3/23/05

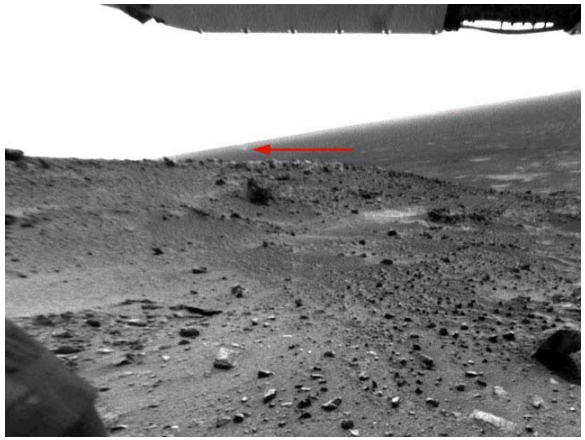
News: Mar 11, 2005.The White House announced nomination of Michael Griffin as Administrator of NASA. PhD, 5 Ms degrees. Applied Physics Laboratory, Johns Hopkins University, past NASA chief engineer. executive positions with Orbital Sciences Corporation and In-Q-Tel.

Hot Jupiters seen directly in other solar systems with Spitzer Satellite

Mars Rovers, churning wheels finds highest concentration yet of salt deposits, ancient salty, acidic shallow water. Steve Squyers, UT Colloquium yesterday: dust devils cleaned off the photocells!

Pic of the day

Dust devil on Mars



Extra Credit (5 points in term grade, half a grade)

Evening:

Orion with Betelgeuse is moving East, have to look earlier in the evening (before 11 ish to see it). Don't wait until the end of the term to do this.

Sirius A, brightest star in the sky, has white dwarf companion.

Cassiopeia - Location of Cas A (not naked eye, but direction)

Taurus - direction of Crab Nebula/Pulsar

Algol

Andromeda - Andromeda Galaxy

Virgo - Virgo cluster of galaxies, supermassive black hole in M 97, nearby bright supernovae.

