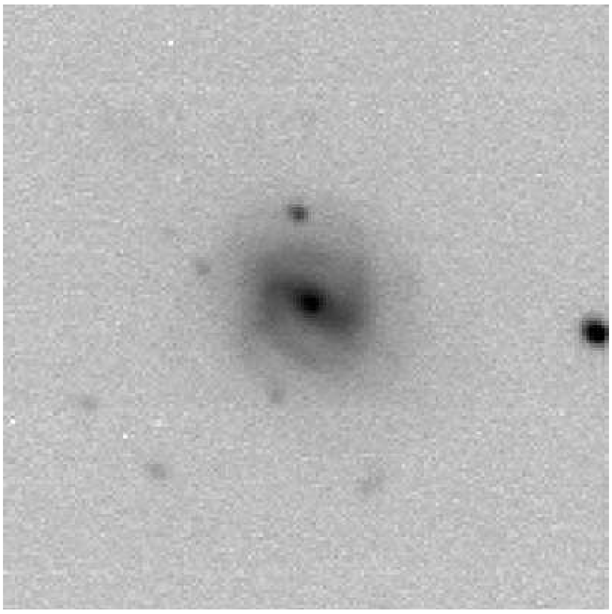
Supernovae (SNe)

- Great fun because . . .
  - Final step in stellar evolution
  - Perfect laboratory for high energy processes
  - Generate and dissipate all elements heavier than iron
  - Trigger star formation in gas clouds
  - Allow us to study surrounding medium

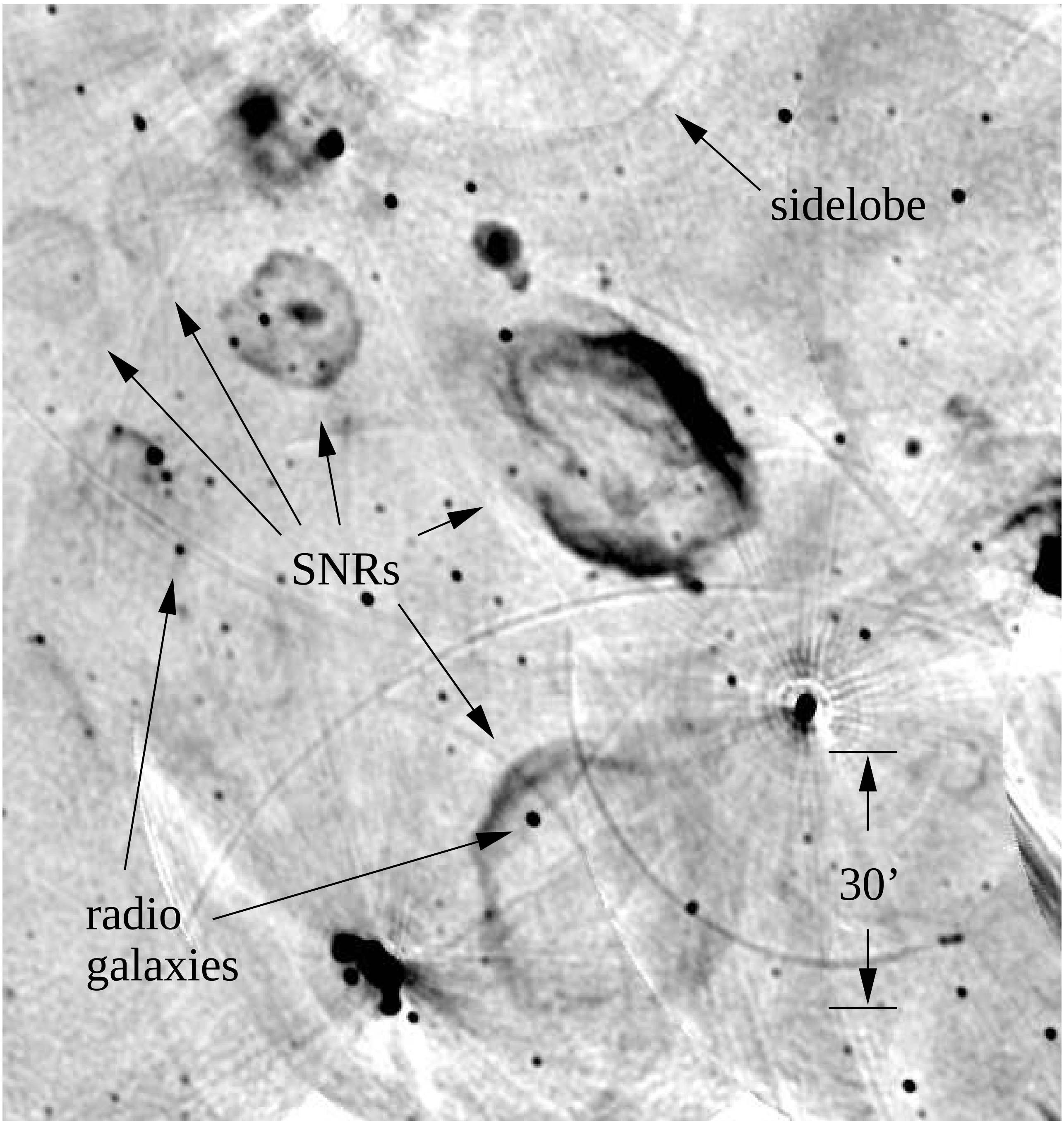
- But difficult to study:
  - Observed via intense optical emission (hot gas)
  - Extremely rare: last Milky Way SN was in 1670
  - Approx 60/year found in very distant galaxies
  - Usually found days–weeks after event
  - Visible for weeks to months before fading



