Friday, March 13, 2015

Reading for Exam 3 (two weeks from today)

Chapter 6, end of Section 6 (binary evolution), Section 6.7 (radioactive decay), Chapter 7 (SN 1987A)

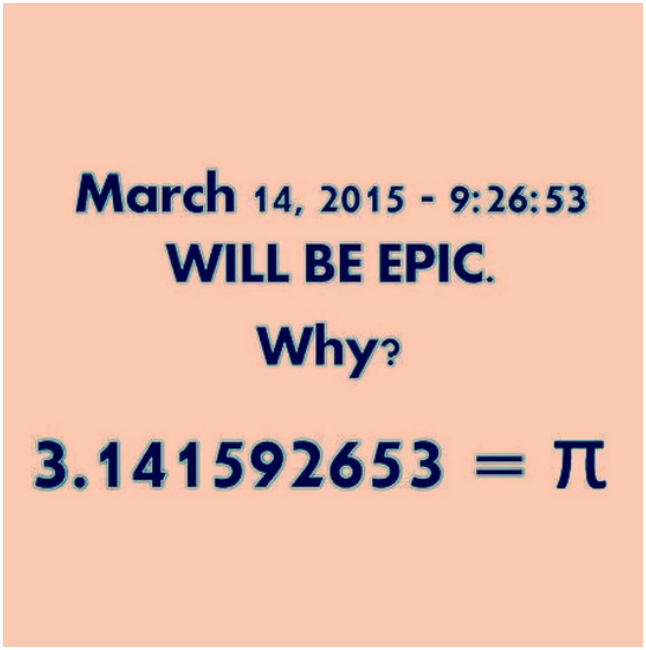
Background in Chapters 3, 4, 5.

Background: Sections 3.1, 3.2, 3.3, 3.4, 3.5, 3.8, 3.10, 4.1, 4.2, 4.3, 4.4, 5.2, 5.4 (binary stars and accretion disks).

Astronomy in the news?

Epic π-day, 2015, at 9:26:53, π to 10 significant figures!

Also Happy 136th birthday to Albert Einstein



Goal:

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

Large Magellanic Cloud, closeup (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