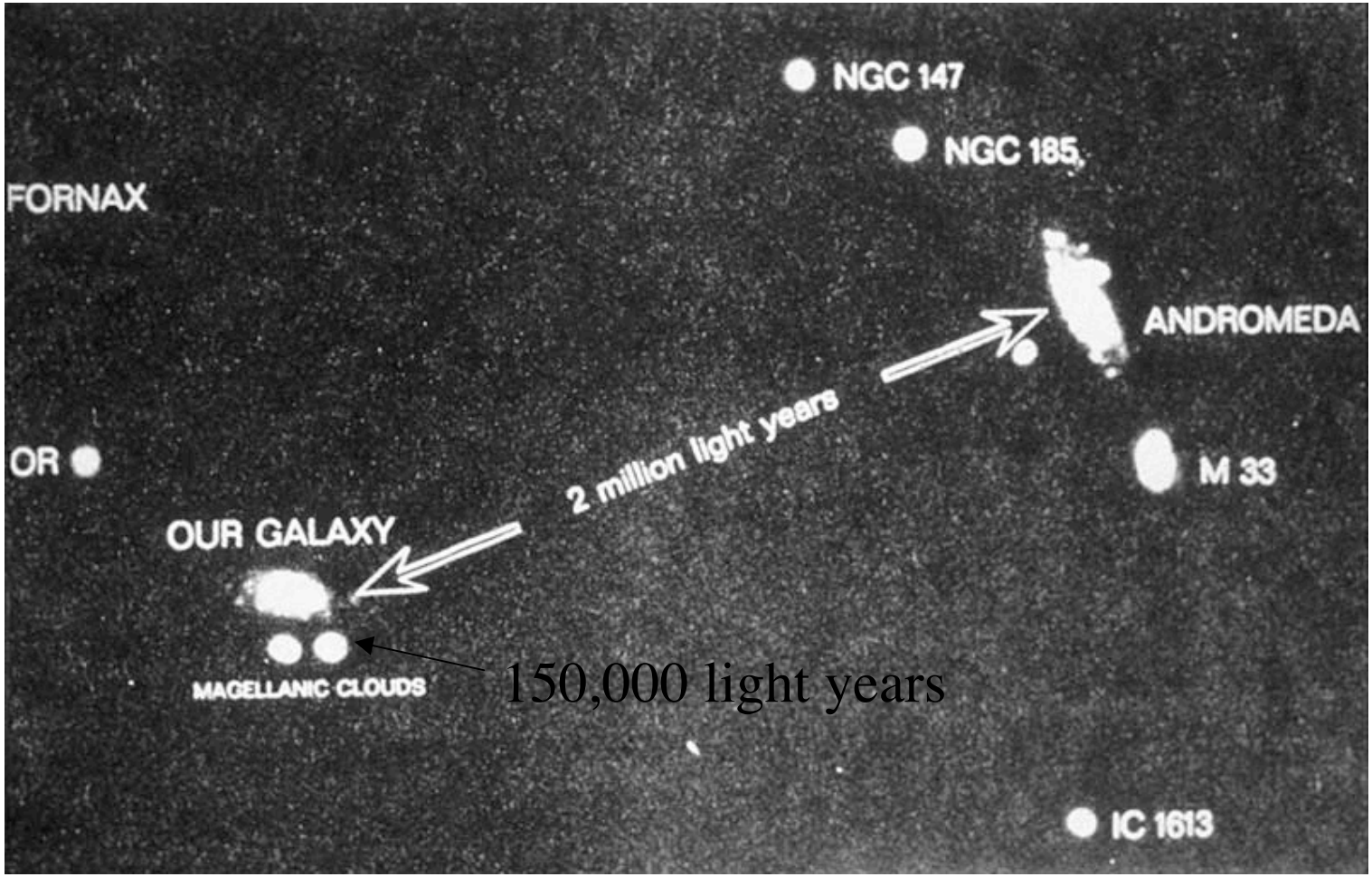
Midnight: Vela - Vela SN, pulsar

Morning:

Scorpius - U Sco, recurrent nova, possible future SN Ia

Cygnus - direction of Cygnus X-1, most famous binary black hole

Local group


NGC 147
NGC 185
FORNAX
ANDROMEDA
2 million light years
OR
M 33
OUR GALAXY
MAGELLANIC CLOUDS
150,000 light years
IC 1613

