



ASTRONOMY

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 variable stars.

A TEAM OF UP TO: 2

APPROXIMATE TIME: 50 minutes

2. **EVENT PARAMETERS:** Each team 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.
3. **THE COMPETITION:** Using information which may include H-R diagrams, spectra, light curves, motions, distance equations and relationships, stellar magnitudes and classification, multi-wavelength images, charts, graphs, and animations, participants will be asked to complete activities which include the following:
 - a. Use all available information to determine answers relating to variable stars, including Cepheids, Long Period Variables, **Recurrent Novae**, **T Tauri**, **Symbiotic**, **U Geminorum**, Type Ia & Type II supernovae, **Eclipsing Binaries** and **X-Ray Binaries**.
 - b. Use all available information, including Kepler's laws, to determine answers relating to the orbital motions of globular clusters and binaries, cosmological distance equations, rotation, and circular motion to answer questions about orbital motions and distances related to Cepheids, and RR Lyrae variable stars.
 - c. Students should be able to identify and be knowledgeable about light curves, spectra, periodicity, apparent and absolute magnitudes, maxima, minima, types of variability, evolutionary stages, phase diagrams and O-C diagrams.
 - d. Students will be asked to identify, be knowledgeable about, and answer questions relating to the three content areas outlined above for the following Deep Sky Objects (DSOs): **Circinus X-1**, **RU Virginis**, ***Epsilon Aurigae**, **RX Andromedae**, **Z Andromedae**, **SN 1006**, **RX J0822-4300**, **G292.0+1.8**, **NGC 2440**, **Betelgeuse**, **RS Ophiuchi**, **Mira**, **T Tauri**, **RS Puppis**, **Hinds Variable Nebula**. ***Epsilon Aurigae** is part of a nationwide observing campaign for the International Year of Astronomy (2009) and will be included in the Astronomy Event for 2010 and 2011
 - e. Competition may include one or more stations. Examples include placing images, light curves and spectra on an H-R diagram; placing images, light curves, and H-R diagrams in sequence from formation to end product; using software to determine the period of a variable star; using spectra, light curves, star charts and O-C diagrams to determine variability and predict maxima; using graphing calculators to plot observational data, and construct phase diagrams and O-C diagrams.
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:

- a. **Science Olympiad Astronomy CD:** Available at <http://www.soinc.org> store
- b. <http://www.aavso.org/>
- c. http://chandra.harvard.edu/edu/formal/variable_stars/
- d. http://chandra.harvard.edu/edu/formal/stellar_ev/
- e. http://www.tufts.edu/as/wright_center/products/sci_olympiad/sci_olympiad_astro.html
- f. <http://chandra.harvard.edu/photo/index.html>
- g. <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).