Coordinating Star Party Volunteering for Child Participants with USOE K-12 Science Education Objectives

School age children are best served by coordination with age appropriate national and federal K-12 science goals. National standards are defined in: CSMEE, National Science Education Standards (1996) at- "Science Standards"
http://www.nap.edu/openbook.php?record_id=4962&page=108

Utah State Office of Education objectives are summarized at: Utah K-12 Core Curriculum Standards for Science
http://www.uen.org/core/

In summary, K-9 standards emphasize knowledge of the solar system, the seasons, planetary motion and the types of deep sky objects. Standards for 10-12 emphasize knowledge of deep sky structure, the cosmic distance scale and the evolution of the universe. Standards for 11-12 students includes physics, and thus, the optical principles of telescopes. All levels emphasize developing critical thinking skills by understanding science as an investigatory process.

Taking a few moments to review these general and astronomy science education content standards suggests a number of appropriate discussion topics when volunteering at a star party. The grade level specific astronomy standards and objectives (next page) suggest heuristic questions that can be used to guide young person's discovery, *e.g.* – when observing Saturn, a young person might be asked whether they think the atmosphere of Saturn is like Earth's and whether they could breathe it. Such a question supports the learning objective of, ``Compare Earth's atmosphere, solar energy, and water to those of other planets and moons in the solar system.''

Type	General Standard or Objective
S	**The Processes of Science:** Communication of Science, and the Nature of Science. Students will be able to apply scientific processes, communicate scientific ideas effectively, and understand the nature of science.
O	**Generating Evidence:** Using the processes of scientific investigation (i.e. framing questions, designing investigations, conducting investigations, collecting data, drawing conclusions.)
O	**Communicating Science:** Communicating effectively using science language and reasoning.
O	**Knowing in Science:** Understanding the nature of science.
S	**Earth and Space Science:** Students will gain an understanding of Earth and Space Science through the study of earth materials, celestial movement, and weather.

Table 1 – USOE General Science and Earth-Space Science Objectives.

USOE Grade level specific astronomy related standards and objectives are listed in Table 2, as follows:

Grade level	Standards, Objectives and Lesson Plans
K-1	L -Compare and contrast light and dark in a daynight cycle.
1	L -Observe and chart the moon when it is visible during the day.
2	L -Observe and describe the number, arrangement and color/brightness of stars in the night sky.
3	S -Students will understand that the shape of Earth and the moon are spherical and that Earth rotates on its axis to produce the appearance of the sun and moon moving through the sky. L -Describe the motions of Earth (i.e., the rotation

Grade level	Standards, Objectives and Lesson Plans
	[spinning] of Earth on its axis, the revolution [orbit] of Earth around the sun). L -Use a chart to show that the moon orbits Earth approximately every 28 days.
5	L -Investigate the effects of magnets on the needle of a compass and compare this to the effects of Earth's magnetic field on the needle of a compass (e.g., magnets effect the needle only at close distances, Earth's magnetic field affects the needle at great distances, magnets close to a compass overrides the Earth's effect on the needle).
6	L -Explain patterns of changes in the appearance of the moon as it orbits Earth. L -Demonstrate how the relative positions of Earth, the moon, and the sun create the appearance of the moon's phases. S - Students will understand how Earth's tilt on its axis changes the length of daylight and creates the seasons. L - Explain how the relationship between the tilt of Earth's axis and its yearly orbit around the sun produces the seasons.
8	L - Demonstrate how white light can be separated into the visible color spectrum. L - Describe how Earth's gravitational force on an object depends upon the distance of the object from Earth.
9-12	S -Students will understand the scientific evidence that supports theories that explain how the universe and solar system developed. L -Determine the motion of a star relative to Earth based on a red or blue shift in the wavelength of light from the star. L -Explain how evidence of red and blue shifts is used to determine whether the universe is expanding or contracting.
	L - Describe the big bang theory and the red shift evidence that supports this theory. L - Provide an example of how technology has helped scientists investigate the universe. L -Relate the structure and composition of the solar system to the processes that exist in the universe. L -Compare the elements formed in the big bang (hydrogen, helium) with elements formed through nuclear fusion in stars. L -Relate the life cycle of stars of various masses to the relative mass of elements produced. L -Explain the origin of the heavy elements on Earth (i.e., heavy elements were formed by fusion in ancient stars). L -Present evidence that the process that formed Earth's heavy elements continues in stars today. L -Compare the life cycle of the sun to the life cycle of other stars.
9-12 con	L -Relate the structure of the solar system to the forces acting upon it.
9-12 con	S -Students will understand that the features of Earth's evolving environment affect living systems, and that life on Earth is unique in the solar system. L -Compare Earth's atmosphere, solar energy, and water to those of other planets and moons in the solar system.

Table 2 – USOE Astronomy Related Standards, Objectives and Lesson Plans by Grade Level