成で私が知りたいこと

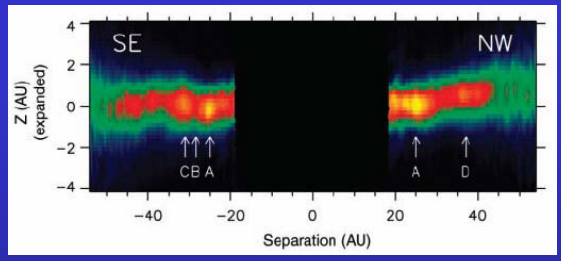
- When and how do planets form?
  - disk accretion phase?
  - core-accretion or gravitational instability or else?
- How diverse are planetary system architectures?
  - where do planets form? Or orbital evolution?
  - are Solar-system-like planets favored (in original)?
  - are planets in habitable zones common or rare?
  - environmental effects?
- Can we observe extra-solar planets directly?
  - can we determine atmospheric structure and chemistry?
  - can we detect signatures of life?
- How do stellar mass are determined?
- How do binaries and clusters from?
- What is the role of magnetic fields in star formation?

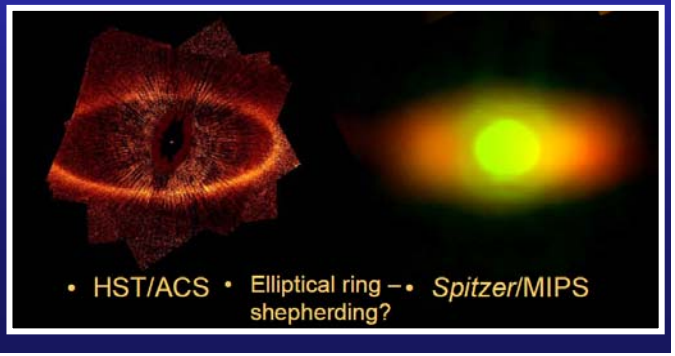
Just to discuss the first 3 items due to limited time.

惑星は何時如何に生まれるのか？

- What we know
  - Young low-mass brown dwarfs do exist around 1 Myr star. <VLT/Subaru/HST>
  - Not sure about young planets yet! <ANY>
  - Inner gap around 1 Myr stars. <Spitzer>
  - Asymmetric dust distribution around ~100 Myr stars (Vega-like stars). <HST>
- Key observations
  - probing accretion disks surrounding young stars and searching for tidal gaps diagnostic of forming planets
  - searching for gaps in Vega-like disks around main-sequence stars
  - determining accurate ages for star-disk systems
- Key facilities
  - ALMA
  - ELT
  - SPICA/JWST