LMC color

Rob McNaught patrol photos - the day before

2-22-87

The first known photo of SN 1987A hours after shock breakout

2-23-87

One day later

2-24-87

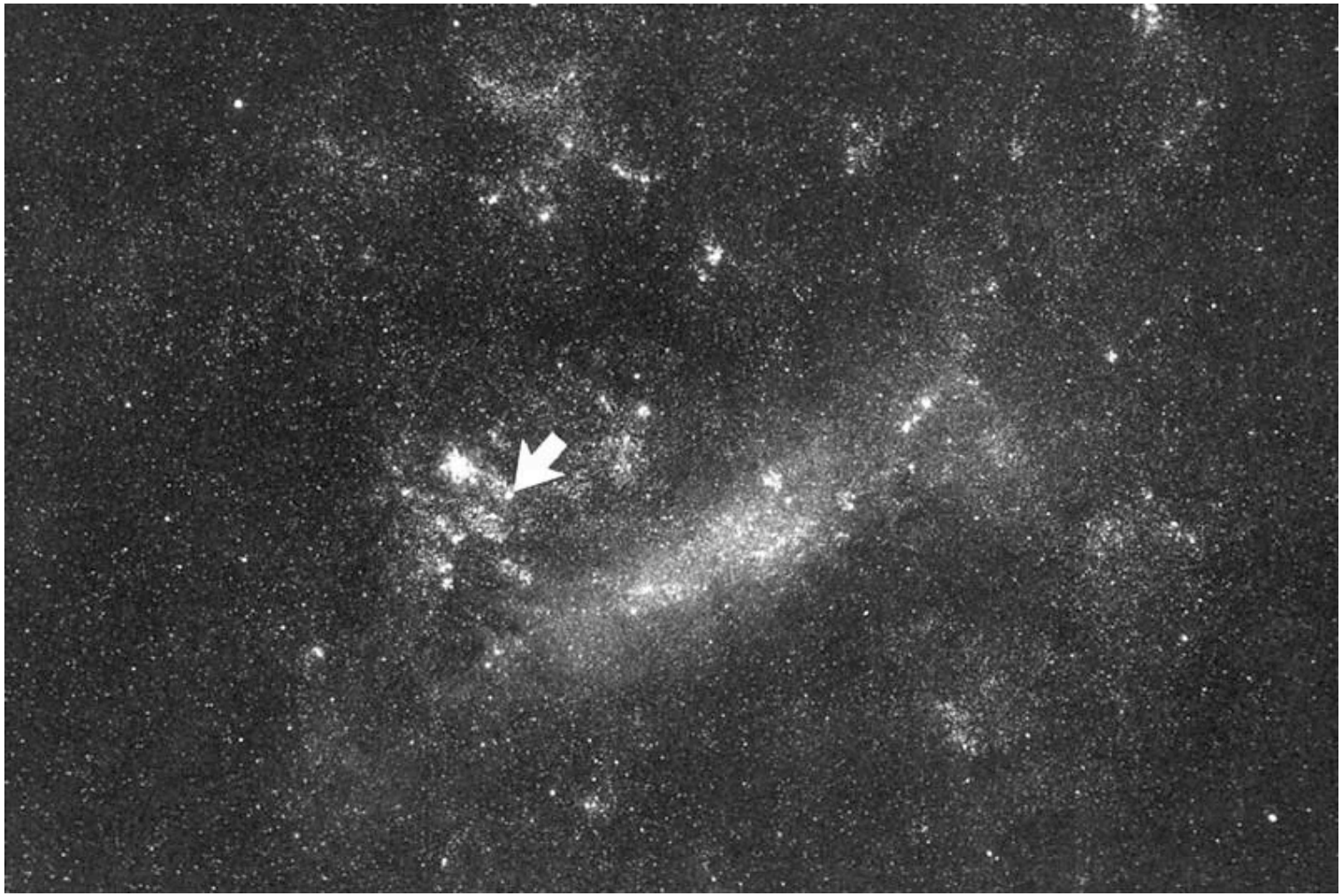
