Wednesday, February 29, 2012

Happy Leap Day!

Exam 2 Wednesday. Key posted.

Reading: Chapters 7, 8

Astronomy in the news?

News:

Goal:

To understand the nature and importance of SN 1987A for our understanding of massive star evolution and iron core collapse.

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

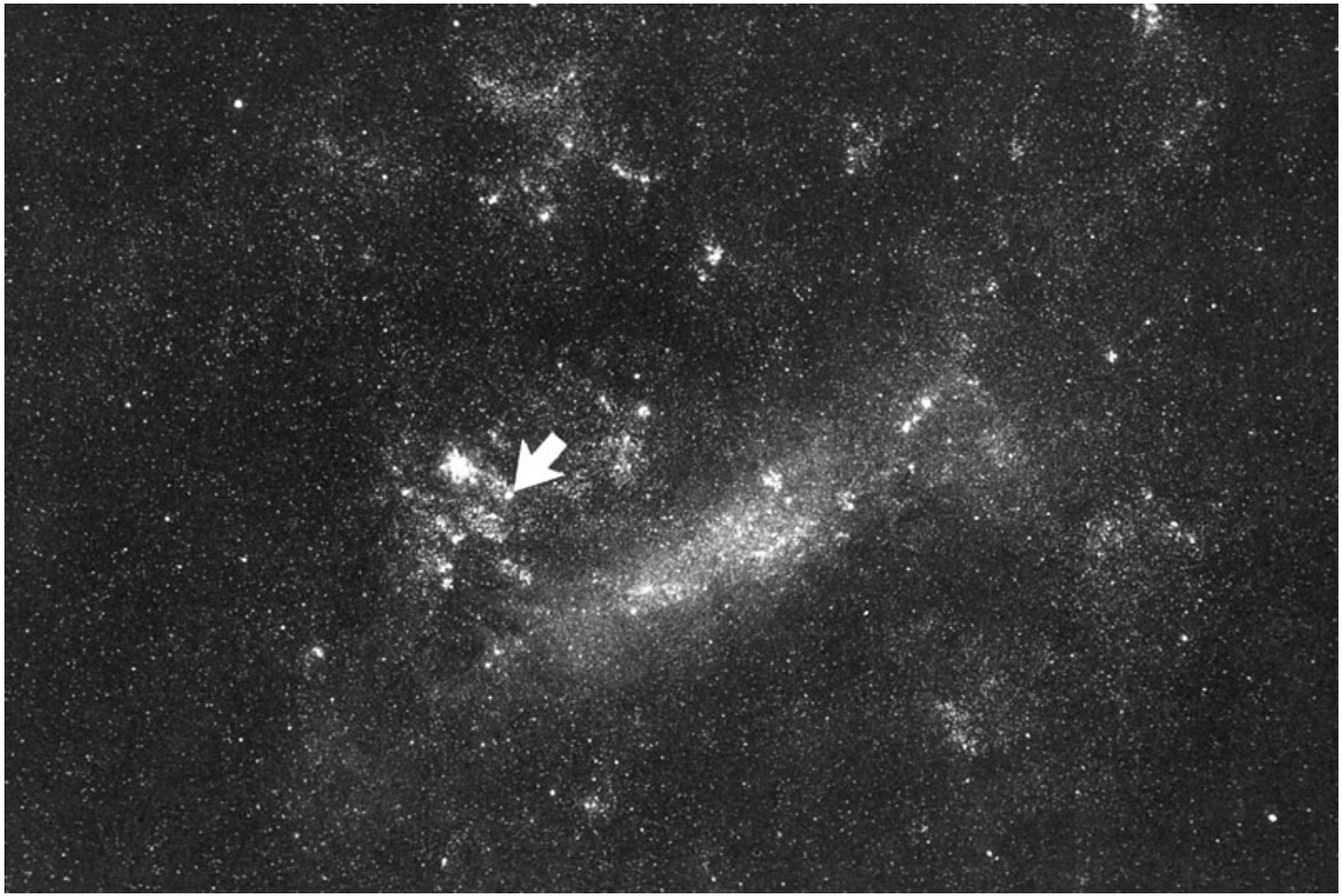
Near maximum light

5-20-87

About when I saw it

8-23-87

LMC w/arrow



One Minute Exam

When SN 1987A exploded, where would have been a good place to have seen it with your naked eye?