Supernova 1996as

Supernova Remnants II

- In the radio sky, the Galactic Plane is filled with SNRs



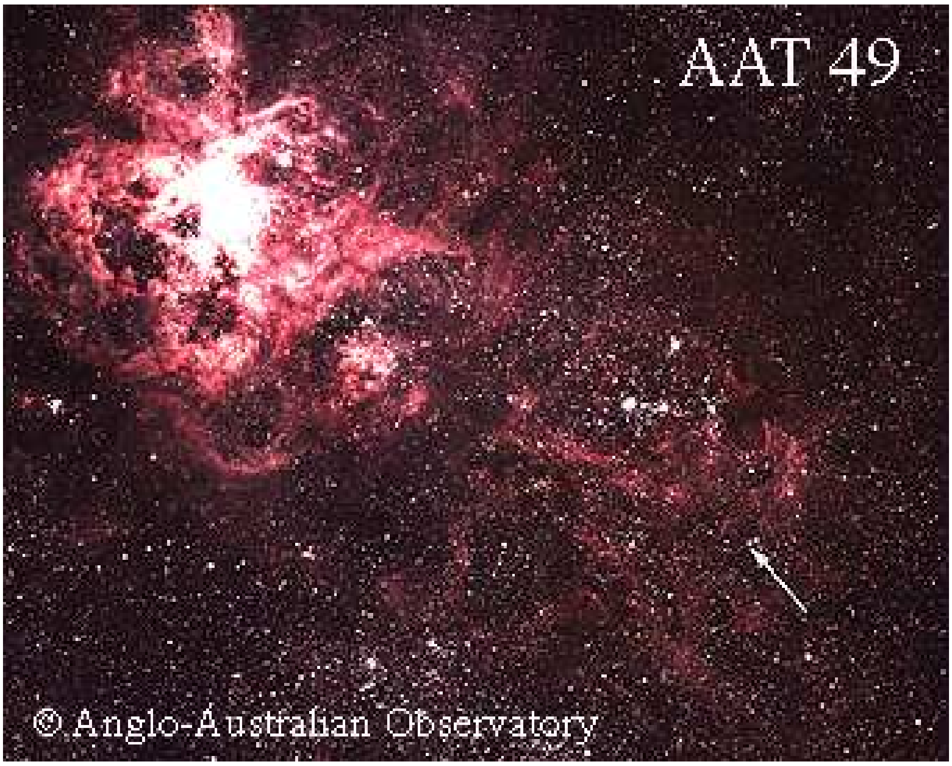
Molonglo Observatory Synthesis Telescope (MOST)

Supernova in Taurus, 1054 AD
(Chaco Canyon, New Mexico, USA)