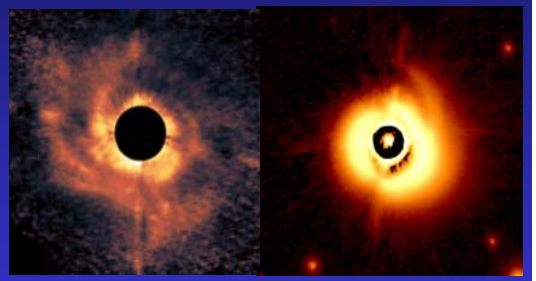


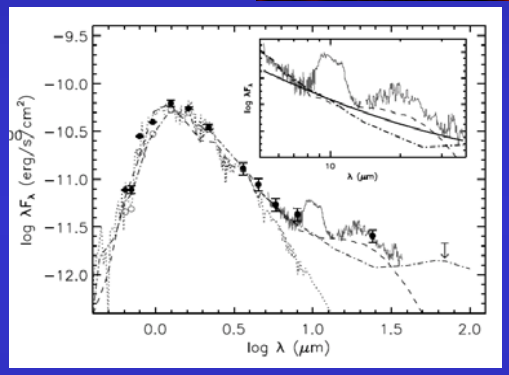


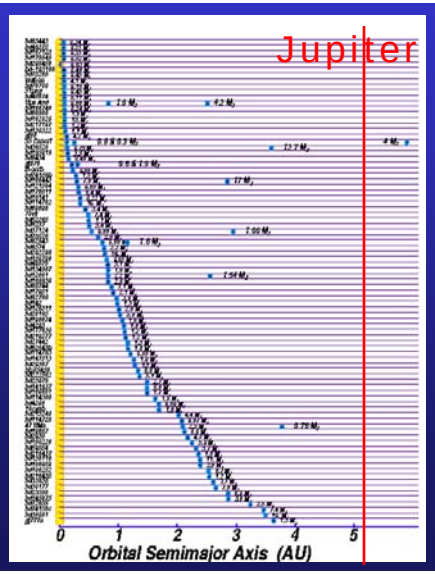


惑星系・円盤はどの程度多様なのか？

- What we know
  - Disk morphology is diverse. <Subaru/HST>
  - Disk mineralogy is diverse. <Spitzer>
  - Planets are diverse. <since Mayor/Queloz>
- Key observations
  - Various indirect observations (Doppler, Transit)
  - Statistical studies of dust distributions
  - Precise measurements of reflex motions:
    - continuation of current radial velocity programs
    - precise proper motion measurements
- Key facilities
  - Specialized small telescopes?
  - SPICA/JWST
  - ELT
  - GAIA/JASMINE?

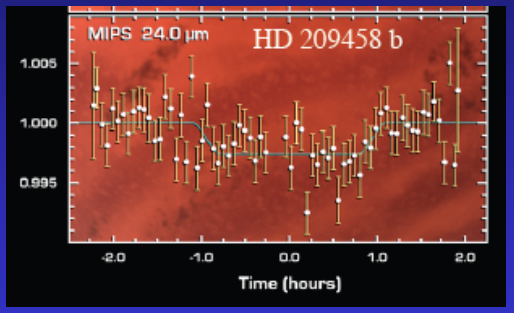


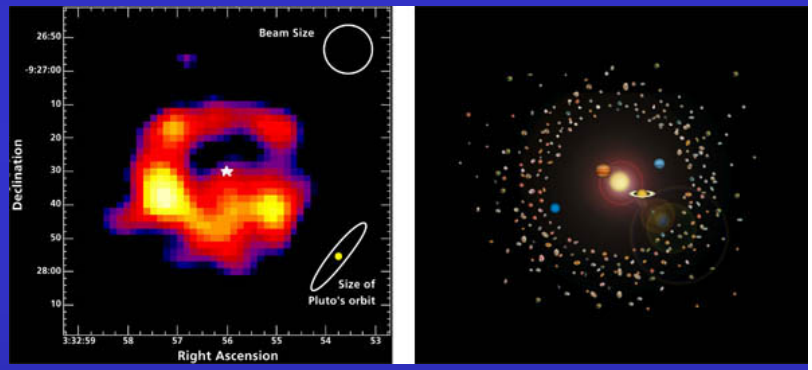


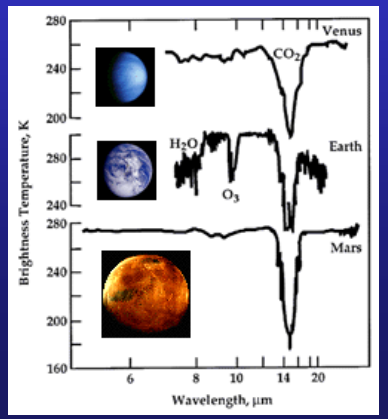


惑星は直接検出できるか？

- What we know
  - All in indirect ways.
  - Thermal emission detected. <Spitzer>
- Key observations
  - Imaging and spectroscopy
- Key theoretical work
  - how to diagnose life from spectroscopic signatures?
- Key facilities
  - high contrast imaging & spectroscopy telescopes
    - coronagraphs that block out light from central star
      - use on current and future ground-based telescopes with ExAO
      - TPF/Darwin/JTPF







まとめ

- 星惑星系形成研究は多様な切り口がある
- 惑星検出研究は単一目的
- すばる
  - 専門化と一般性のバランスを保つ
  - 特長（広い視野と綺麗なPSF）を生かす
  - 機動性：旬の装置を生かす重点観測を
  - 開発の裾野：必要不可欠な装置アップグレードを見極めて必要な投資を
- 地上とスペース（いろいろ思うところはありますが結論だけ）
  - どちらも必要
  - ELTは是非ハワイに
  - SPICAはJWSTと同じくらいの時期に
  - 地球型系外惑星の検出と特徴付けにはTPFが不可欠