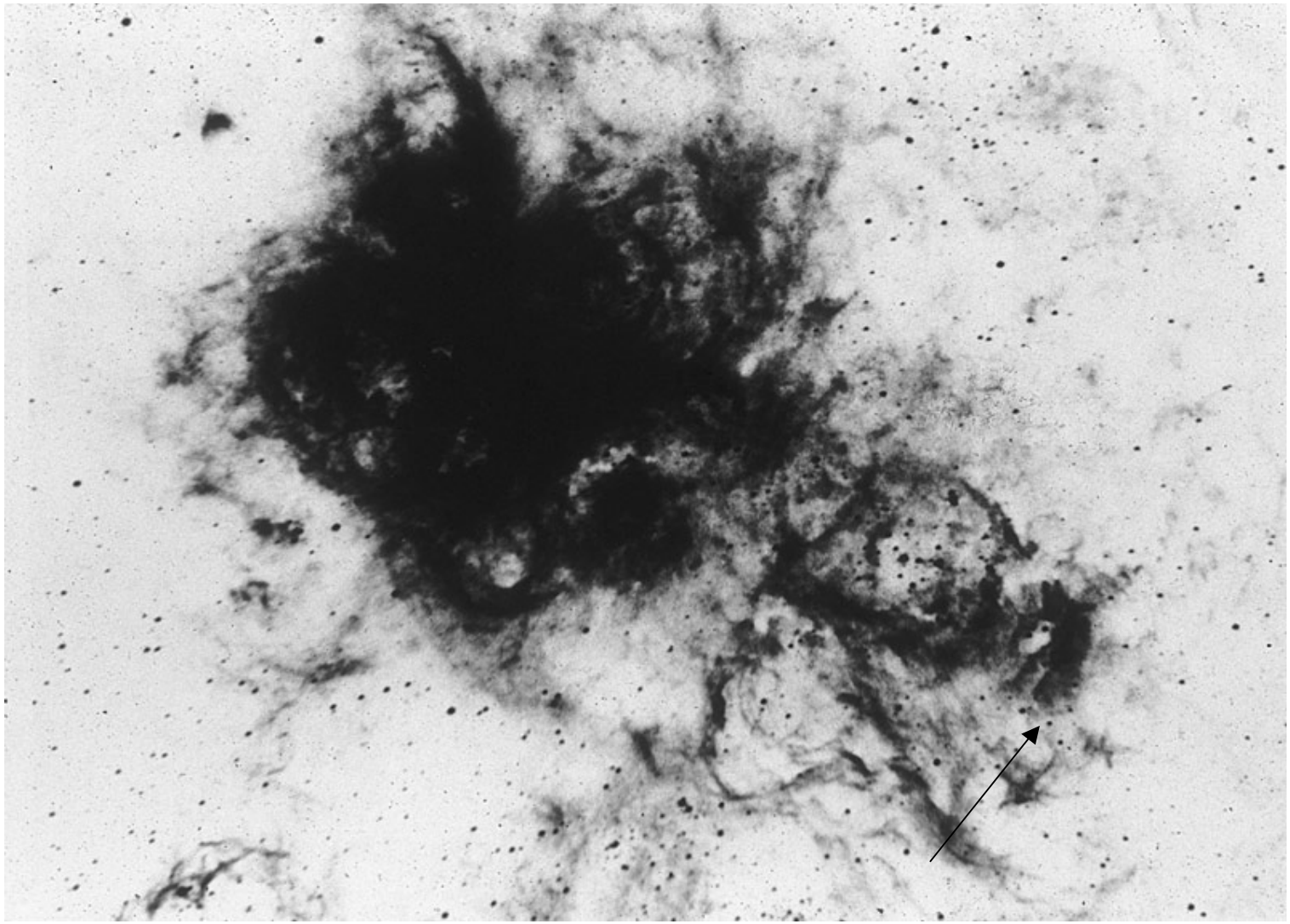
 Texas

 Japan