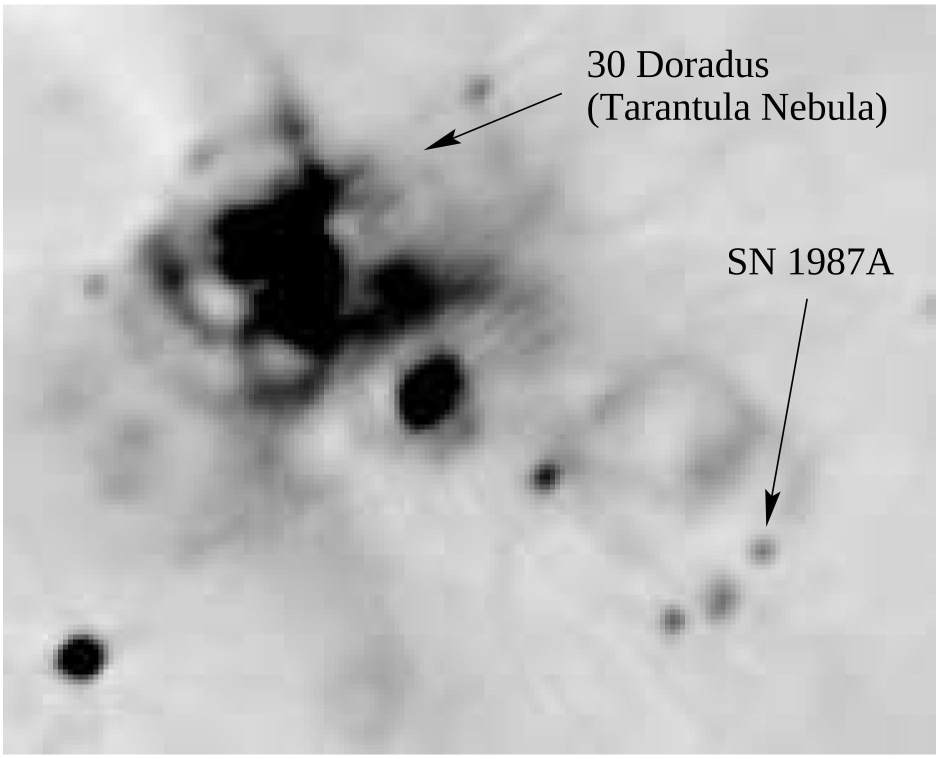
Crab Nebula in Taurus

Supernova 1987A

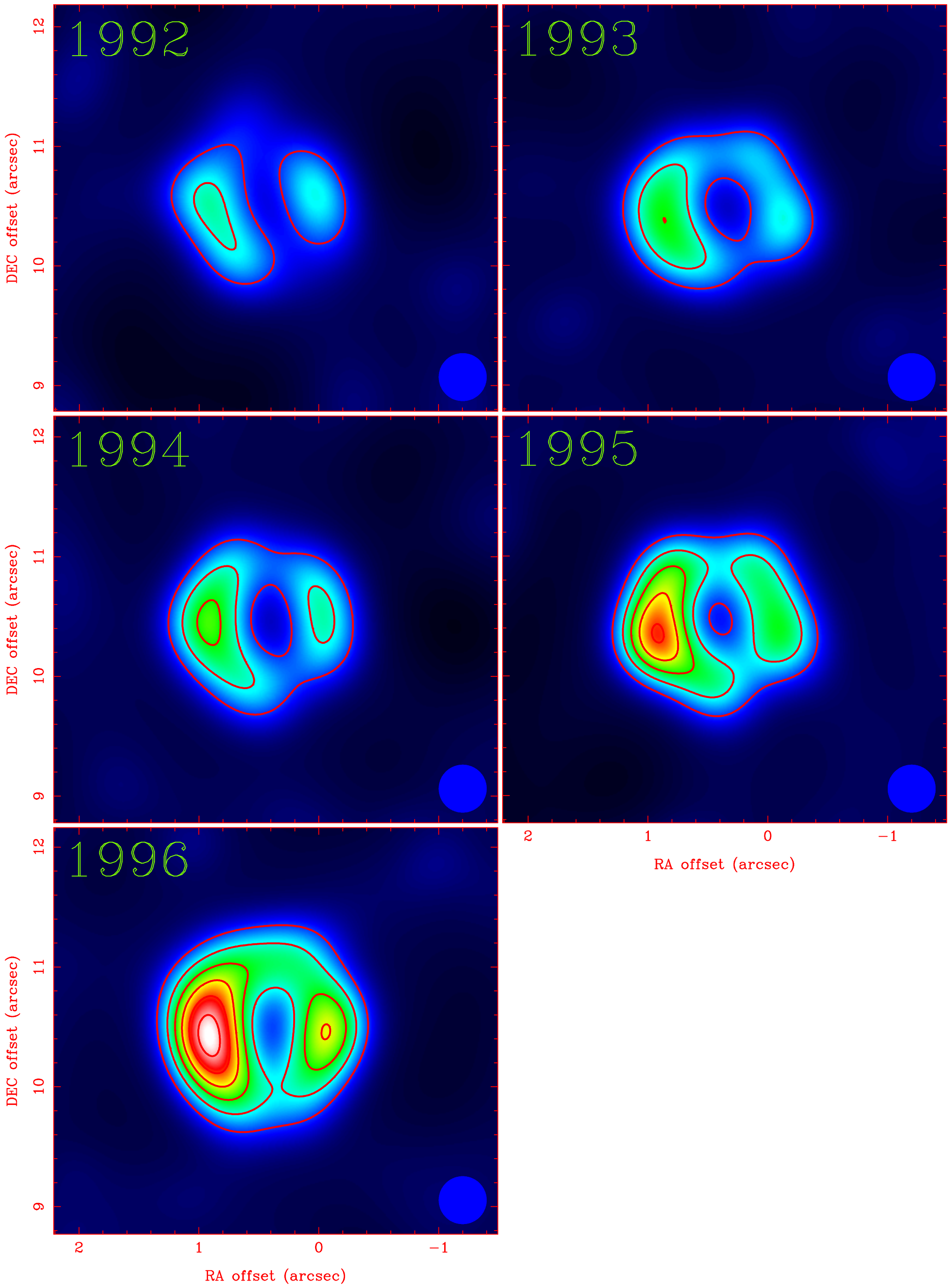
- On 23rd Feb 1987, new star appeared in constellation of Dorado



