

1. **DESCRIPTION:** Students will demonstrate an understanding of the basic concepts of mathematics and astrophysics relating to **variable stars**.

**A TEAM OF UP TO: 2**

**APPROXIMATE TIME: 50 minutes**



2. **EVENT PARAMETERS:** Students will provide a scientific or programmable calculator. All resources including laptop computers are permitted.
3. **THE COMPETITION:** Content areas relating to **variable stars** may include H-R diagrams, spectra, light curves, orbital motions, distance equations and relationships, stellar magnitudes and classification, multi-wavelength images, charts, graphs and animations. Participants will be asked to identify, answer questions or complete activities (a-d for all competition levels) regarding:
- Pulsating and cataclysmic variable stars**, including Cepheids, **Long Period Variables**, RR Lyrae variables, **novae**, **dwarf novae**, **recurrent novae**, **T Tauri**, Type Ia & Type II supernovae, and **RV Tauri**.
  - Light curves**, spectra, **periodicity**, **apparent and absolute magnitudes**, **maxima**, **minima**, type of variability, evolutionary stage; and **phase diagrams**.
  - Deep Sky Objects (DSOs): **Mira**, **47 Tucanae**, **SS Cygni**, **Cas A**, **Tycho's Remnant**, **Algol beta Persei**, **Delta Cephei**, **GK Per (Nova Persei 1901)**, **SN 1987A**, **DEM L316**, **Omega Centauri**, **Z Cam**, **R Scuti**, **Mz 3 (Ant Nebula)**, **Orion Nebula (M42)**, **Nova Aquilae** and **Betelgeuse**.
  - Sample Lab Stations:** a) **place images on an H-R diagram**, b) **place images, light curves, and H-R diagrams of DSOs in sequence from formation to end product**.
  - For State and National (S/N only): Use Kepler's laws to determine answers relating to the following topics: orbital motions of globular clusters and binaries; and cosmological distance equations; rotation, and circular motion to answer questions about orbital motions and distances of Cepheids, RR Lyrae variable stars, type Ia supernovae, and planetary nebulae.
  - Sample Lab Stations for S/N only:** a) use software to determine the period of a variable star, b) use spectra, light curves, and O-C diagrams to predict maxima.
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 as tiebreakers.

5. **RESOURCES:**

**Science Olympiad Astronomy CD:** <http://www.soinc.org>

<http://www.aavso.org/>

[http://chandra.harvard.edu/edu/formal/variable\\_stars/](http://chandra.harvard.edu/edu/formal/variable_stars/)

[http://chandra.harvard.edu/edu/formal/stellar\\_ev/](http://chandra.harvard.edu/edu/formal/stellar_ev/)

<http://chandra.harvard.edu/photo/index.html>

<http://antwrp.gsfc.nasa.gov/apod/astropix.html>

[http://www.tufts.edu/as/wright\\_center/fellows/sci\\_olympiad](http://www.tufts.edu/as/wright_center/fellows/sci_olympiad)

[/sci\\_olympiad\\_astro.html](http://www.tufts.edu/as/wright_center/fellows/sci_olympiad/astro.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).