Introductory Astronomy

Week 5: Stellar Evolution

Clip 7: Clusters and Populations

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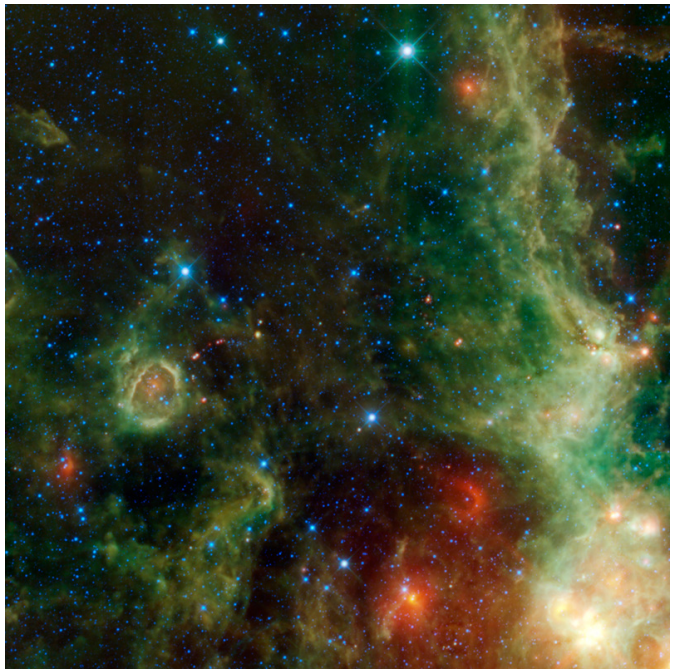
Clusters and the Model

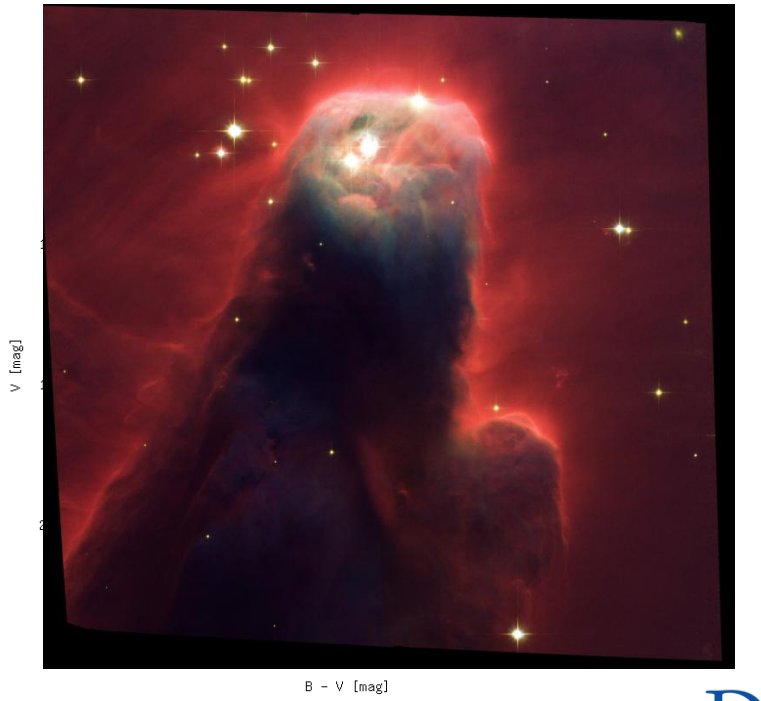
- Model predicts how clusters will evolve
- Massive stars evolve faster
- Later stages of evolution rapid
- Can find cluster age from Main-Sequence turnoff
- Main Sequence Matching leads to distance: Spectroscopic Parallax and other cluster distance measures

Does it Work?

