

Read the General Rules in the manuals and on www.soinc.org as they apply to every event.

1. **DESCRIPTION:** Students will demonstrate an understanding of the basic concepts of mathematics and physics relating to **stellar evolution** and **type Ia supernovas**.

A TEAM OF UP TO: 2

APPROXIMATE TIME: 50 minutes

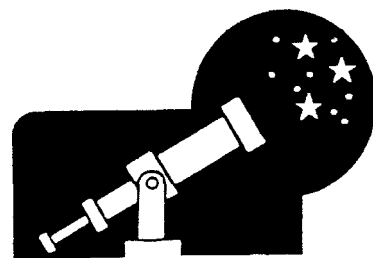
2. **EVENT PARAMETERS:** Each team member is permitted to bring either a laptop computer or one 3-ring binder (any size) containing information in any form from any source. The materials must be 3-hole punched and inserted into the rings (notebook sleeves are allowable). Each team member is permitted to bring a programmable calculator. No Internet access is allowed.

3. **THE COMPETITION:** Using information which may include Hertzsprung-Russell diagrams, spectra, light curves, motions, cosmological distance equations and relationships, stellar magnitudes and classification, multi-wavelength images (X-ray, UV, optical, IR, radio), charts, graphs, animations and DS9 imaging analysis software, participants will be asked to complete activities which include the following:

- Use all available information to determine answers relating to stellar evolution, including spectral features and chemical composition, luminosity, blackbody radiation, color index (B-V), and H-R diagram transitions, stellar nurseries and star formation, proto-stars, T-Tauri objects, main sequence stars, red giants, Mira variable stars, RR Lyrae variable stars, planetary nebulae, white dwarfs, Type Ia supernovae and globular clusters.
 - Use all available information, including Kepler's laws, rotation and circular motion to determine answers relating to the orbital motions of binary and multiple star systems, and globular clusters; use parallax, spectroscopic parallax, and the distance modulus to calculate distances to RR Lyrae variable stars, type Ia supernovas, and planetary nebulae.
 - Students will be asked to identify, know the location, be knowledgeable about, and/or answer questions relating to the three content areas outlined above for the following Objects: Mira, SNR 0509-67.5, CH Cyg, Kepler's SNR, Tycho's SNR, M15, Carina Nebula, T Tauri, Sirius B, RR Lyrae, U Scorpii, Rosette Nebula, BP Psc, NGC 2440, RX J0806.3+1527, DEM L238 & L249.
4. **SCORING:** All questions will have been assigned a predetermined number of points. The highest score wins. Selected questions having differentiated weights will be used to break ties.

Recommended Resources: All reference and training resources including the **Astronomy CD** are available on the Official Science Olympiad Store or on the Website at <http://www.soinc.org> Also: <http://www.aavso.org/>; <http://chandra.harvard.edu/photo/index.html> <http://antwrp.gsfc.nasa.gov/apod/astropix.html>

National Science Education Standards: Science as Inquiry, Content Standard A: Use Technology and Mathematics to Improve Investigations and Communications; Formulate and Revise Scientific Explanation and Models using Logic and Evidence; Earth and Space Science, Content Standard D: The Origin and Evolution of the Universe (Grades 9-12). See soinc.org for other event Standards.



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Eric Merlo (contact me through Annie)

1. After two years of Galaxies and three years of Variable Stars, the Astronomy topic has rotated back to Stellar Evolution and Type 1a Supernovae.

This is the beginning of the Stars and Galaxies topic in astronomy textbooks, so it might be a good chance to bring in some younger kids, and let them grow with the subject.

Make sure the kids read the rules!!! Don't study the wrong stuff. It's stellar evolution, not the solar system or galaxies.

As usual, each listed deep sky object is carefully chosen and illustrates a concept about the topic. Some are just "special". Use them to help guide the kids' study.

Pay attention to the topics listed in sections 3a. and 3b. of the rules. The test will not be limited to the objects listed in 3c.. I will cover all topics listed in the rules.

All concepts related to the listed objects and their types and to stellar evolution in general are fair game, but I will not add any specific objects. For example I may ask general questions about Type II supernovae, but not about a specific one.

2. The event will be a test, there will be no stations. No moving around. Multiple choice, identification, and short answer questions will be included. There will be some calculations as outlined in Section 3 b. of the rules. There may be a sketch problem. Tie-breaker questions will be identified.

A graphing calculator is not essential: a scientific calculator will be adequate for all calculations. Bring one. Resources: Either a Laptop or binder per team. (this matches last year's state competition rules for astronomy, but is a deviation from the national rules, which allow one of each) No internet. Bring pencils and a sharpener.

* won't need a graphing calculator

* I will not include any questions or exercises that utilize the DS9 imaging software. (it's never been used at the state competition either)

3. The SOINC Astronomy CD is a good resource for this year, because it includes information on stellar evolution. I recommend an undergraduate college text on astronomy. Astronomy Today by Chaisson & McMillan is as good as any.

Look at the Chandra, Spitzer, and Hubble sites. Astronomy Picture of the Day is also a great site.

\$16
from
sci olymp website
astronomy CD

Deep Sky Objects:

A. Stellar Nurseries & Star Formation

- 1) Carina Nebula (NGC 3372)
- 2) Rosetta Nebula (NGC 2237)

B. Proto-Stars & Main Sequence Stars

- 1) T-Tauri

C. Red Giants, RR Lyrae Variable Stars & Globular Clusters

- 1) Mira (Red Giant Mira Variable)
- 2) BP Psc (Red Giant Mira Variable)
- 3) RR Lyrae (Prototype for all RR Lyrae Variable Stars)
- 4) M15 (Globular Cluster)

D. Planetary Nebulae & White Dwarfs (NGC 2440, RX J0806.3+1527)

- 1) Sirius B
- 2) Mira (White Dwarf Companion)
- 3) CH Cyg (White Dwarf & Main Sequence Star)
- 4) U Scorpii (White Dwarf Primary & Low Mass Main Sequence Star)
- 5) RX J0806.3+1527

E. Type Ia Supernovas

- 1) Tycho's SNR
- 2) Kepler's SNR
- 3) SNR 0509-67.5
- 4) DEM L238 & L249