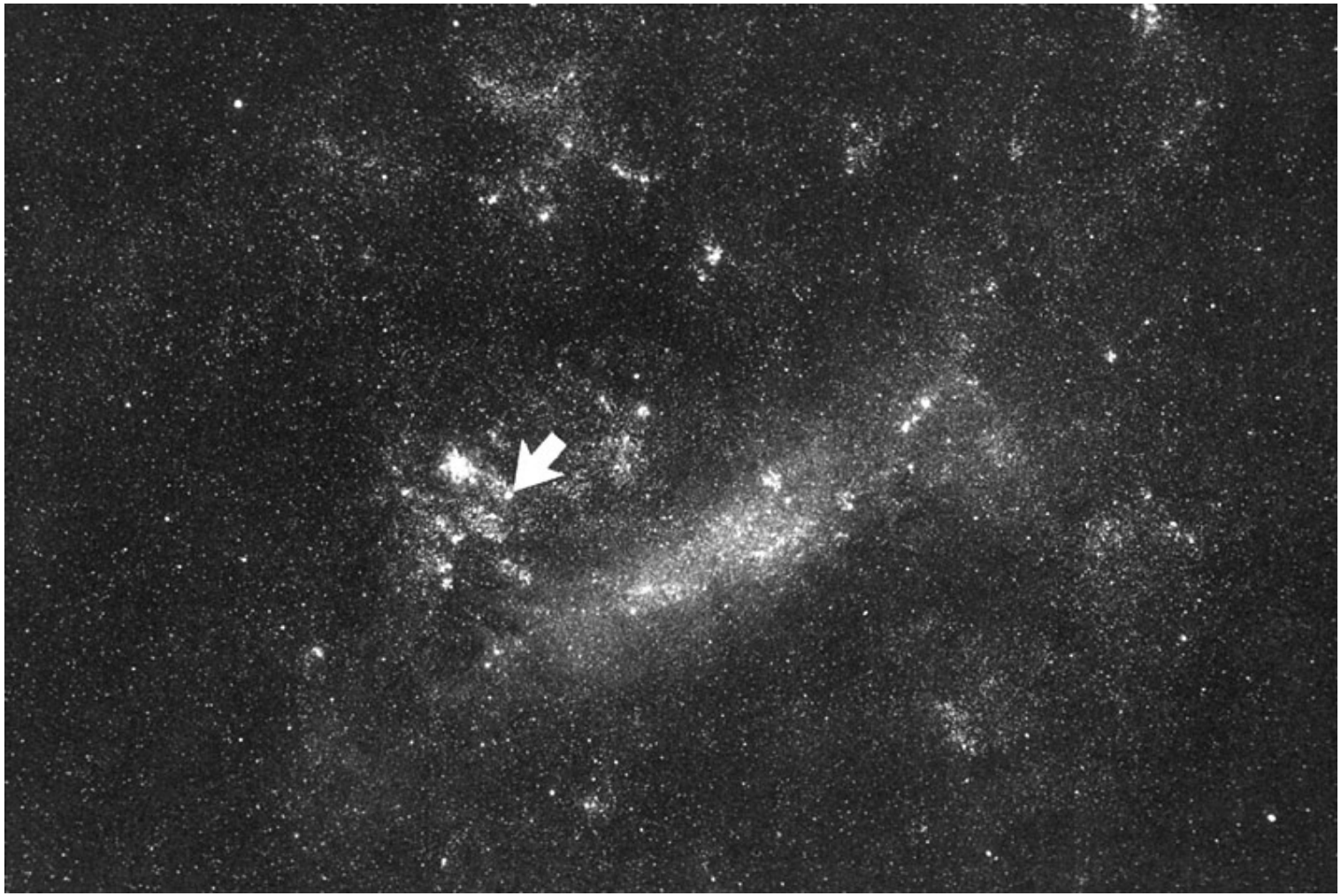
Near maximum light

5-20-87

About when I saw it

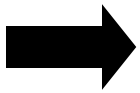
8-23-87

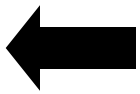