Near maximum light

5-20-87

About when I saw it

8-23-87

LMC w/arrow



LMC negative

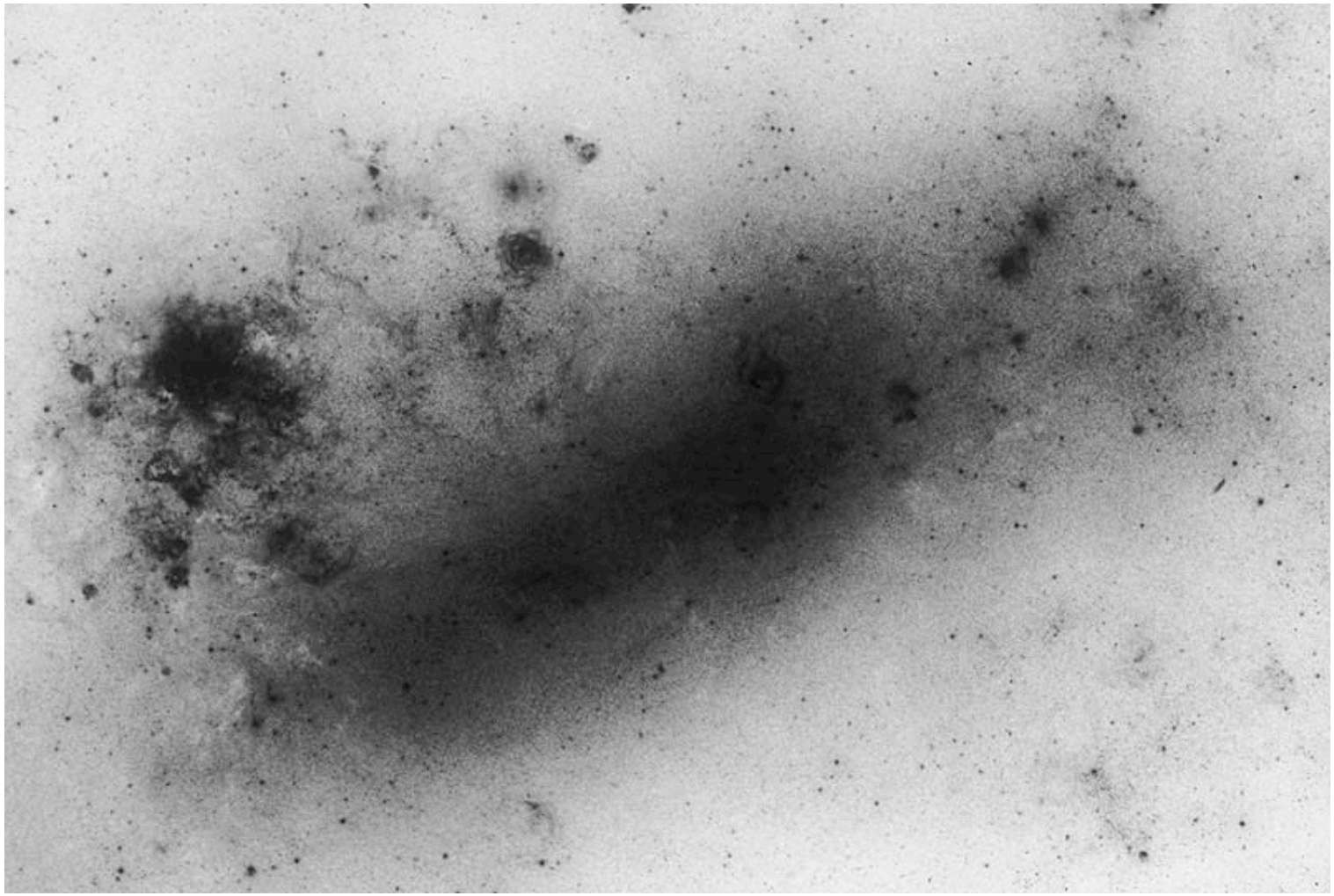
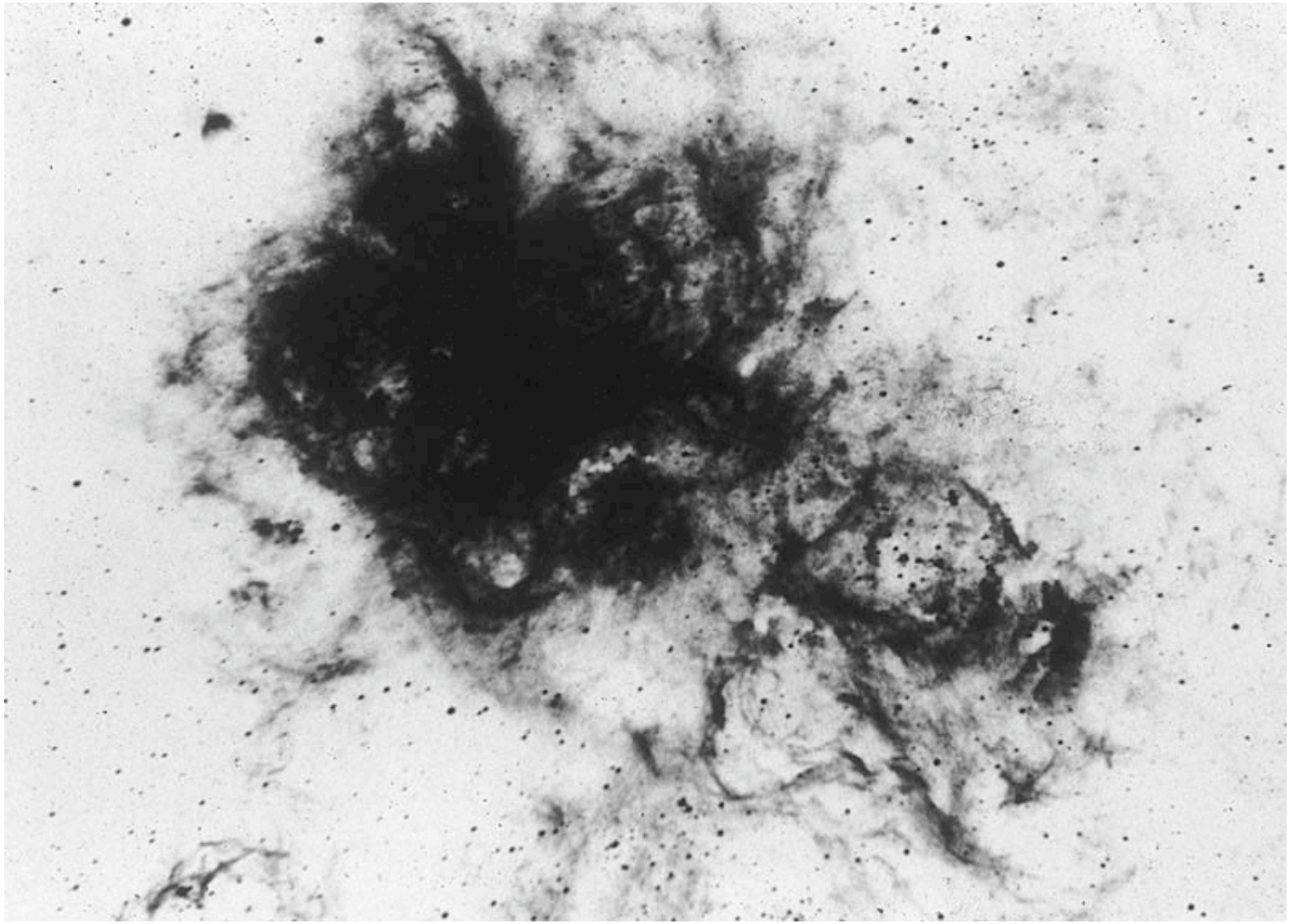
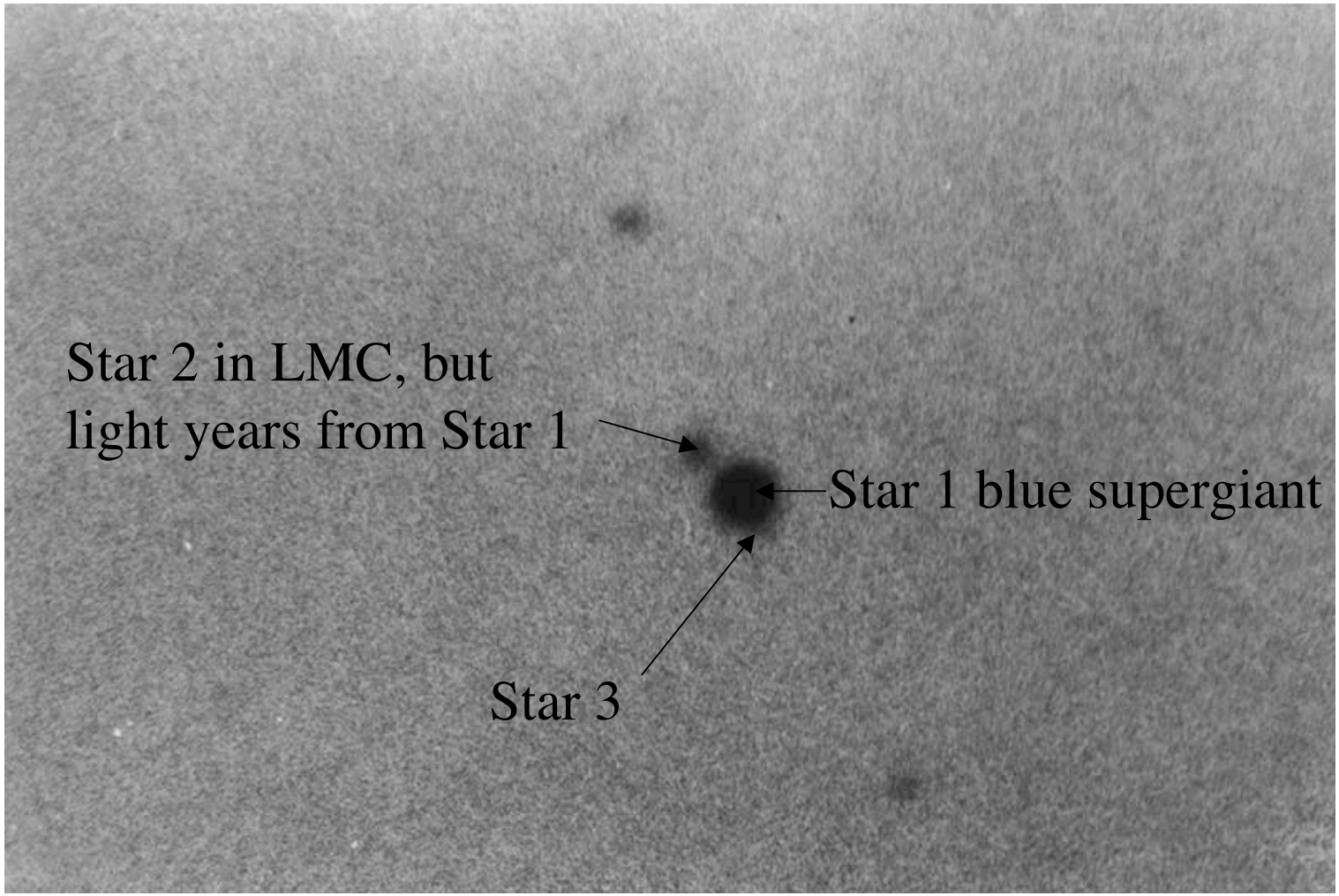


