Introduction to Stars and Planets

Stars and Planets is a series of nine lessons designed to assist students in grades 6-8 in understanding scale in the solar system and beyond, in time as well as space. Many of the lessons use image data from the Hubble Space Telescope and NASA's other Great Observatories as they take students on a voyage through astronomy introducing and reinforcing important concepts along the way.

Using scale in the solar system as a foundation, students will explore the properties of stars, including their formation, main sequence lifetimes, ends, what remains behind. A two-part lesson on the search for planets orbiting distant stars ties together concepts presented in the previous lessons and is designed to serve as both review and assessment. The final lesson, *A Gaggle of Galaxies*, was created to meet the middle school space science content standards from many states. The lesson extends the concept of scale in an introduction to the Milky Way and its most prominent neighbors in the local group, challenges students to create their own classification scheme for galaxies using the Hubble Ultra Deep Field, and ends with a discussion of red shift and the Big Bang.

NASA's exploration of the cosmos is highlighted in multiple lessons along with cutting-edge science. New Horizons is introduced in the *Scale Model Solar System* lesson and the Kepler Mission, a distribution partner for *Stars and Planets*, is highlighted in *Planet Hunting*. Three of the lessons feature student exploration of image data from Hubble Space Telescope (HST), and the entire series provides a wealth of teacher information and supplemental resources. Images from Solar Heliospheric Observatory (SOHO), Spitzer Space Telescope, Chandra X-Ray Observatory and references to past and future NASA missions are also included in the series of lessons.

The *Stars and Planets* sequence begins with a hands-on version of the classic scale model solar system activity that uses a scale factor of 1:10 billion for both size and distance, and then expands the idea to include stars and planets beyond the solar system using the same 1: 10 billion scale. Mathematics plays a central role in each activity. In addition to scale models of size, distance, and time, probability and conditional probability will be introduced in the context of star birth. Each lesson blends practical applications of mathematical modeling with up-to-date accurate astronomical content, guiding students in an exploration of the cosmos and in development of an understanding of "our place in space".

Stars and Planets is intended to build a firm conceptual foundation for understanding important astronomical concepts. Each lesson is designed to build upon concepts presented in prior lessons, but is also modular to allow for flexibility in adapting to classroom curriculum requirements.