

1. **DESCRIPTION:** Teams will demonstrate an understanding of the basic concepts of mathematics and physics relating to stellar evolution and **star formation and exoplanets**.

A TEAM OF UP TO: 2

APPROXIMATE TIME: 50 minutes

2. **EVENT PARAMETERS:** Each team may bring either two computers (**of any kind**) or two 3-ring binders (any size) containing information in any form from any source, or one binder and one computer. The materials must be inserted into the rings (notebook sleeves are permitted). 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, **color-color diagrams**, spectra, light curves, motions, cosmological distance equations and relationships, stellar magnitudes and classification, multi-wavelength images (X-ray, UV, optical, IR, **sub-mm**, radio), charts, graphs, animations and DS9 imaging analysis software, teams will complete activities and answer questions related to:
 - a. Stellar evolution, including spectral features and chemical composition, luminosity, blackbody radiation, color index and H-R diagram transitions, proto-stars, planet formation, T Tauri variables, FU Orionis variables, Herbig Ae/Be stars, brown dwarfs, protoplanetary disks, debris disks, H I/II regions, molecular clouds, and exoplanets including but not limited to: gas giants, terrestrial planets, super Earths, mini-Neptunes, and hot Jupiters.
 - b. Use Kepler's laws, rotation and circular motion to answer questions relating to the orbital motions of **planets and planetary systems**; use parallax, spectroscopic parallax, and the distance modulus to calculate distances to **planetary systems**; use **radial velocity and transit timing methods to determine properties of exoplanets**; **calculate surface temperature of an exoplanet to determine habitability**.
 - c. Identify, specify the location and answer questions relating to the content areas outlined above for the following objects: T Tauri, HL Tauri, AB Aurigae, HAT-P-11b, 51 Pegasi b, WASP-43b, WASP-18b, HD 106906b, WISE 0855-0714, 2MASSJ22282889-431026, M42, Barnard 68; and systems: 55 Cancri, Kepler-186, HD 95086, GD 165, HR 8799.

4. **SCORING:** All questions will have been assigned a predetermined number of points. The highest score wins. Selected questions 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 Website at <http://www.soinc.org> Also see: <http://www.aavso.org/>; <http://chandra.harvard.edu/photo/index.html>; <http://antwrp.gsfc.nasa.gov/apod/astropix.html>

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