Photo of progenitor star (giraffe)



Stars 1, 2, 3



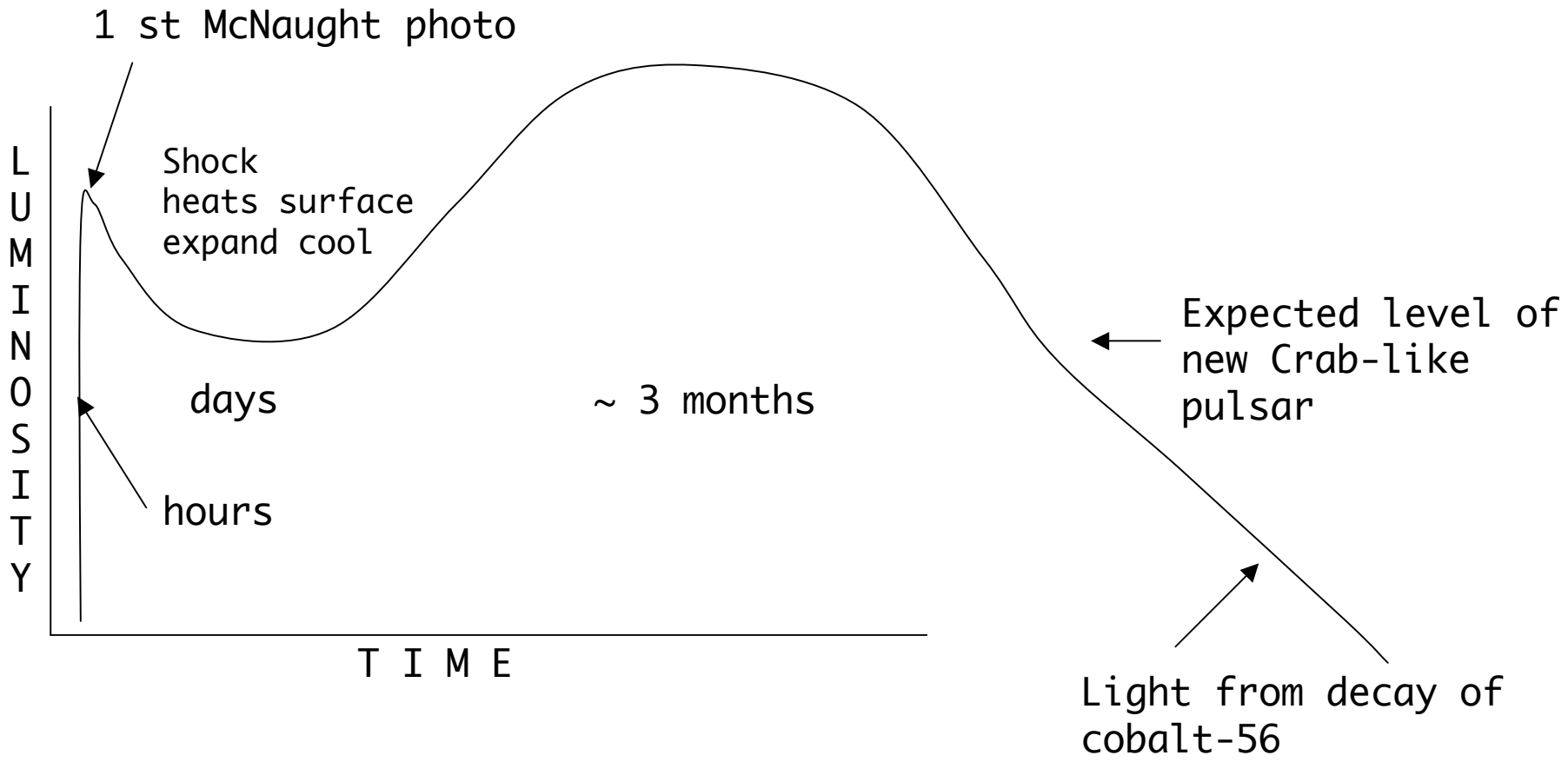
Close-up

The single most important thing about SN 1987A is that we detected the neutrinos!