Radio and Optical Views of SN 1987A

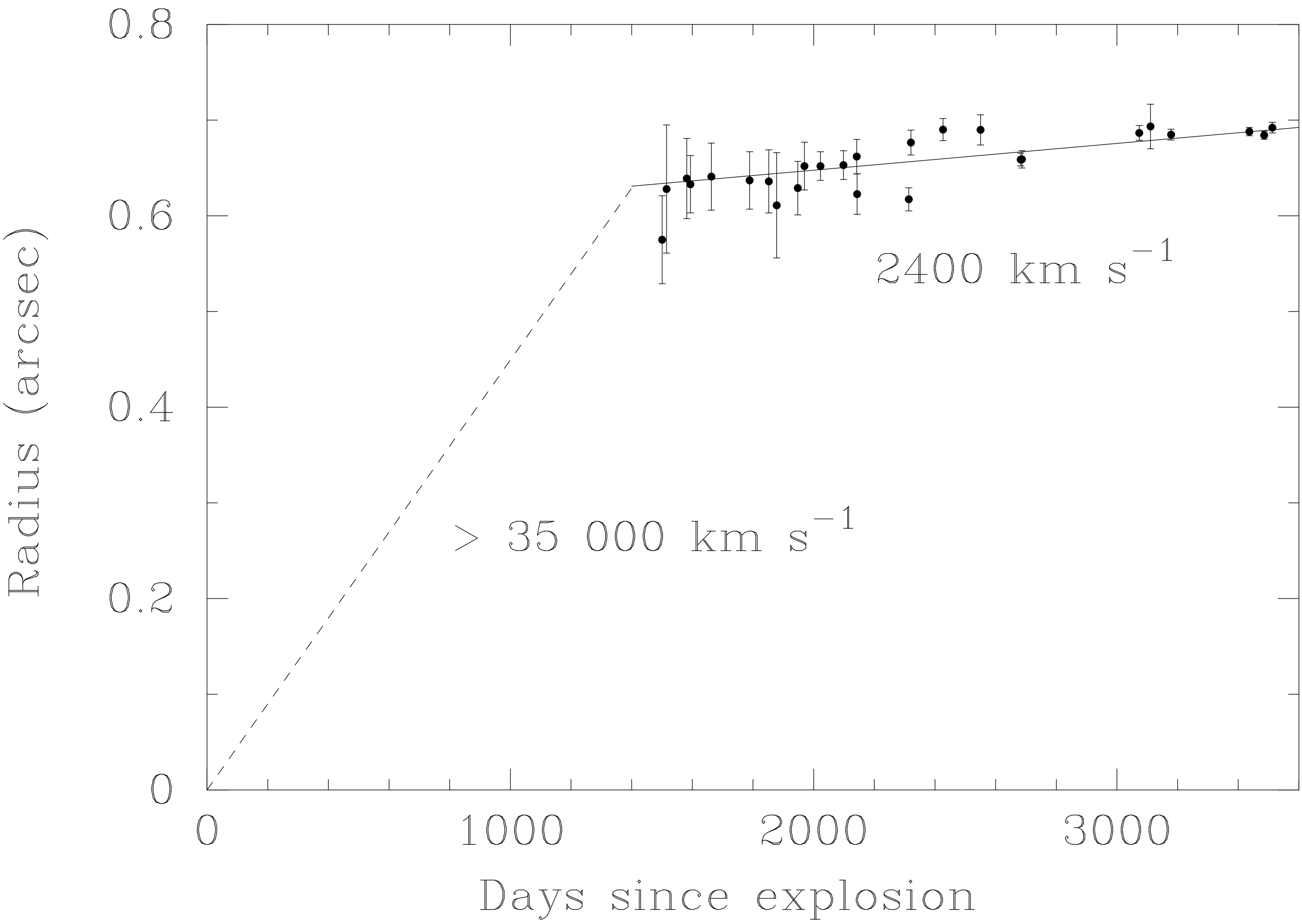


SN 1987A: The Movie



