ASTRONOMY C

See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every event.

1. **DESCRIPTION:** Teams will demonstrate an understanding of stellar evolution in normal & starburst galaxies.

   A TEAM OF UP TO: 2

   APPROXIMATE TIME: 50 minutes

   CALCULATOR: Class IV

2. **EVENT PARAMETERS:** Each team may bring one of the following options containing information in any form from any source: a computer/tablet and a three-ring binder, two computers/tablets of any kind, or two three-ring binders.
   a. If three ring binders are used, they may be of any size and the information contained should be attached using the available rings. The information or pages may be removed during the event. Sheet protectors and laminated sheets are allowed.
   b. Each team may bring two stand-alone Class IV calculators. If the participants are using a computer or tablet, they may use the calculator app or other program on their device in place of a stand-alone calculator.
   c. Participants using computers/tablets as a resource should have all information stored so that it is available to them offline. Unauthorized AI tools (e.g., ChatGPT, or other trained models) are not allowed to be used to answer questions under any circumstances during the event.
3. **THE COMPETITION:** Using information which may include Hertzsprung-Russell diagrams, spectra, light curves, proper motions, cosmological distance equations and relationships, stellar magnitudes and classification, multi-wavelength (gamma-ray, X-ray, UV, optical, IR, radio) and multi-messenger (gravitational waves, neutrinos, cosmic rays) observational data, charts, and graphs, teams will compete in activities and answer questions related to:
   a. Stellar evolution including stellar classification, spectral features and chemical composition, luminosity, blackbody radiation, spectroscopy, H-R diagrams, Cepheid and RR Lyrae variables, Type Ia supernovas, neutron stars, ultra-luminous X-ray sources (ULXs), gravitational waves; normal & starburst galaxies including morphological classification, galactic structure (e.g., stellar populations, globular clusters) and interactions (e.g., tidal disruptions, collisions, mergers).
   b. Use orbital mechanics, Kepler's laws, rotation and circular motion to analyze the orbital motions of binary and galactic systems; use parallax, spectroscopic parallax, the distance modulus, period-luminosity relations (Cepheids and RR Lyrae), the Tully-Fisher relationship, Type Ia supernovas, and Hubble's law to calculate cosmological distances; and use the Stefan-Boltzmann law and Wien's displacement law to answer questions relating to the content areas outlined above.
   c. Identify and answer questions relating to the content areas outlined above for the following objects: Andromeda Galaxy (M31), Sombrero Galaxy, M51, NGC 4536, MCG+07-33-027, NGC 1569, Antennae Galaxies, Arp 143, Arp 147, Cartwheel Galaxy, M82 (X-1, X-2, SN 2014J), GW170817, Terzan 5.
4. **SCORING:**
   a. High Score wins.
   b. Preselected questions will be used to break ties.