- IC 1795 – OB Association



- NGC 2264 8My



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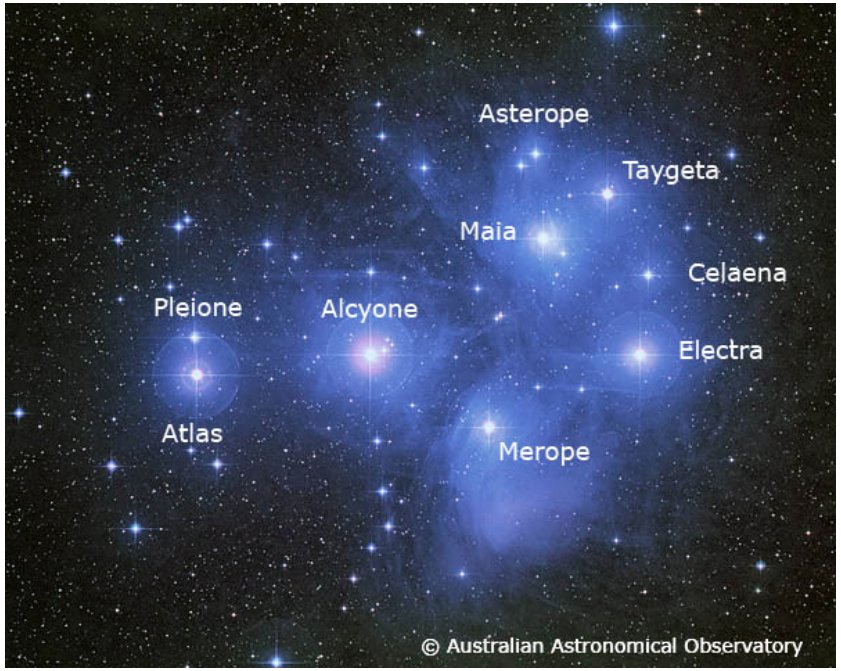
Older

- Orion Nebula Cluster 12My

- M45 130My



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And Older

- NGC6494 300My

- M44 800My

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Oldest

- M67 3.5Gy

- M13 12Gy

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Blue Stragglers

- Some MS stars found past turnoff point
- Mechanism:
  - Mass Transfer in close binary
  - Collision and Merger
- Likely both

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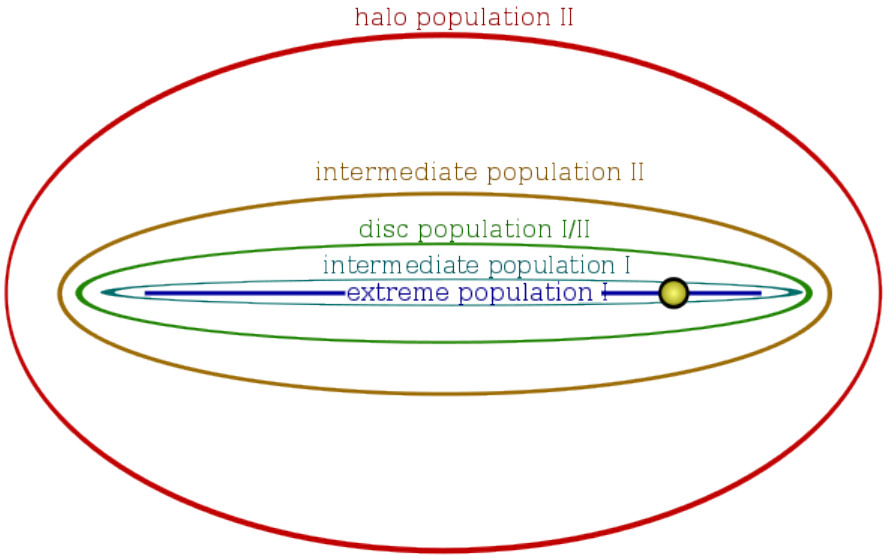
Populations

- Astronomers distinguished Population II from Population I stars based on peculiar motion
- Differ in metallicity: Population II metal-poor formed early
- Globular Clusters are Population II
- Population III: Conjectured first stars – essentially metal free



Distribution of Star Populations in Milky Way

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Credits

- StarClock Simulation: Leos Ondra http://leo.astronomy.cz/sclock/sclock.html
- Cluster CMD plots and Images: WEBDA database, operated at the Institute for Astronomy of the University of Vienna http://www.univie.ac.at/webda/
- IC 1795 Image: NASA/JPL-Caltech/WISE Team http://wise.ssl.berkeley.edu/gallery_IC1795.html
- NGC 2264 Image: NASA, H. Ford (JHU), G. Illingworth (UCSC/LO), M.Clampin (STScI), G. Hartig (STScI), the ACS Science Team, and ESA http://hubblesite.org/gallery/album/pr2002011f/
- M45, M67 Image: David Malin/AAO http://www.aao.gov.au/images/general/messier.html
- M23 Image: N.A.Sharp, REU program/AURA/NOAO/NSF http://messier.seds.org/more/m023_more.html
- M44 Image: NOAO/AURA/NSF http://messier.seds.org/more/m044_more.html
- M13 Image: Bob Star/Flickr http://www.flickr.com/photos/52031391@N00/66973527
- M13 CMD plot: Javik, Rasmus Flytkjaer, Morten Moeller and Mikkel Smedemand/ESO http://www.eso.org/public/outreach/eduoff/cas/cas2002/cas-projects/denmark_m13_1/
- Blue Stragglers in NGC 6397: Francesco Ferraro (Bologna Observatory), ESA, NASA http://apod.nasa.gov/apod/ap020220.html

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