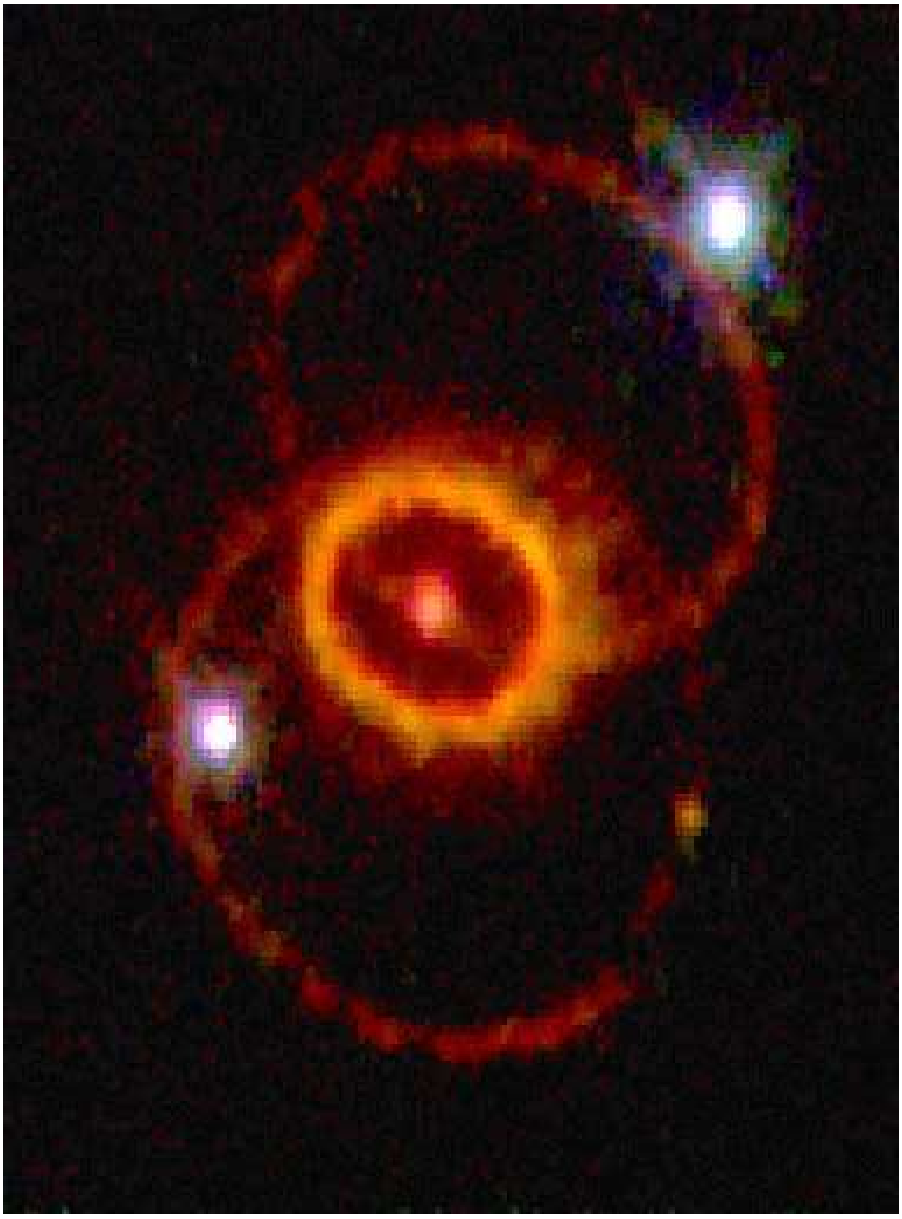
– Circular shell (miniature SNR)
– Asymmetric
– Little apparent expansion