It was definitely a core-collapse event

10^{57} neutrinos emitted, most missed the Earth. Of those that hit the Earth, most passed though since neutrinos scarcely interact.

About 19 neutrinos were detected in a 10 second burst.

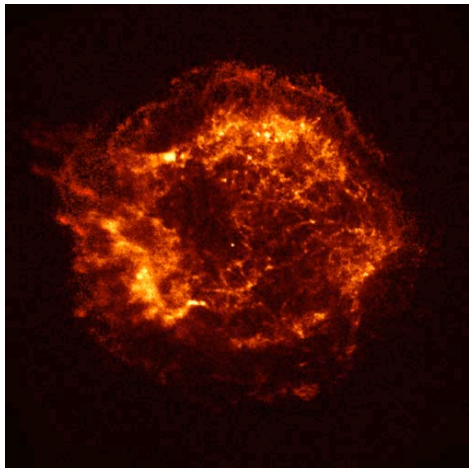


SN 1987A had a rather peculiar light curve because it was a relatively compact blue supergiant, not a red supergiant, brief shock heating, rapid cooling by expansion, no plateau, subsequent light all from radioactive decay

Neutrinos from SN 1987A proved a neutron star formed and lasted for at least 10 seconds while neutrinos were detected - where is it?

Expected to see it in ~ 1 year - still looking 17 years later

Any neutron star is dimmer by at least a factor of 10 than 1000 year-old Crab pulsar



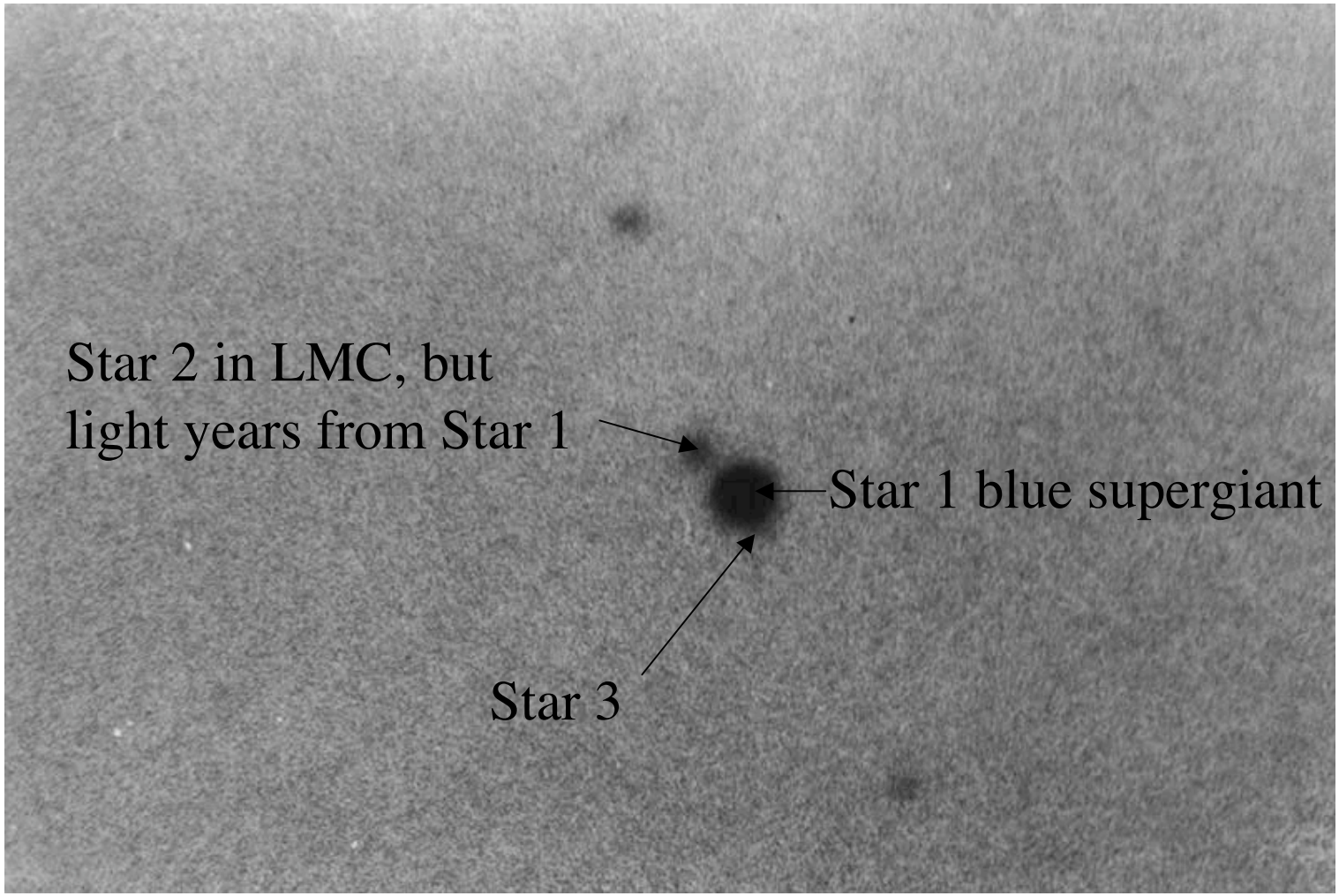
If similar to object in Cas A, much too dim to detect

