

Solar System Formation

- Our solar system & nebular model
- Indications from young stars
- Results from other solar systems

Solar system regularities

1. All planets orbit in same direction (but do not have aligned spins).
2. Most angular momentum ($M \cdot V \cdot R$) in gas giants
3. Rocky planets in inner solar system, gas giants in middle, icy bodies in outer regions
4. Moons orbit (mainly) in prograde direction

Basic Nebular Model

- Protosun -> collapse from interstellar cloud
- Angular momentum from Galactic orbit-> disk formation
- Planets condense within the disk
- Condensation sequence from ices to refractory elements depending on location and phase of disk evolution
- Planet formation ends with disk clearing
- Final formation in period of planet bombardment

Solar System Disk Model

- Provides regular, near circular orbits
- Evidence for condensation sequence CAIs-planets
- Age 4.5 Gyr before present
- Icy material in outer solar system--gradients in T
- Major interactions
 - Comets--Oort cloud
 - Inclined/retrograde rotators (Venus/Uranus)
 - lunar and other cratering

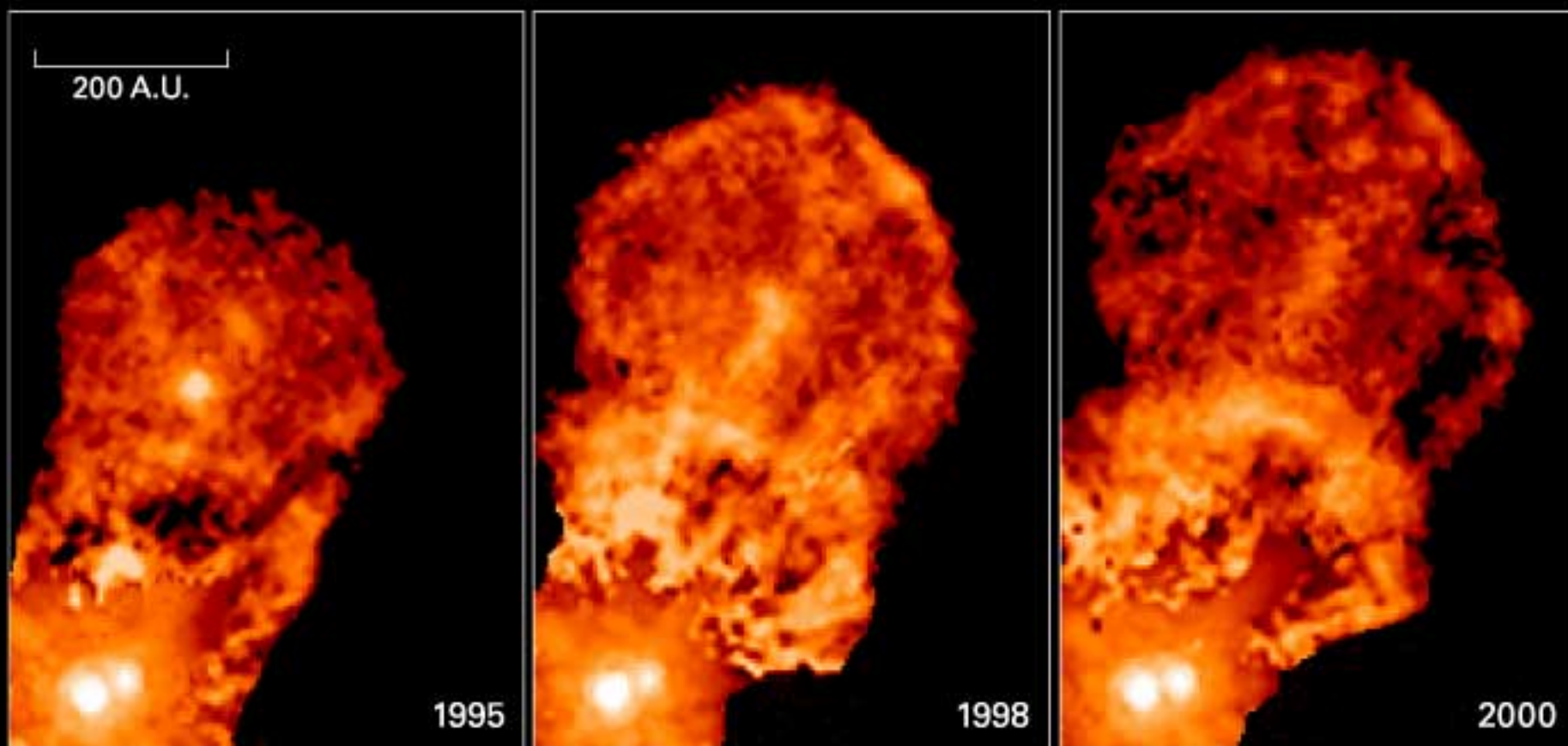
200 A.U.

1995

1998

2000

The Dynamic HH 30 Disk and Jet
Hubble Space Telescope • WFPC2



Hot Gas Bubble Ejected by Binary Star XZ Tauri
Hubble Space Telescope • WFPC2

Protostars

- Disks are common features
- Jets associated with disks so lifetimes limited
- Some hints of planets in disks

Hints from Extrasolar Planets

- Gas giant planets can exist near stars
- Orbits sometimes elliptical
- Not all solar systems like ours
- Planet migration during formation likely due to interactions with disks