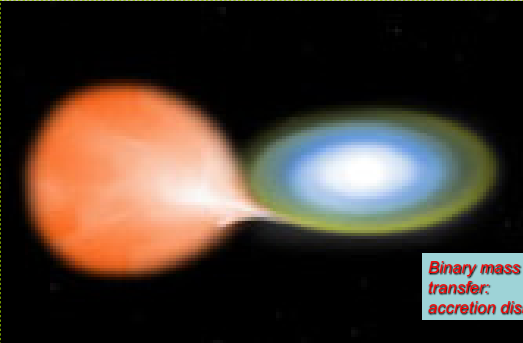


**ASTR 1040: Stars & Galaxies**



Binary mass transfer: accretion disk


Prof. Juri Toomre TAs: Ryan Horton, Loran Matilsky  
Lecture 18 Thur 25 Oct 2018  
zeus.colorado.edu/astr1040-toomre

**Today and Tues**

- Famous supernovae: **SN1987A + earlier**
- Black holes**, their general properties, and their “**care and feeding**” – and **Mr. Einstein’s work** S.2 (special relativity), S.3 (general relativity)
- Overview read **Chap 19: ‘Our Galaxy’**
- New **HW # 9** (involves supernova energies + MA review), **HW #8** due today
- Second Mid-Term Exam** in class today

**White dwarf SN as distance estimators**

- “**Standard explosion**” = fusion of 1.4 solar masses of material
- Nearly the same amount of energy released

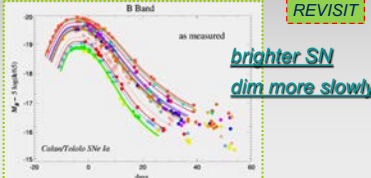


**Clicker: What happens in a “white dwarf supernova” ?**

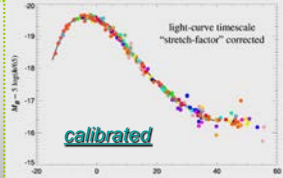
- A.** Carbon fuses throughout the white dwarf
- B.** Hydrogen fuses on the surface of the white dwarf
- C.** The white dwarf collapse into a neutron star
- D.** Helium fuses throughout the white dwarf

**White dwarf supernovae**

- Carbon fusion explosion:** mass transfer in binary takes white dwarf ‘over the edge’
- Roughly same amount of energy released (calibrate)




brighter SN dim more slowly!



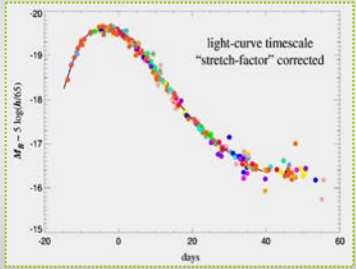
light-curve timescale “stretch-factor” corrected