100 to 1000 × dimmer than Crab pulsar

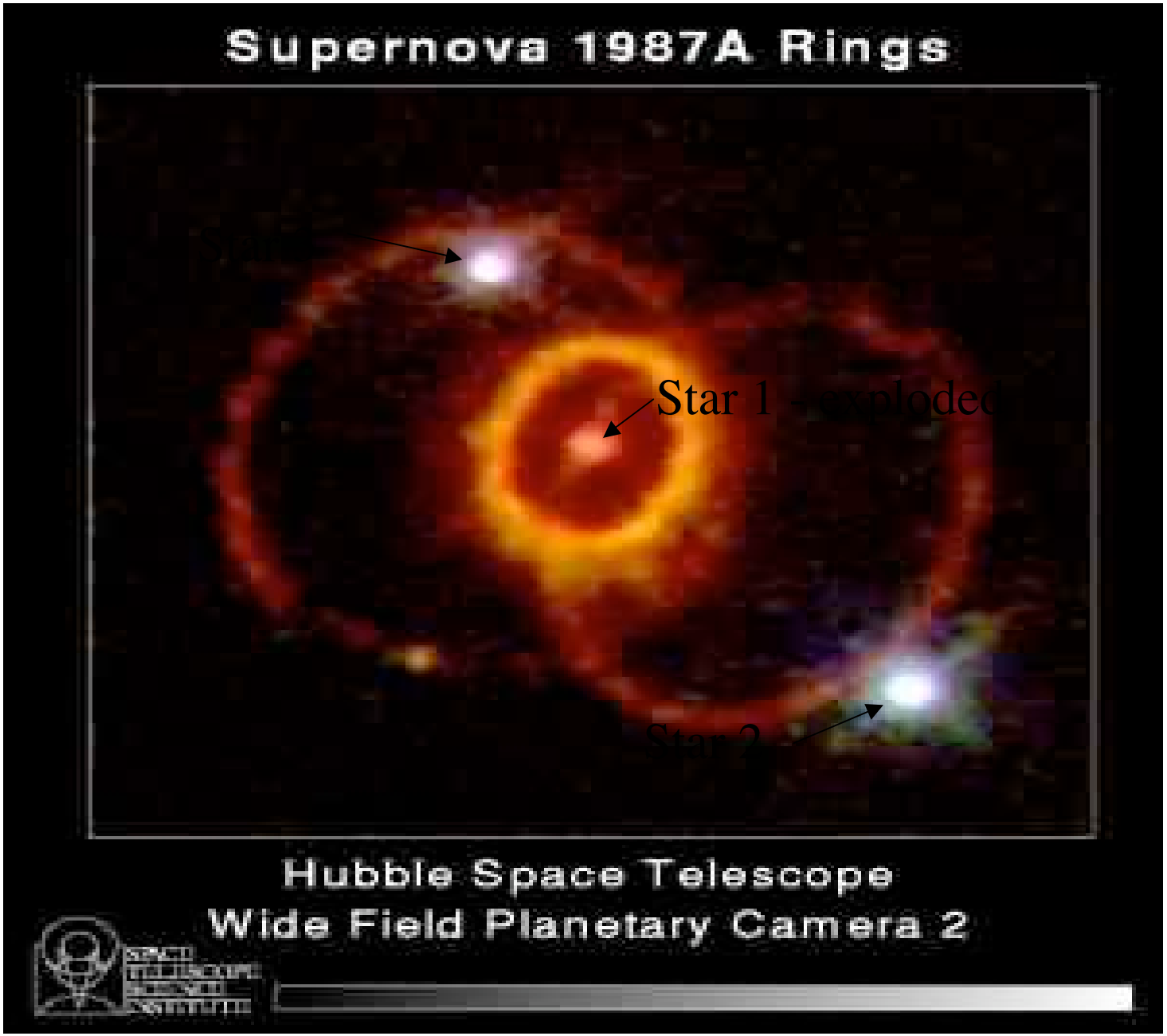
Possibly black hole, not neutron star??
Don't know. Can't rule out.