LMC w/arrow

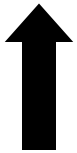


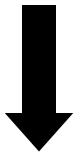
One Minute Exam

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

 Texas

 Japan

 Russia

 South Africa

LMC negative

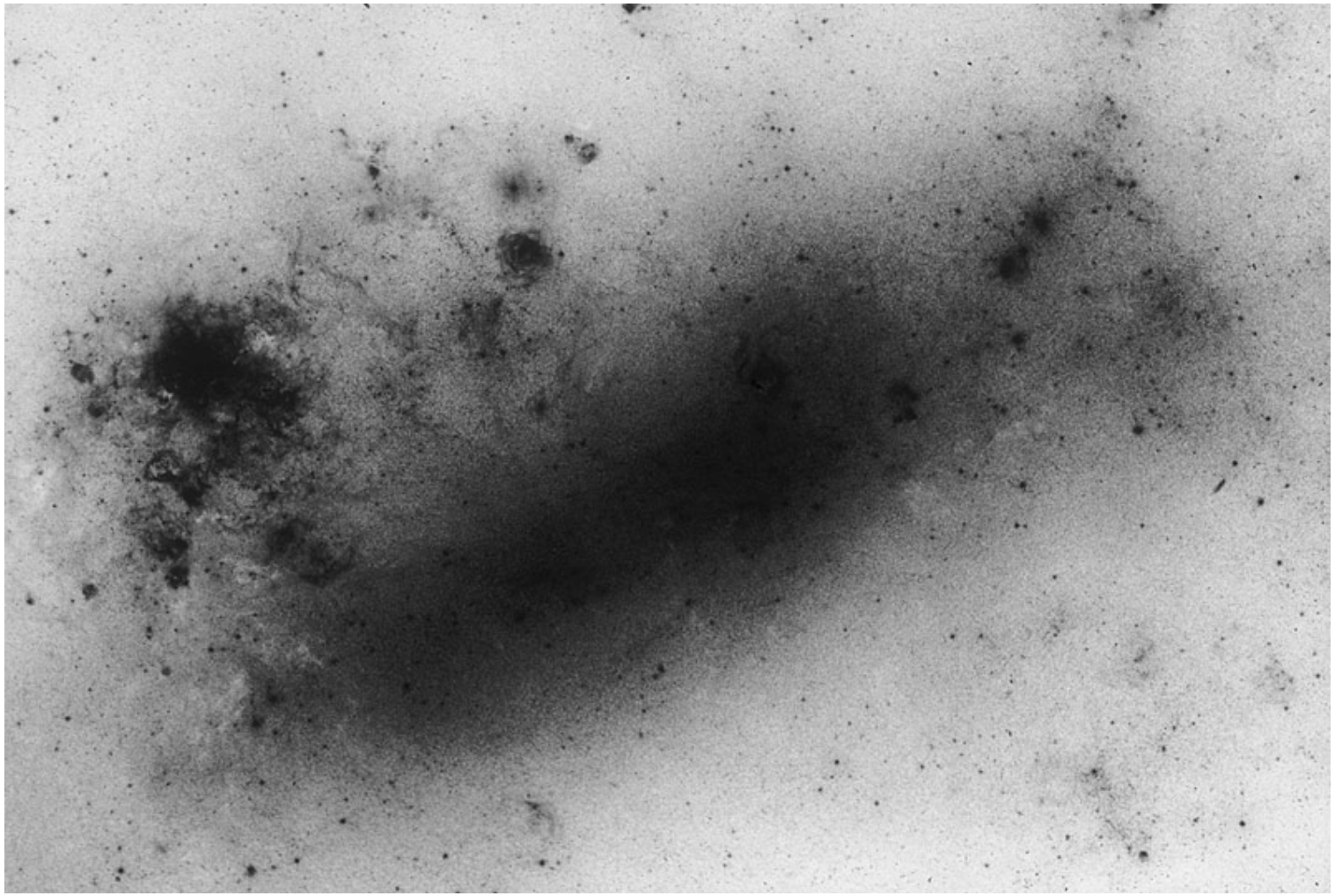
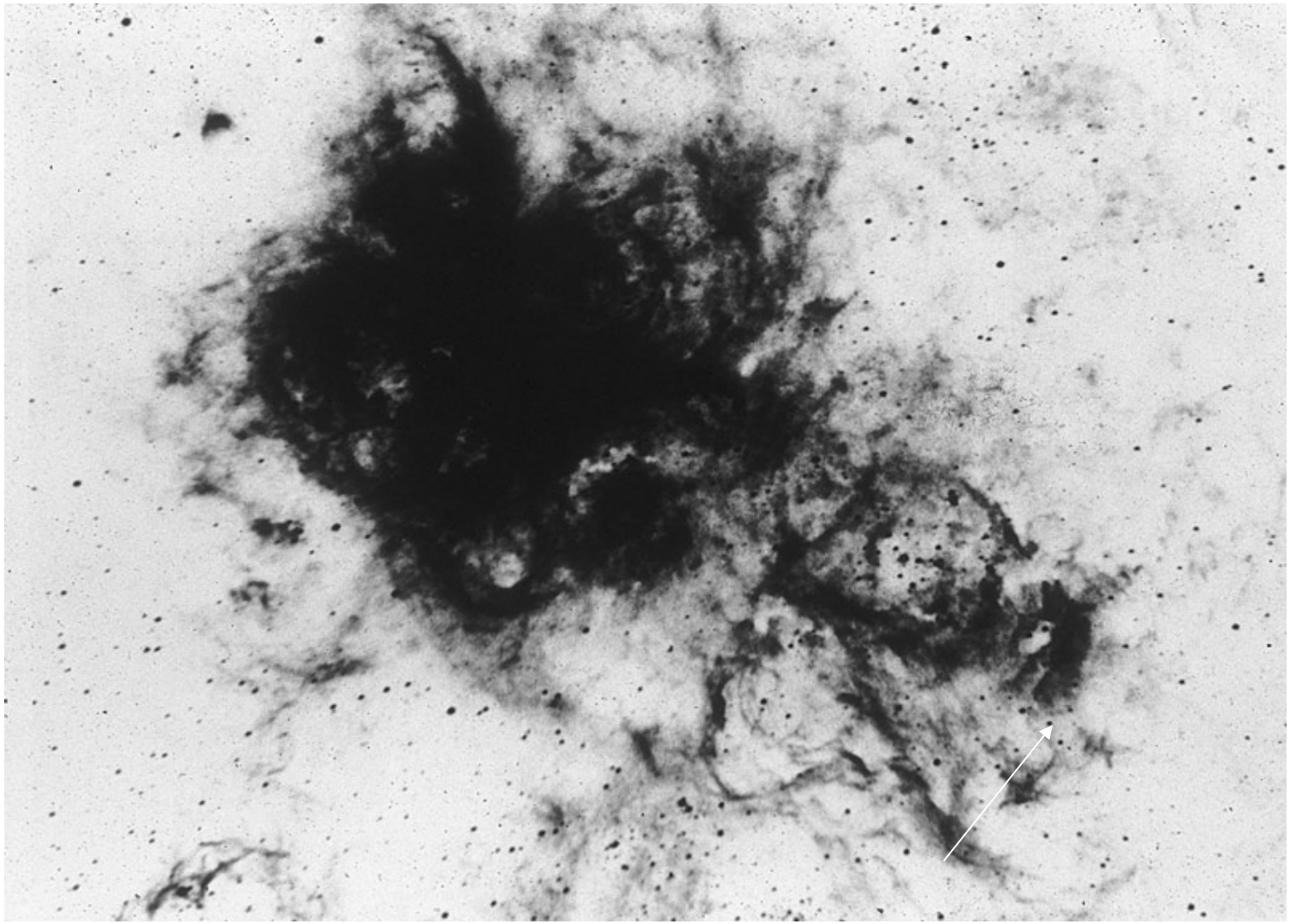
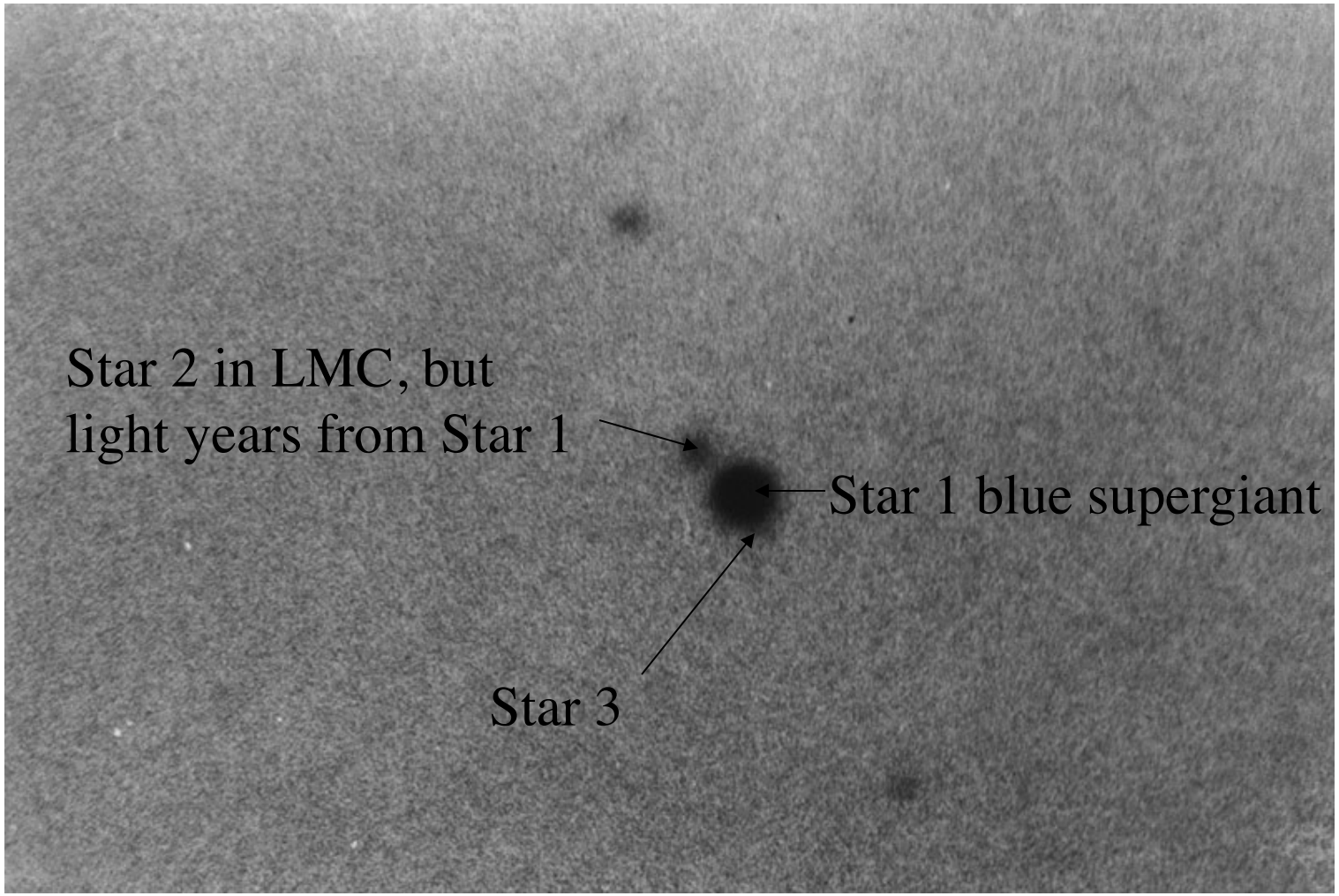