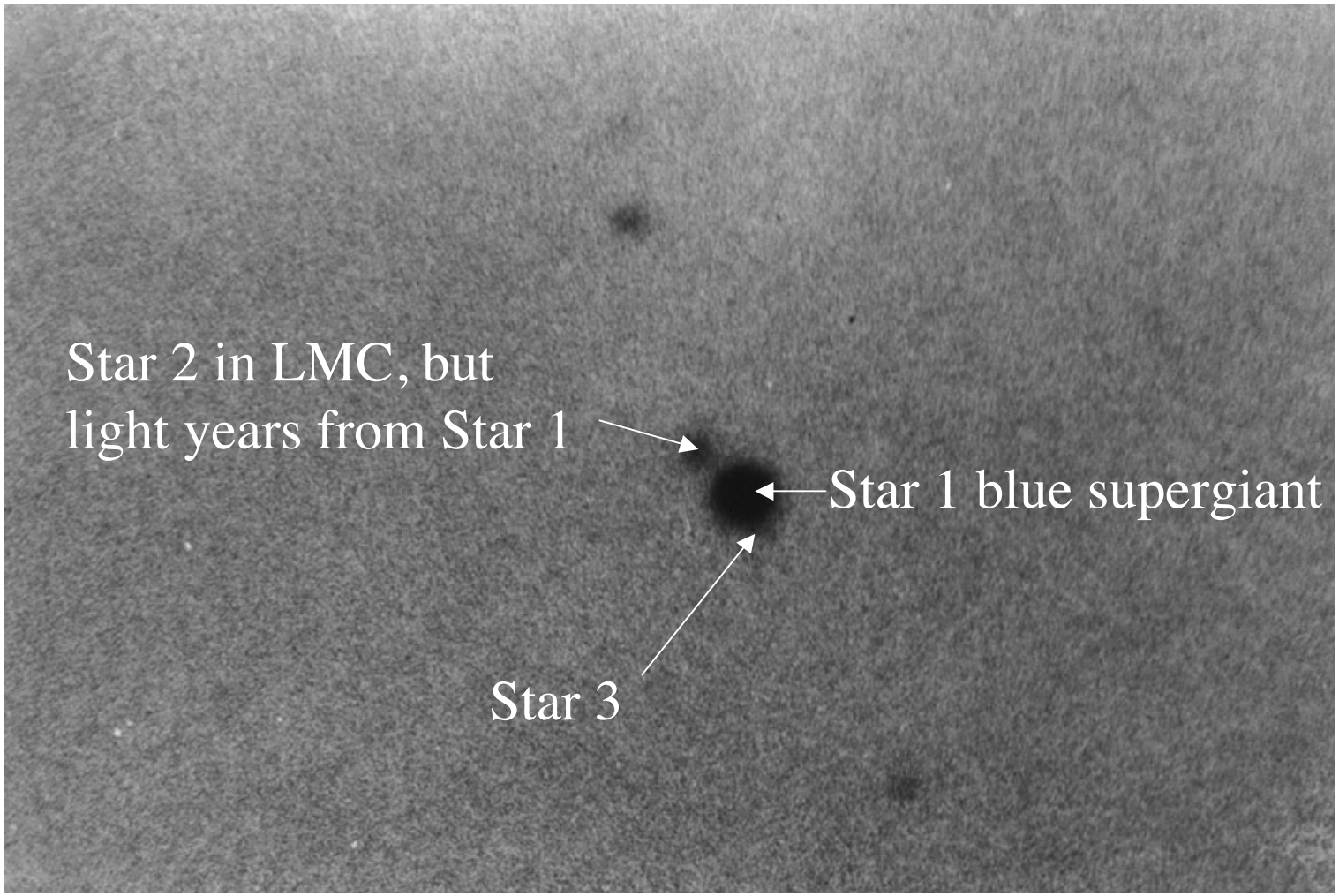
 Russia

 Argentina

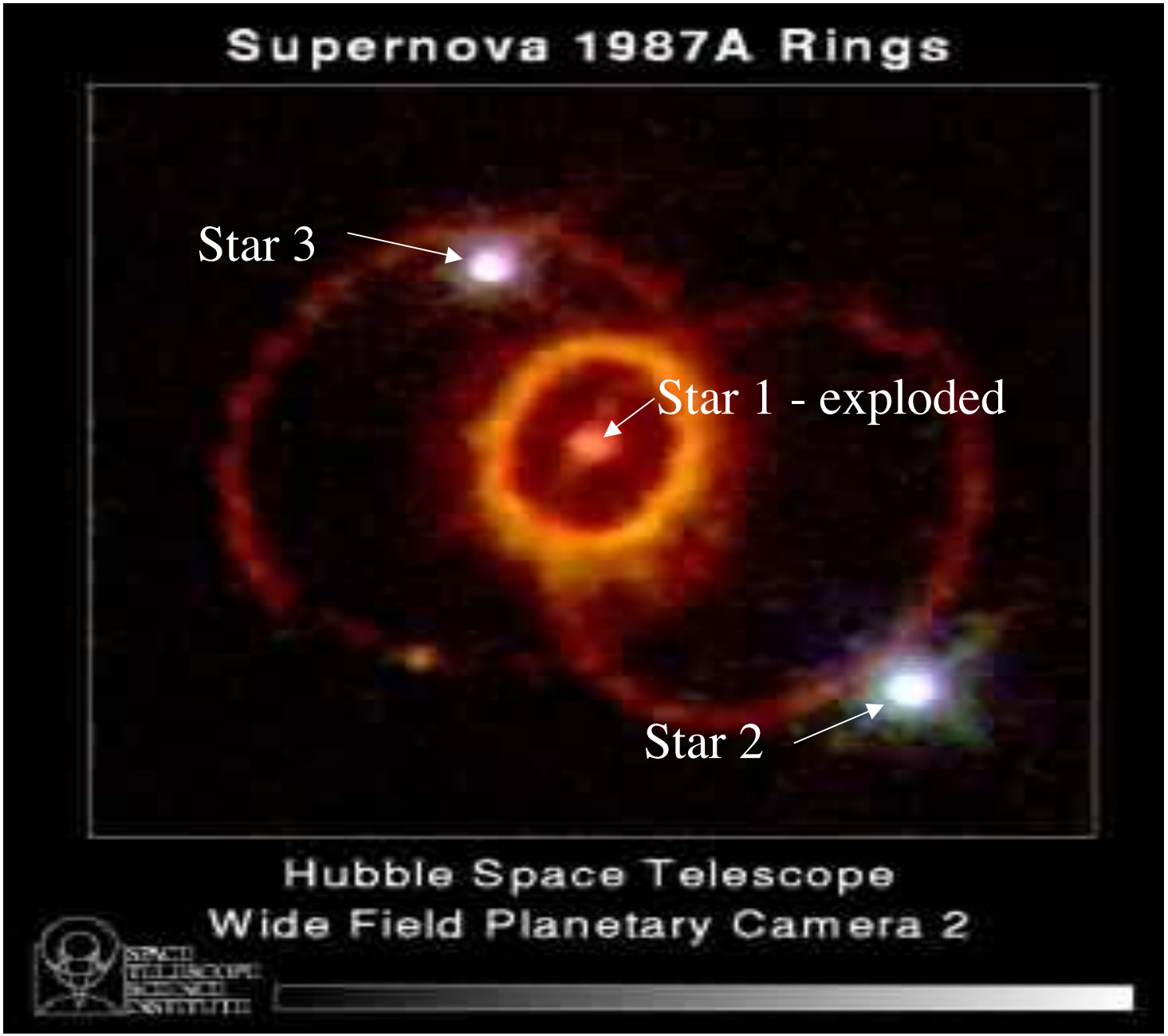
Photo of progenitor star (giraffe): Courtesy Yu Hua Chu