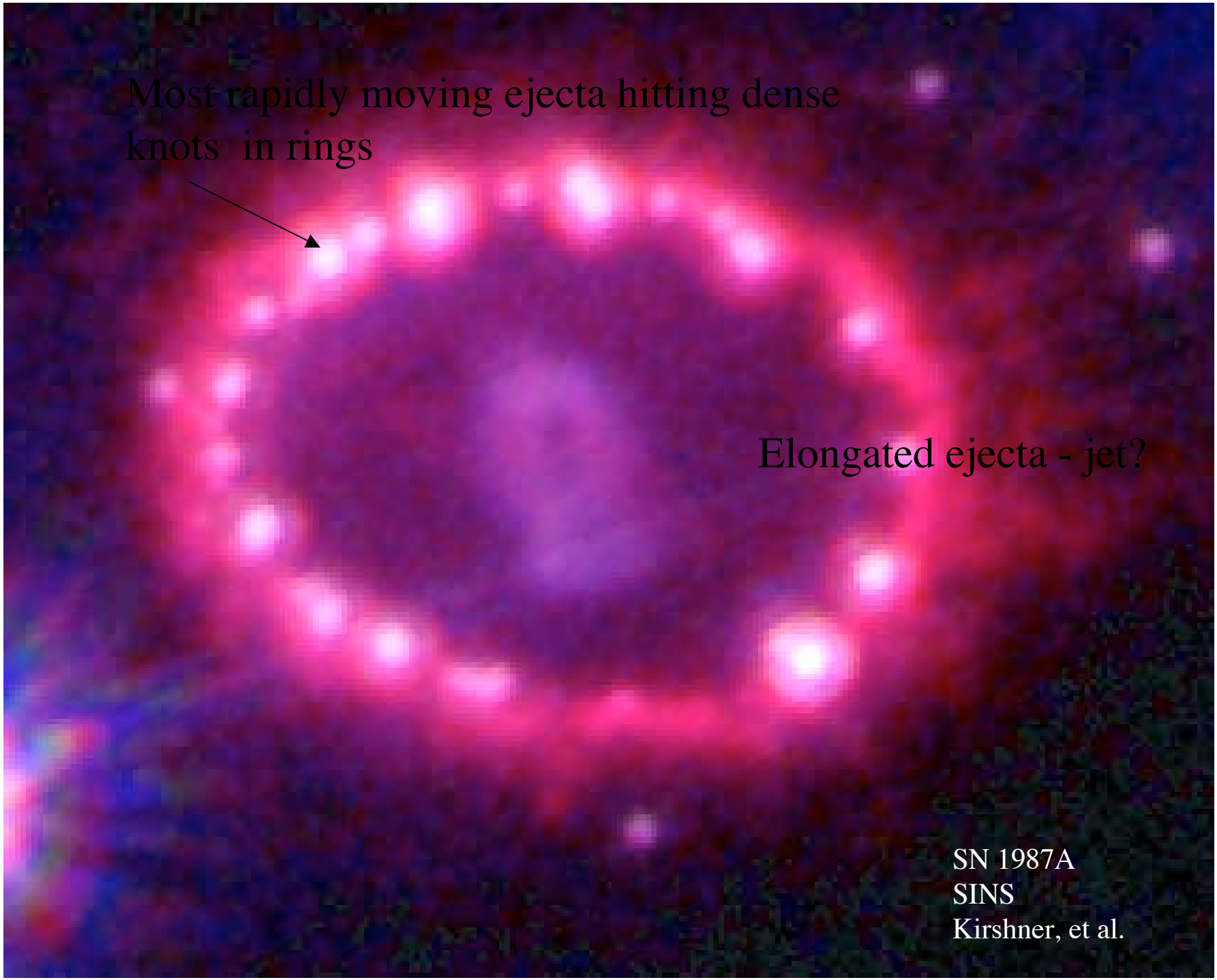
Neutron star could be "hidden," or a slow rotator, or with a weak magnetic field, but counter to notion of jet - some evidence for jet

Stars 1, 2, 3



Close-up


Supernova 1987A Rings
Star 1 - exploded
Star 2
Hubble Space Telescope
Wide Field Planetary Camera 2


Most rapidly moving ejecta hitting dense knots in rings
Elongated ejecta - jet?
SN 1987A
SINS
Kirshner, et al.

Doppler shifts - motion away - Redshift
motion toward - Blue shift

Ring closer edge on top
jet should be moving *away on top,* but measured blue shift

Puzzle - then realized images show "jet" brightened by radioactive decay

Spectrum to get Doppler shift with Hubble Space Telescope examined Calcium, but Calcium is expected to be in the torus (bagel) - top *should be* moving toward us

Consistent with jet-induced picture

NEUTRON STARS (Chapter 8)

mass of Sun

radius ~ 10 km

density like atomic nucleus (even a few times more!)

gravity at surface huge - crush human
highest “mountain” ~ 1 foot

Pulsars - rotating magnetic neutron stars

~600 radio pulsars known

"active" for ~1-10 million years, then magnetic field decays or aligns → *no radiation*

Probably ~ billion "inactive" neutron stars ~1% of all stars in the galaxy

To radiate, pulsars must be magnetic:

Wiggle magnetic field $\Rightarrow$ wiggle electric field

$\Rightarrow$wiggle magnetic field $\Rightarrow$ ***Electromagnetic radiation***

Simplest configuration North, South poles ***Dipole***

"lines of force" connecting poles

Magnetic axis must be tilted

If aligned, system is too symmetric to "wiggle"

Magnet, filings