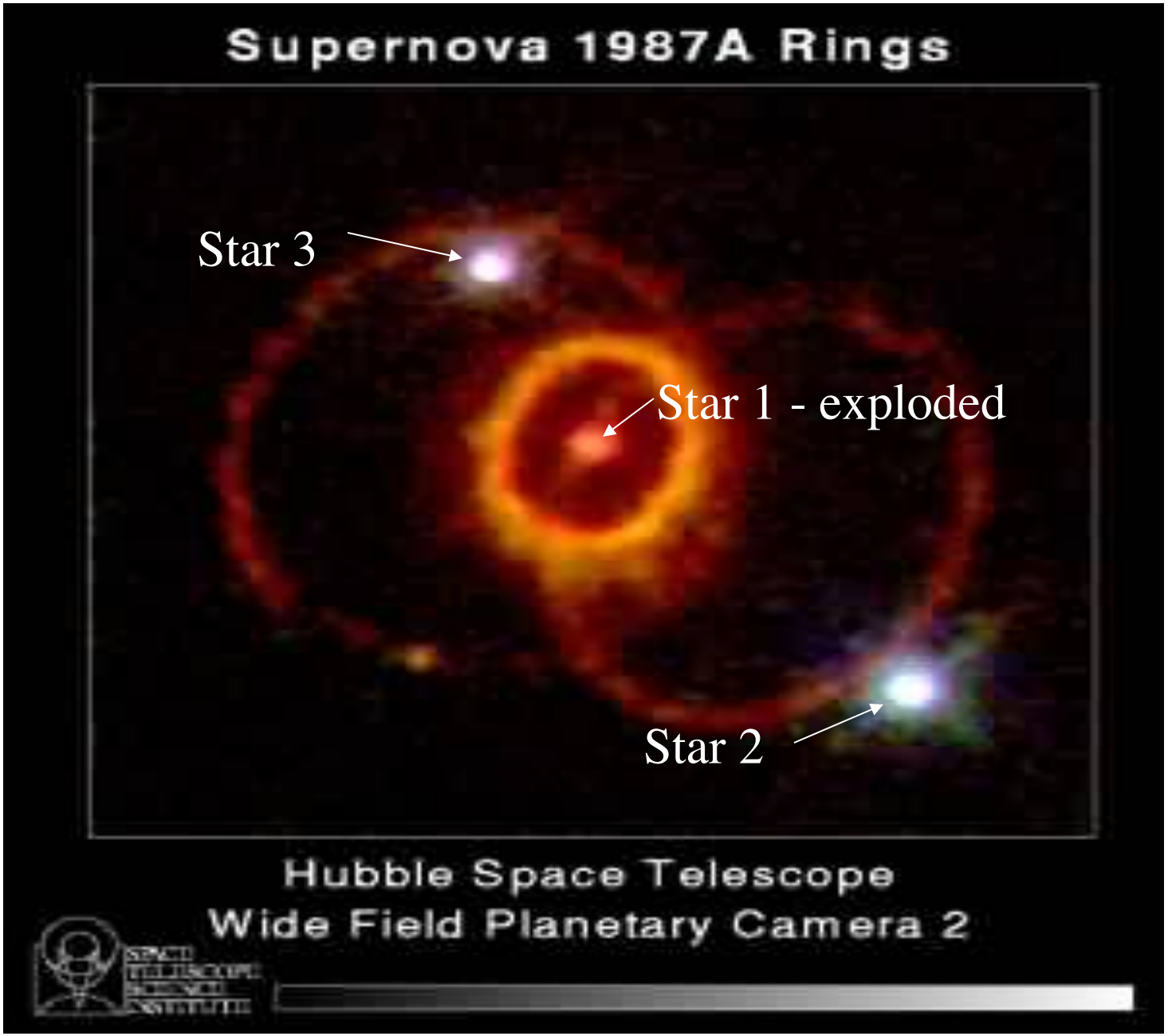
Photo of progenitor star (giraffe): Courtesy Yu Hua Chu

