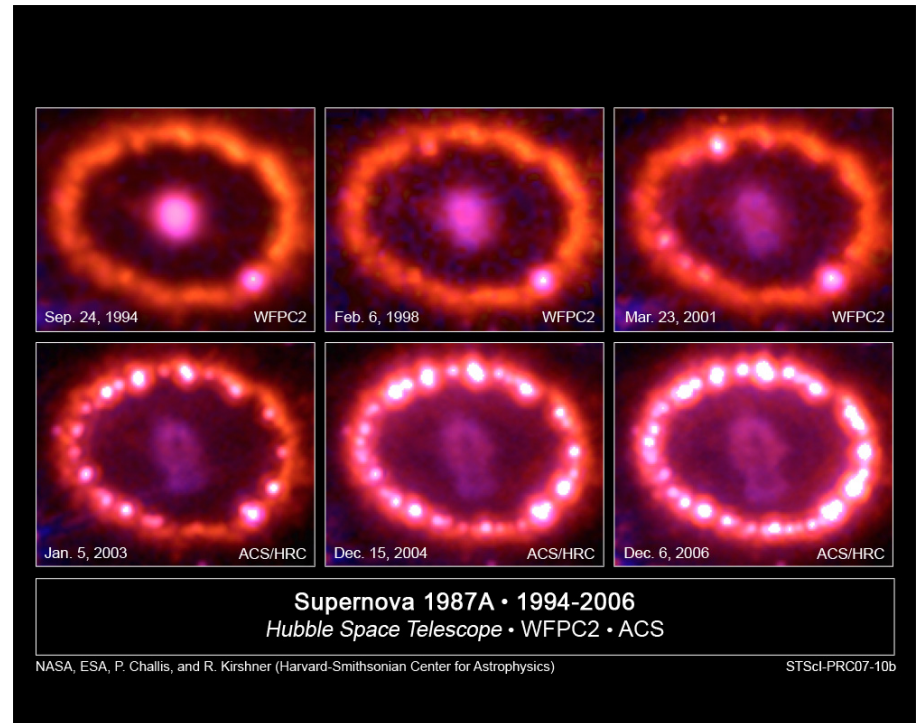


Introductory Astronomy

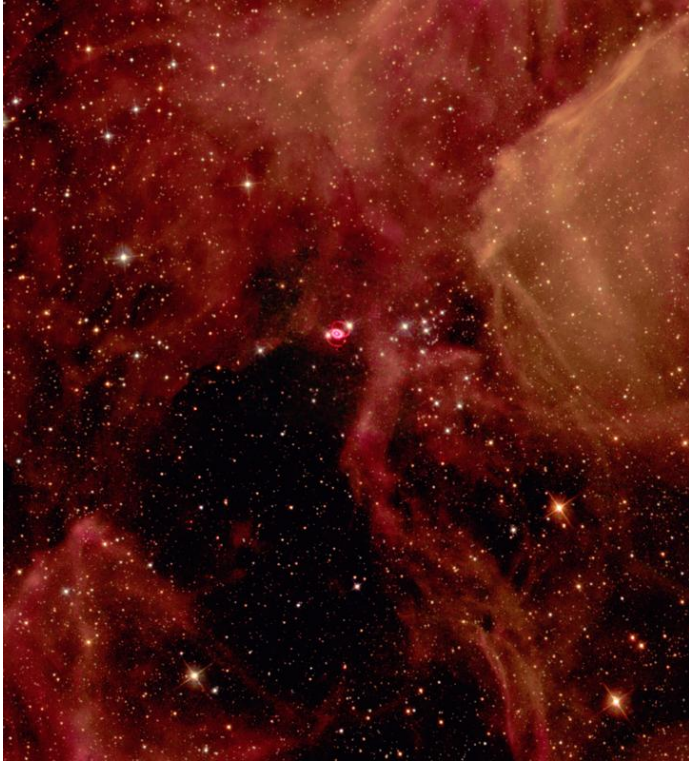
Week 5: Stellar Evolution

Clip 14: SN 1987A

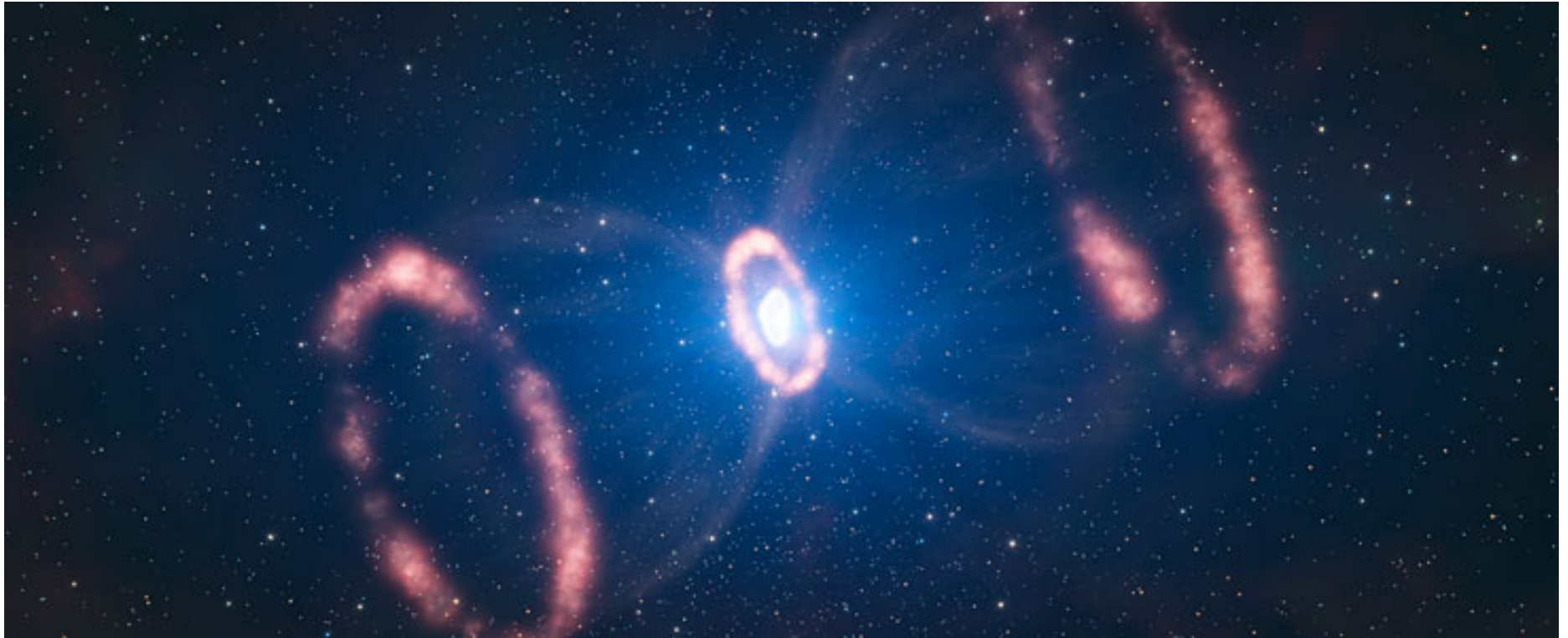
- 168,000 years ago a B3 I supergiant collapsed in LMC
- Observed as SN 1987A
- Progenitor known – changed theory
- Remnants observed in detail



The Nebula

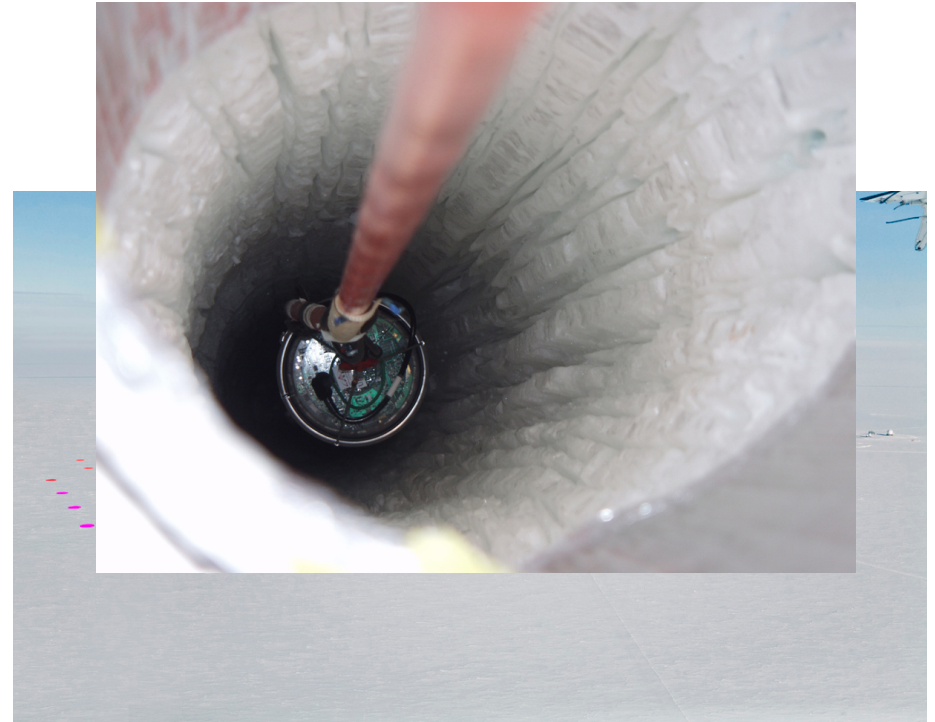


What we are Seeing



Neutrinos

- Three hours **before** the supernova detected, **neutrino detectors** observed a **burst** (20) of neutrinos from the right direction.
- 20 detected implies 10^{58} emitted carrying 10^{46} J in agreement with **models**
- **Neutrinos** get out before shock wave disperses outer layers, so got here **before the light**
- **Neutrino Astronomy** launched, many new experiments planned



Credits

- SN 1987A: NASA, ESA, P. Challis and R. Kirshner (Harvard-Smithsonian Center for Astrophysics)
<http://hubblesite.org/newscenter/archive/releases/2007/10/image/b/>;
The Hubble Heritage Team (AURA/STScI/NASA)
<http://hubblesite.org/gallery/album/pr1999004a/>
Dr. Christopher Burrows, ESA/STScI and NASA
<http://hubblesite.org/gallery/album/pr1995049a/>
- SN 1987A: ESO/L. Calçada <http://www.eso.org/public/images/eso1032a/>
- IceCube Detector: Haley Buffman/NSF & Jamie Yang/NSF
<http://icecube.wisc.edu/gallery/view/140>
IceCube Collaboration/NSF <http://icecube.wisc.edu/gallery/view/170>