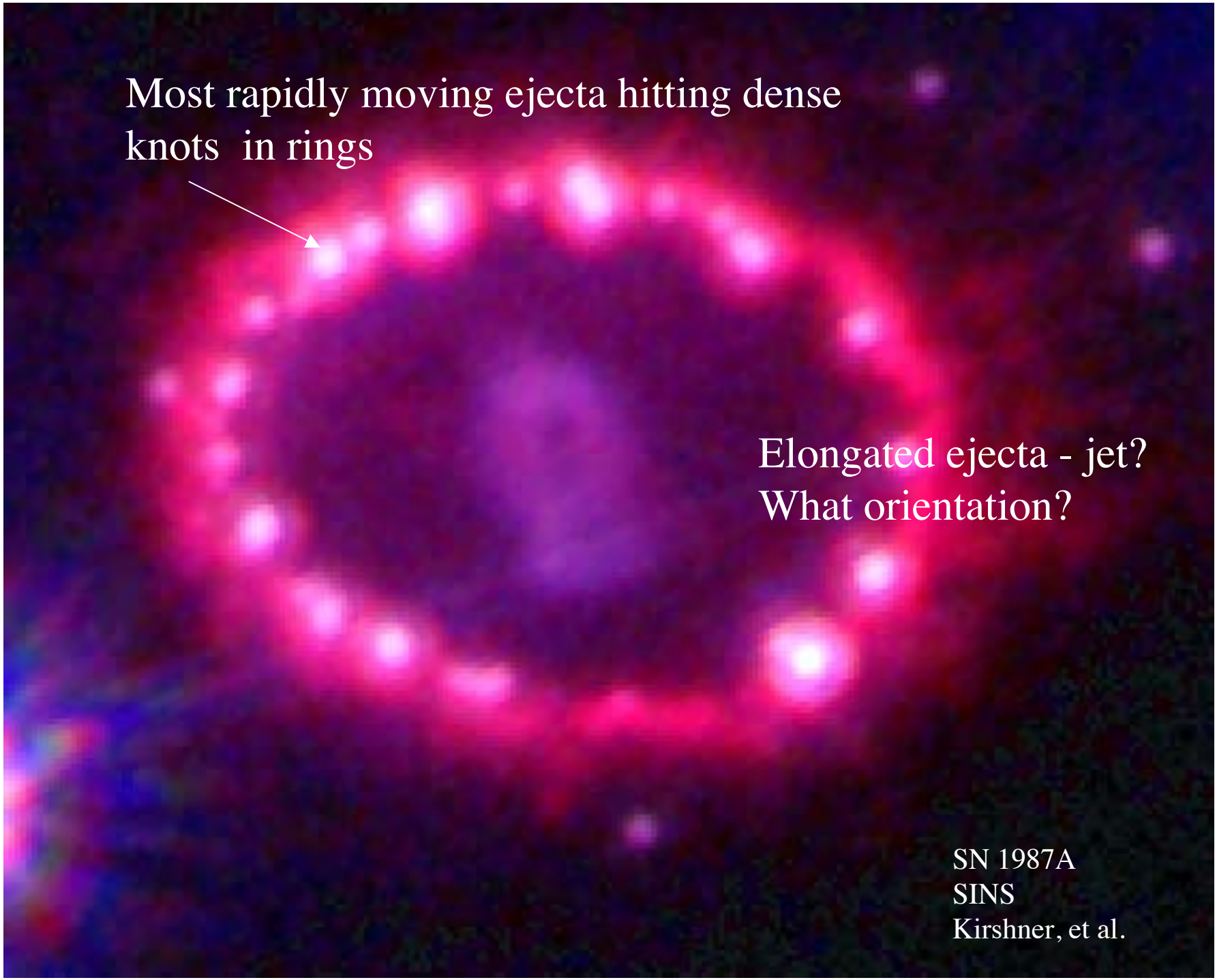


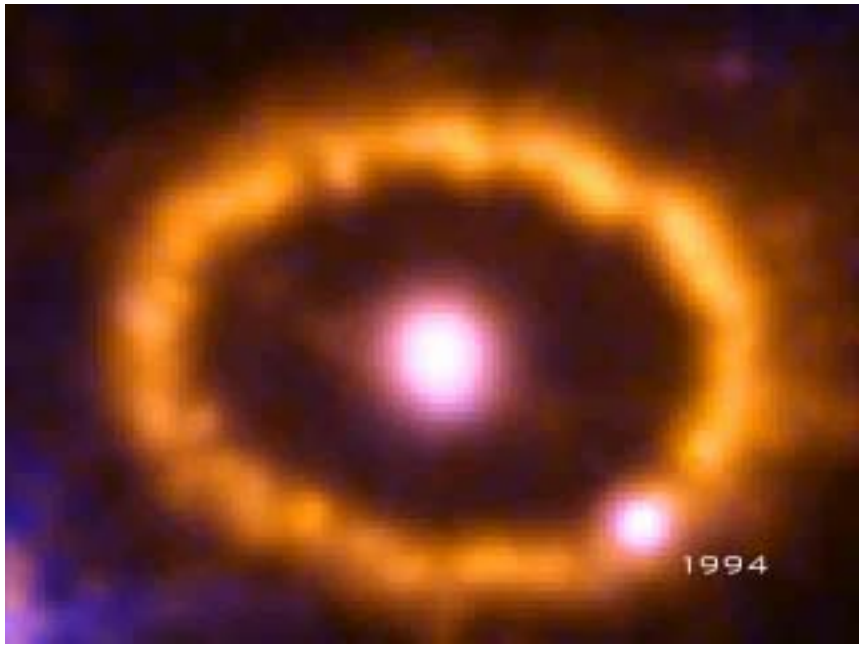