calibrated

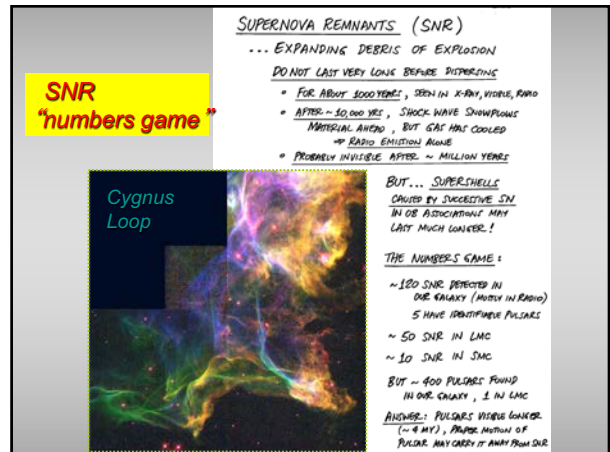
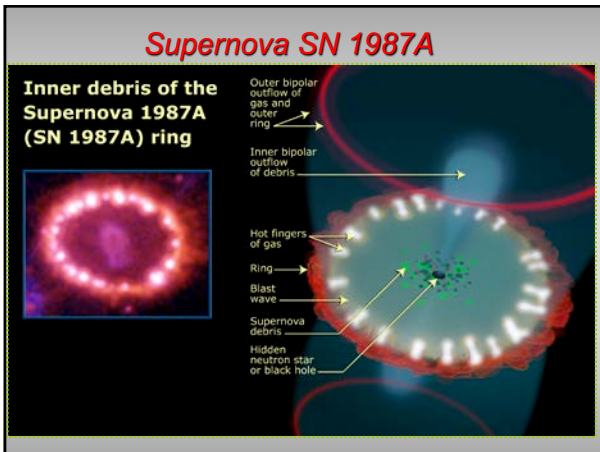
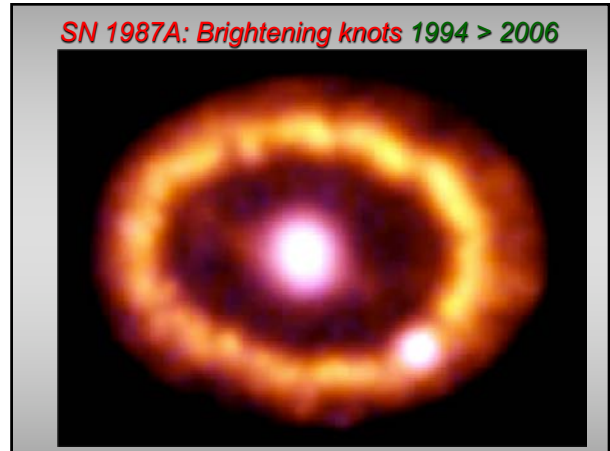
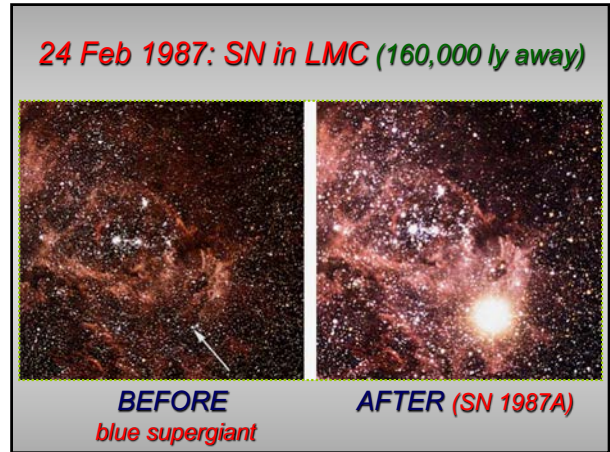
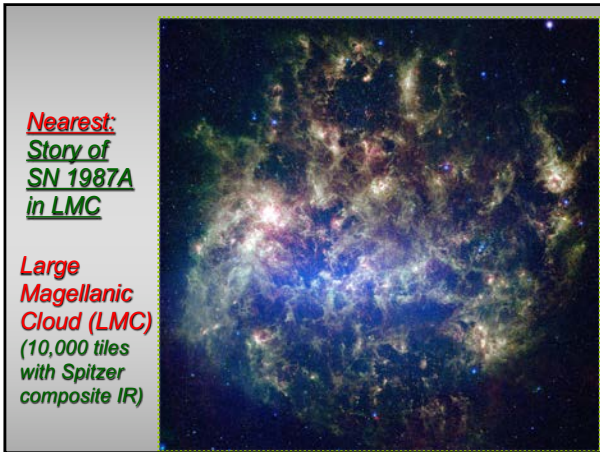


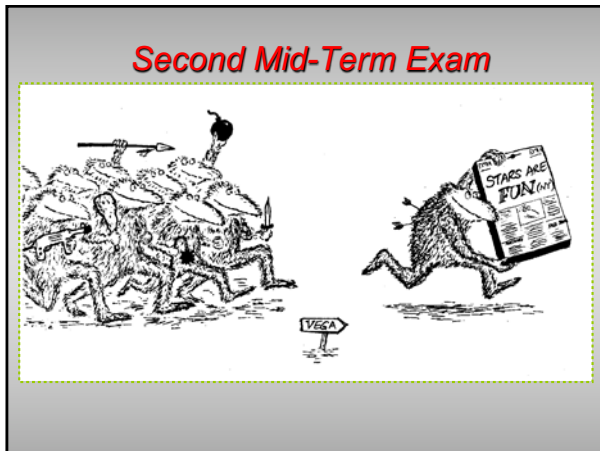
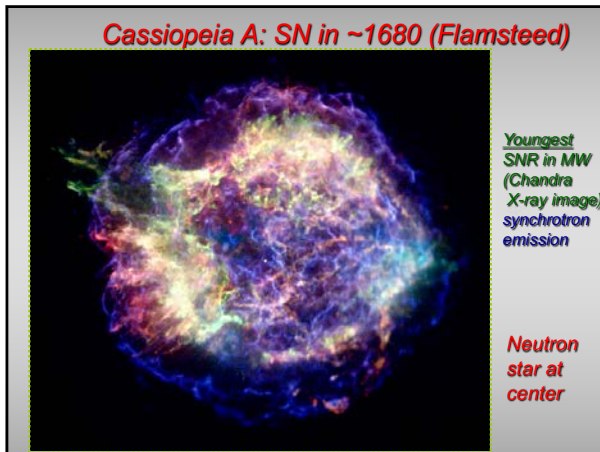
**Practical difficulty: White dwarf SN**

- Need to catch them within a day or two of the explosion
- About 1 per galaxy per century
- Need to monitor thousands of galaxies to catch a few per year → galaxy clusters are useful



light-curve timescale “stretch-factor” corrected





**Rules of the Game**

- Closed book, closed notes, can use double-sided handwritten "crib sheet"; 50 minutes
- **Print your name and student ID on top of pages 1 and 6 of exam sheets**
- **Print and encode your name and student ID on scan sheet (and nothing else)**
- Use # 2 (soft) pencil for marking your answers on scan sheet (\$ 1 buys you a pencil !)
- **Respond carefully to Essay Question 47 with full and lucid sentences (and sketch if useful)**