Expansion of SN 1987A



- Enormous deceleration: density has increased by factor of 1000
- All evidence points to shell of dense material shed by progenitor star

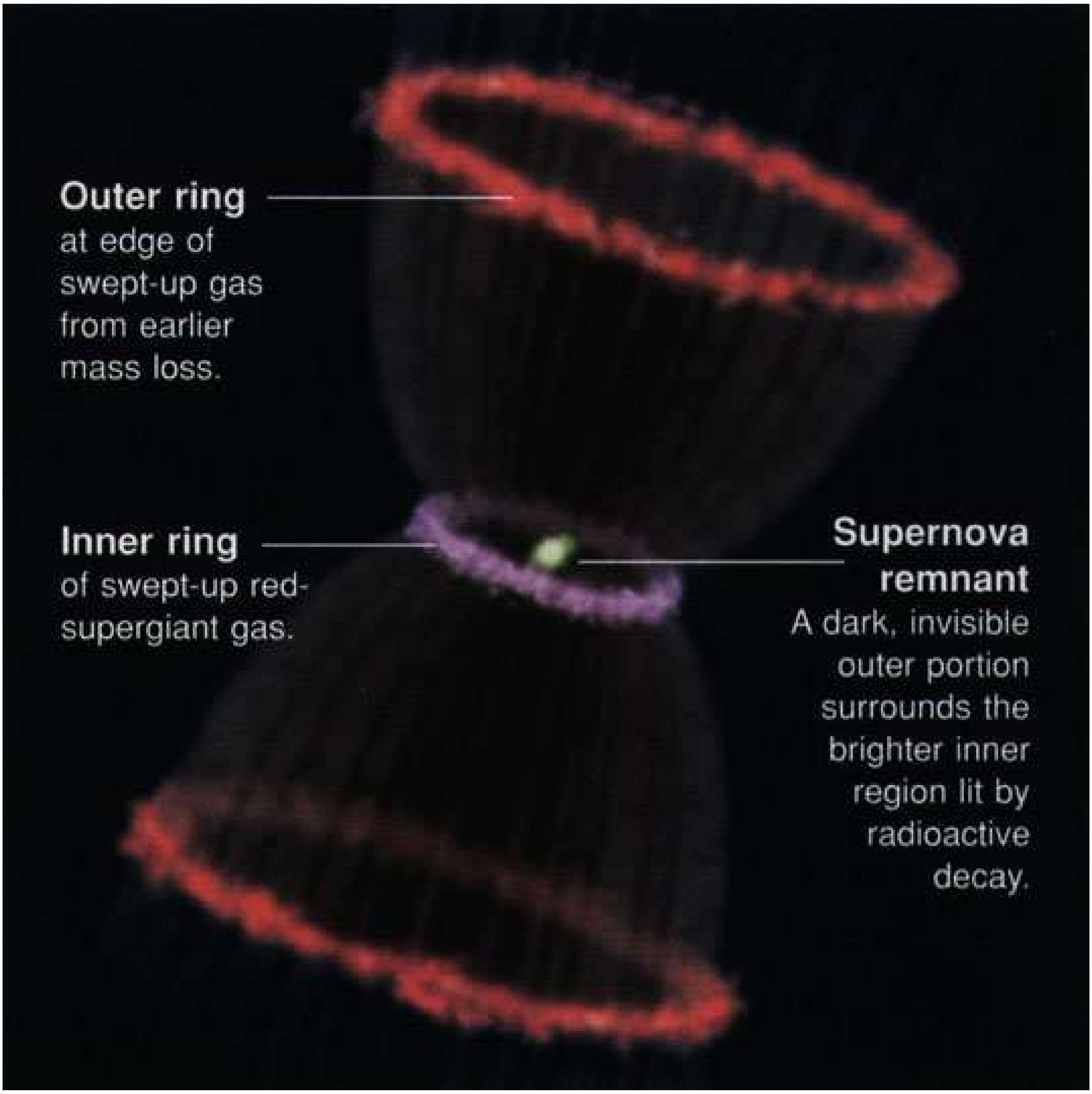
Pre-existing material around SN 1987A



Hubble Space Telescope

- Optical images show “three-ring circus”
- Pre-existing material lit up by supernova flash

Pre-existing material II