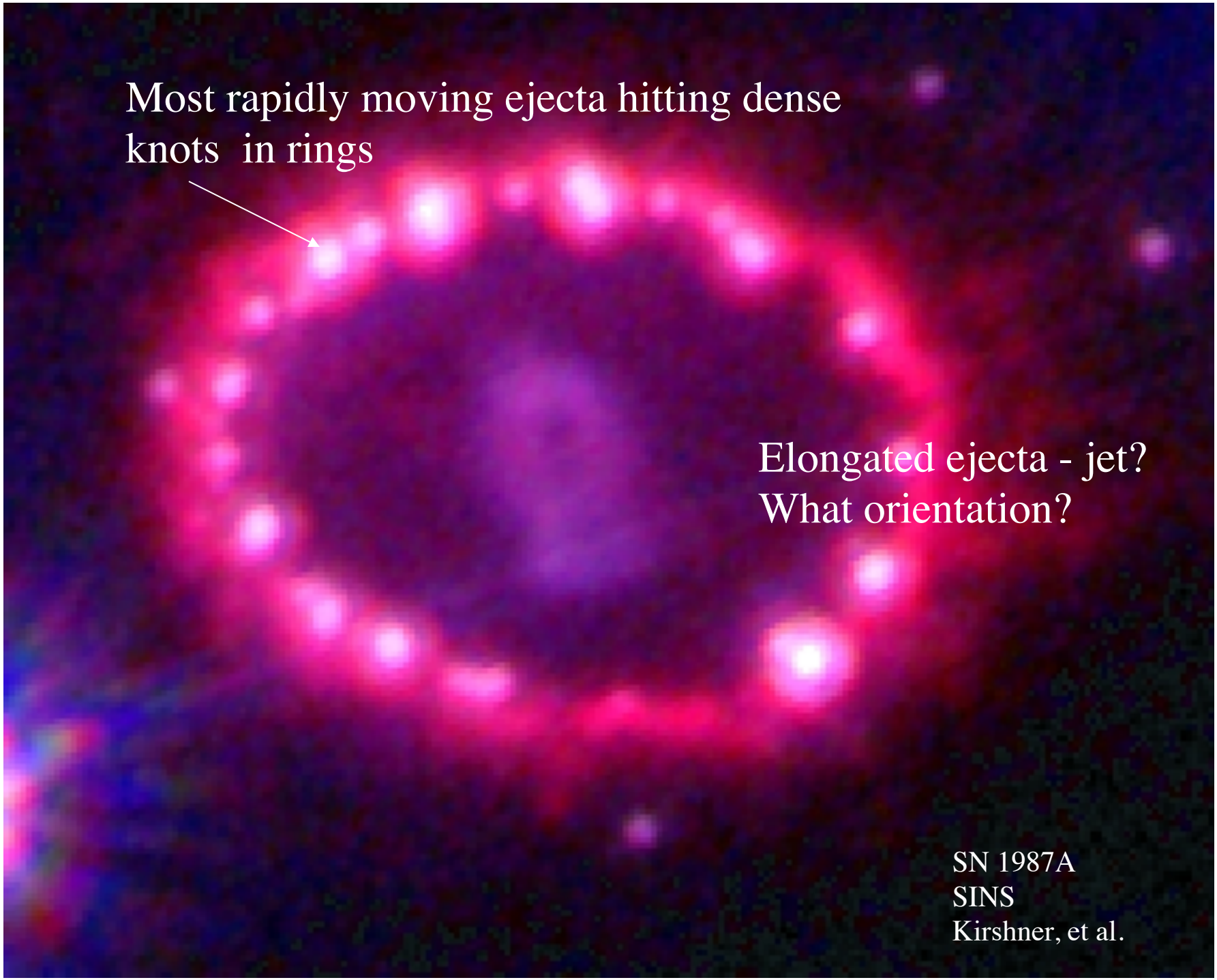


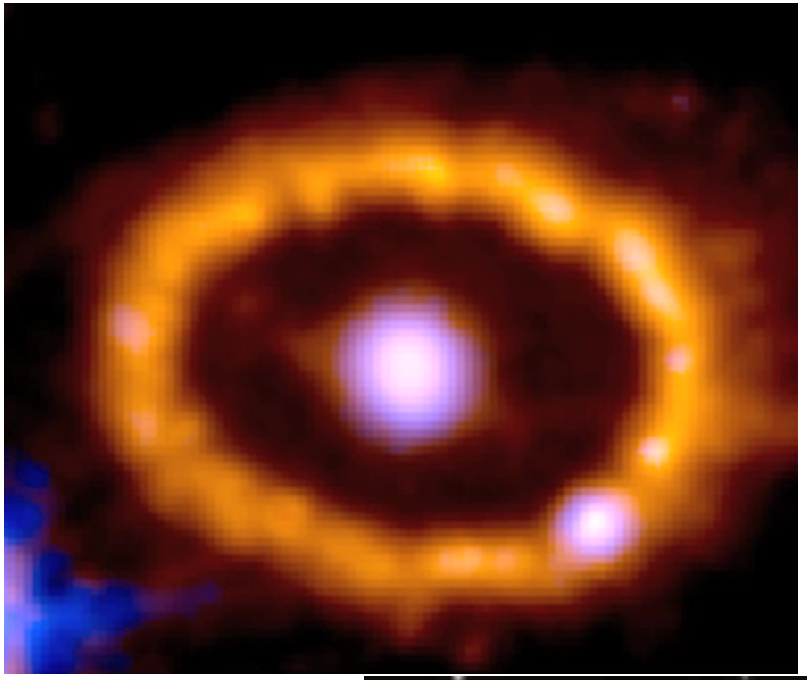
Stars 1, 2, 3: Courtesy Yu Hua Chu



Close-up