Stars 1, 2, 3: Courtesy Yu Hua Chu



Close-up

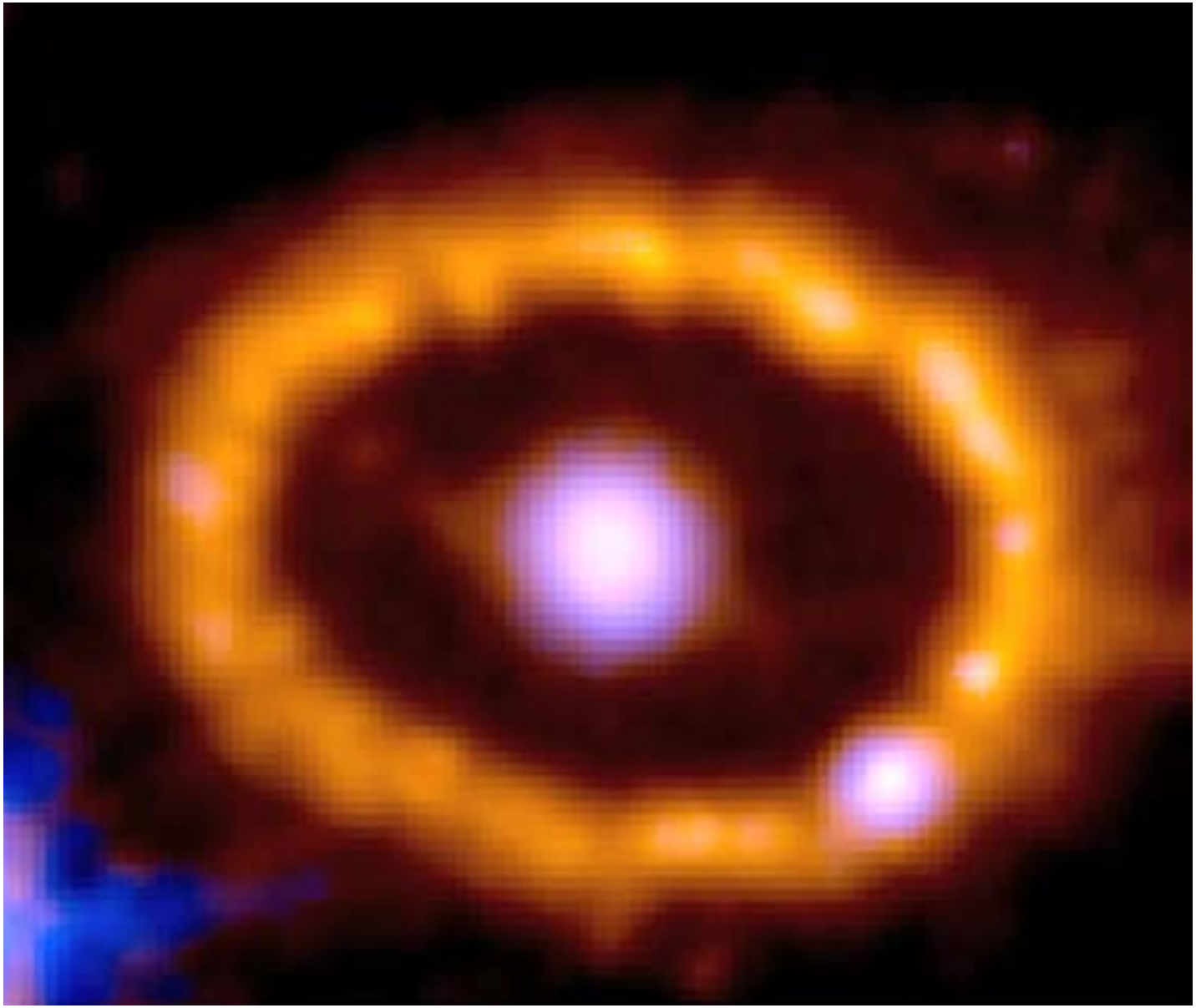

Supernova 1987A Rings
Star 3
Star 1 - exploded
Star 2
Hubble Space Telescope
Wide Field Planetary Camera 2