- Outer edge of shell expelled by progenitor 20 000 yrs before explosion

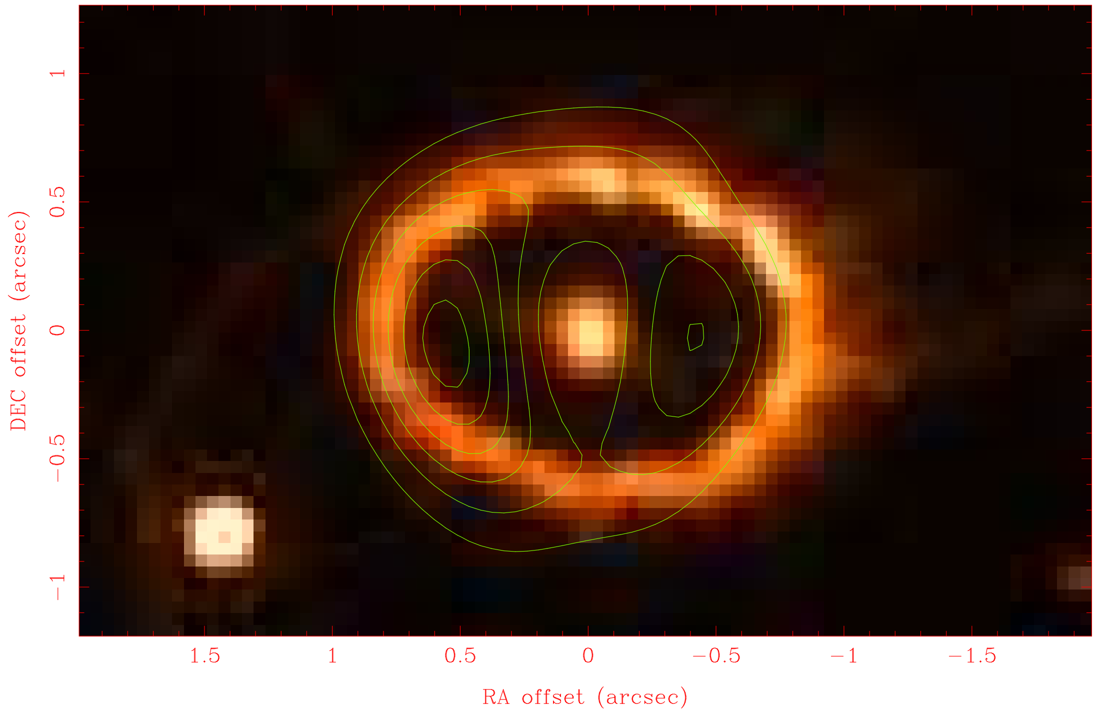
- Rapidly rotating star?

- Binary system?

Pre-existing material III

- Comparing optical and radio images is difficult

- Observe nearby *radio stars*



- Radio remnant is inside ring

- Radio lobes lie in "waist" of hourglass

- Asymmetry between two lobes