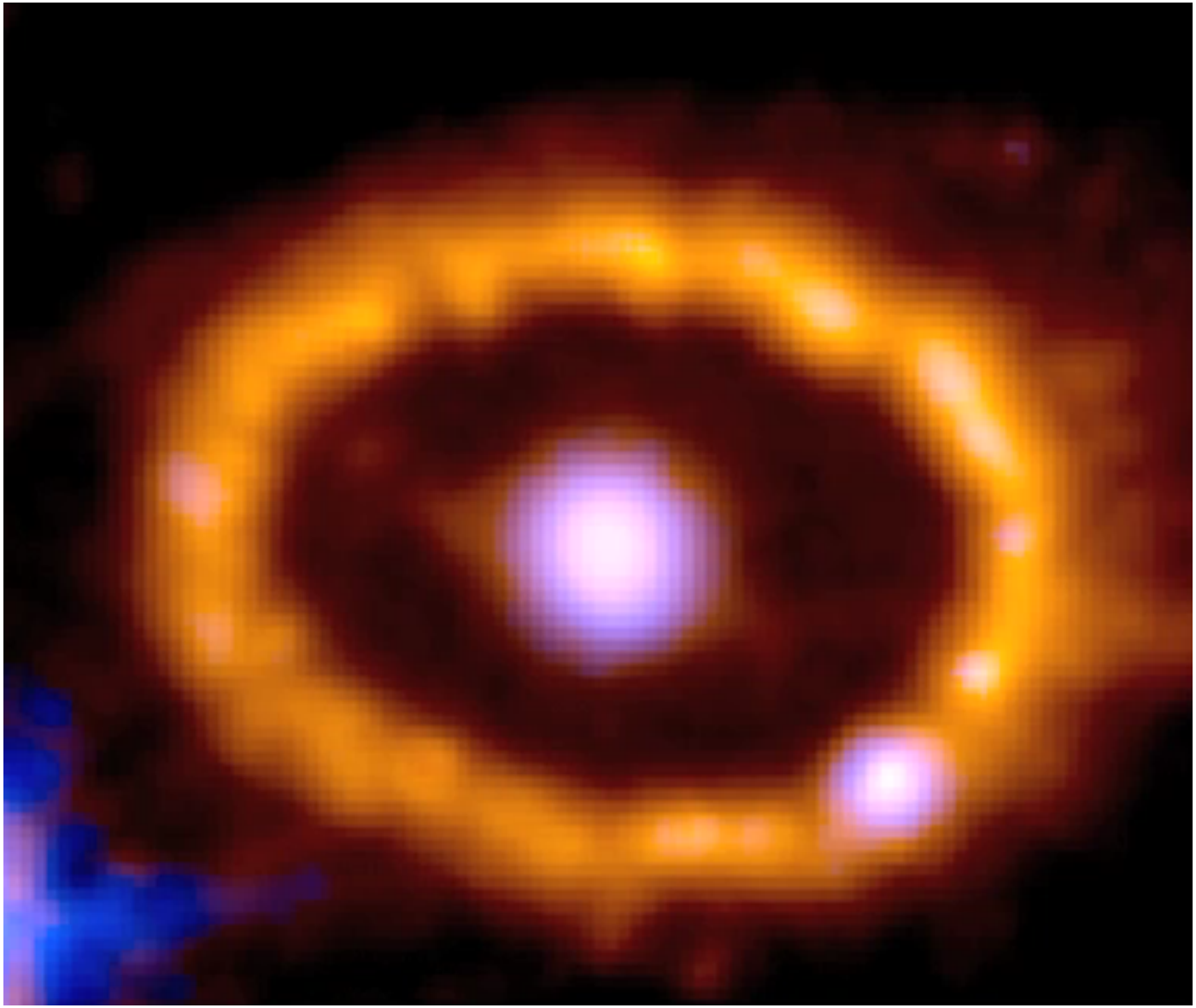

Supernova 1987A Rings
Star 3
Star 1 - exploded
Star 2
Hubble Space Telescope
Wide Field Planetary Camera 2