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


1994


Optical

Updated to 2010



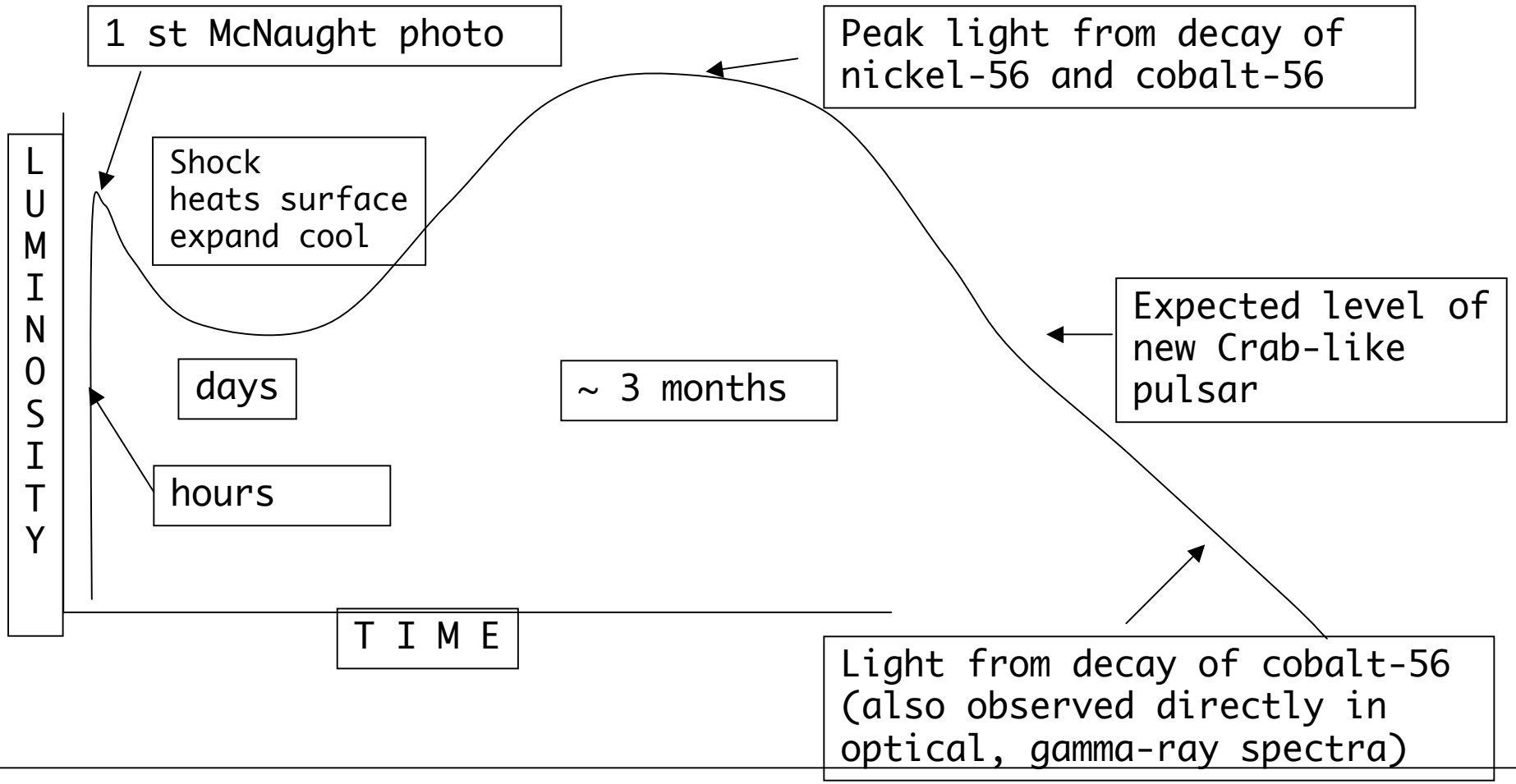
The single most important thing about SN 1987A is that we detected the neutrinos!

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.

170,000 year history!



SN 1987A had a rather peculiar light curve because it was a relatively compact blue supergiant, not a red supergiant (not sure why, maybe in binary system), brief shock heating, rapid cooling by expansion, no plateau, subsequent light all from radioactive decay.

One Minute Exam

What was the most important thing about SN 1987A in terms of the basic physics of core collapse?

 It exploded in a blue, not a red supergiant

 It was surrounded by a ring

 It produced radioactive nickel and cobalt

 Neutrinos were detected from it

Saw neutrinos, neutron star must have formed and survived for at least 10 seconds.

If a black hole had formed in the first instants, neither light nor neutrinos could have been emitted.

No sign of neutron star since despite looking hard for 25 years.

Whatever is in the center of Cas A, most likely a neutron star, is too dim to be seen at the distance of the LMC, so SN 1987A might have made one of those.

Also possible that after explosion and formation of neutron star, some matter fell back in and crushed the neutron star to become a black hole.

Dim neutron star or black hole? Still do not know.