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




Optical

Updated to 2010



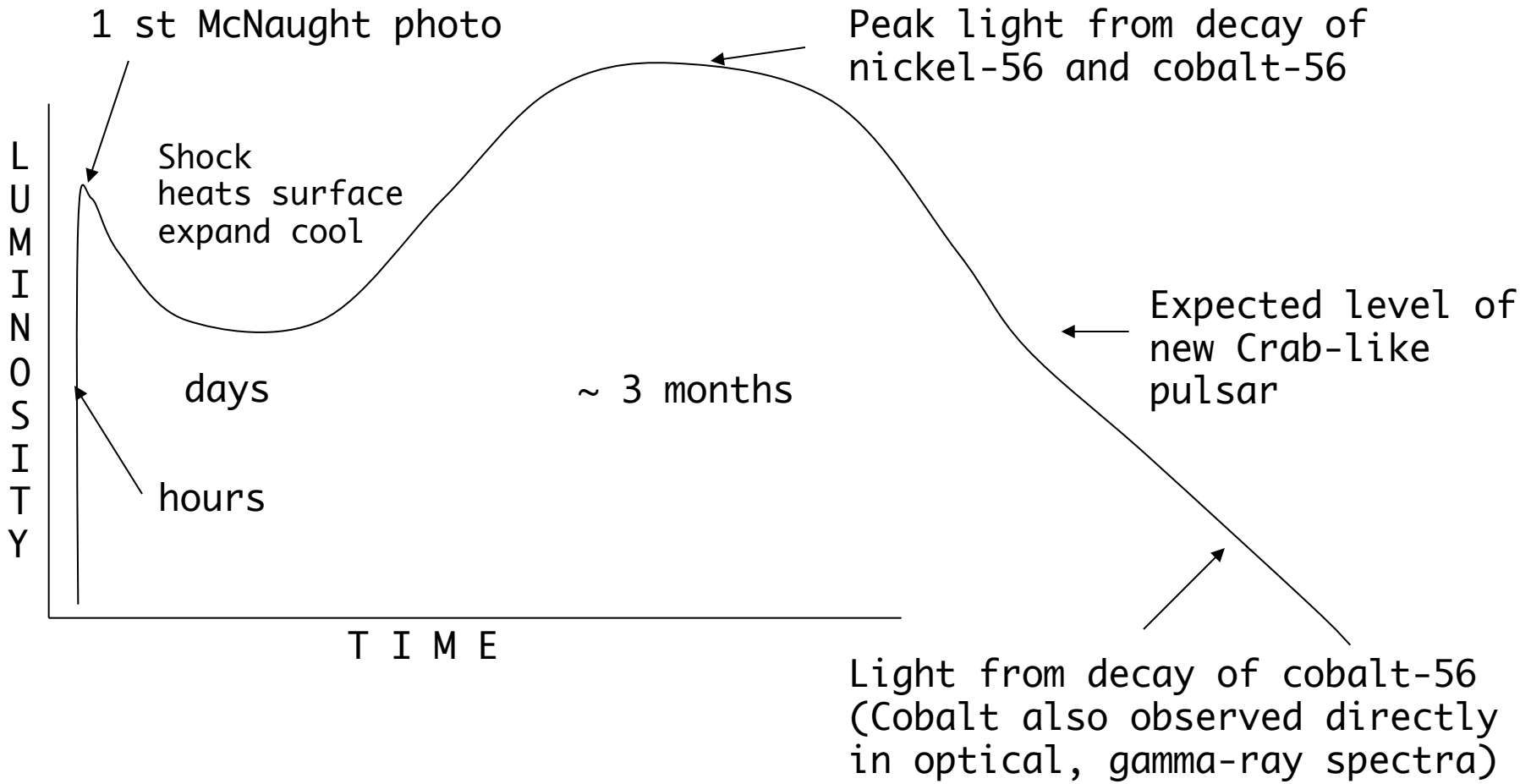
The single most important thing about SN 1987A is that we detected the neutrinos!

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.

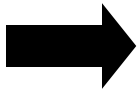
170,000 year history of humanity!

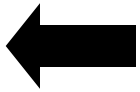


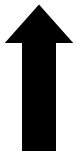
SN 1987A had a rather peculiar light curve because it was a relatively compact blue supergiant, not a red supergiant (not sure why, maybe in binary system), brief shock heating, rapid cooling by expansion, no plateau, subsequent light all from radioactive decay.

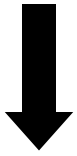
One Minute Exam

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