Preflight

RA and Dec
Driving the SDSS Telescope – Understanding Right Ascension and Declination

<table>
<tr><td colspan="2">Summary

This Preflight training provides students with an overview of lines of right ascension and declination, how they are measured, and how the decimal degrees (specialized representation of RA and Dec in the SDSS) are calculated by computers.</td></tr>
<tr><td>Key Vocabulary

declination
right ascension

Supporting Vocabulary

degrees, minutes, and seconds
hours, minutes, and seconds
decimal degrees
celestial north pole
celestial south pole</td><td>Comments

This activity is a useful resource for reviewing RA and Dec in the form of decimal degrees used by the SDSS.

If your students have no prior experience with RA and Dec, consider Launch – My Special Place in the Database or Launch – Constellations as part of the experience.</td></tr>
</table>

Structured Query Language – SQL
Locating Objects in a Database

<table>
<tr><td colspan="2">Summary
In this Preflight training, students are introduced to the fact that massive amounts of data can be stored on computers in an organized manner. This data can be searched in variety of ways using a simple language called SQL (structured query language). The activity uses the first two lines of code – the Select and From lines - to demonstrate how a query functions.</td></tr>
<tr><td>Key Vocabulary

SQL
database
query

Supporting Vocabulary</td><td>Comments

This activity is recommended if you come across the concept of querying a database but it is not part of the main lesson.

Other activities that teach SQL as part of the</td></tr>
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	lesson are Launch – Galaxies and Expedition – Galaxy Color.

Preflight – Asteroids

Summary

Asteroids are not targets of the SDSS. During the long exposures times used to capture faint galaxies and quasars, many asteroids are recorded as colored streaks or a series of colored dots on the image. In this Preflight, students learn how to identify asteroids in SDSS images and how the engineering goals of the telescope (target faint objects) result in clear images of stars and galaxies and streaked images of asteroids.

Key Vocabulary	**Comments**
asteroid filter **Supporting Vocabulary** image SDSS camera planets stars comet meteor	Although the aim of this activity is to help students identify asteroids and moving objects in SDSS images, you can use it as a starting place for a discussion about how the SDSS telescope was designed by engineers to meet a particular goal. The engineering goal of the SDSS camera and telescope is to capture images and spectra of very faint and distant objects over large portions of the sky. If you are interested in continuing to explore the nature of the data captured by the SDSS, Launch – What is SkyServer provides the details. Preflight – Artifacts provides more examples of objects captured by the SDSS telescope and camera that were not the intended targets of the system. A discussion of the design characteristics the system would have needed to successfully image these objects would help students think about the engineering involved in scientific discoveries.

Preflight – Spectrum Graphs

Summary

This Preflight training takes a detailed look at an SDSS spectrum graph. Students are provided with information about the types of data recorded on the graphs, the units used, and how to interpret the information.

Key Vocabulary

spectrum graph
X and Y axes
continuum
emission line
absorption line
blackbody curve

Supporting Vocabulary

nanometer
angstrom
erg
flux
ultraviolet
infrared

Comments

The information on the page is very dense; a great number of topics related to spectra are covered. As in all Preflight trainings, students are being told the information that is known about spectra. If you would like your students to uncover and interpret these patterns for themselves, we recommend Launch – Stellar Spectra for exploring the nature of the continuum curve, Launch – Stars as Blackbodies for interpreting temperature, and Launch – Redshift for a closer look at absorption and emission lines.

Preflight Redshift

Summary

Preflight – Redshift covers the very basics about what a redshift is and a generalized description of how it is measured on an SDSS spectrum graph.

Key Vocabulary

redshift
Doppler effect

Supporting Vocabulary

Comments

For more about redshift, Launch – Redshift provides a detailed investigation of how spectral lines are identified and used to calculate redshift.

spectrum spectrum graph spectral lines z value	

Preflight – Filters

Summary	
Using an analogy, Preflight – Filters explains the function of a filter and how it does the job of blocking some colors of light. As with all Preflight trainings, information is presented in the context of the SDSS; no other filters or systems are discussed. The wavelength nature of light is introduced as it is essential to understanding the "colors" that we do not see and how filters function.	
Key Vocabulary light filter wavelength color **Supporting Vocabulary** electromagnetic spectrum electromagnetic radiation Angstrom camera – as separate from the filter	**Comments** This Preflight activity does not attempt to teach everything about the electromagnetic spectrum or the nature of light. There are many supporting classroom experiences that accomplish this effectively. Our aim here is to provide an understanding of light and filters within the SDSS that serves as a context for further experiences such as Launch - Star Color.

Preflight – Magnitude

Summary	
The magnitude scale in astronomy is very confusing. Preflight – Magnitude is here to provide a quick reference when students need a review or the basic overview for the first-time astronomer. This training provides the historical background for the development of the scale and numerous examples to ground this unit-less measurement to familiar objects like the moon.	
Key Vocabulary magnitude	**Comments** Try Launch – Star Color if you would like you students to uncover the nature of the magnitude

Supporting Vocabulary standard comparison apparent magnitude absolute magnitude	scale on their own. Preflight – Magnitude is also a good review before starting on any of the available Expeditions.

Preflight - Calculating Magnitude

Summary
This Preflight training offers a short demonstration about how magnitude (a unit-less measurement) is derived by comparing the energetic output of the star to that of the star Vega.

Key Vocabulary	**Comments**
radiant flux magnitude logarithm **Supporting Vocabulary**	Some student questions require a more in-depth understanding of the nature of magnitude measurements. Magnitude itself is a useful demonstration of the different base operations of the log scale.

Preflight – The SDSS Telescope

Summary
The SDSS telescope has many unique design features as well as much in common with other large research telescopes. This Preflight training provides background information about the location, design, and dimensions of the telescope.

Key Vocabulary	**Comments**
telescope **Supporting Vocabulary**	This Preflight could be used along with Preflight – SDSS Instruments and Preflight – Types of Data to explore how the science goals of the survey were met in the engineering design process. Questions

primary mirror secondary mirror	such as - What features and functions did engineers need to design into the SDSS telescope/camera system to capture the different types of SDSS data? – are accessible through these readings. A video introduction to this activity in Spanish and American Sign language is available HERE. Voyages is eager for feedback about how teachers are using these videos at voyage@sdss.org .

Preflight – The SDSS Telescope Instruments
Recording Information

Summary

This Preflight training reviews the function of a telescope and introduces the idea that a way to record the information (light) is necessary if your goal is to share images and data. The CCD camera and spectrograph are the two main instruments that work with the SDSS telescope to do those jobs. The reading explains how each instrument is designed to produce different outcomes.

Key Vocabulary	**Comments**
CCD camera spectrograph CCD chip pixel telescope **Supporting Vocabulary** prism wavelength fiber optic cable SDSS plate Angstrom	Video resources: Plugging the Plates SDSS at Night We recommend that no matter what activity you do with students, you always reinforce the telescope/camera or telescope/CCD as a system that works together to achieve a goal. This Preflight is always available as a reminder. Students can reference this section anytime they are unclear about the role of each instrument in gathering data.

Preflight – Types of Data

Summary

This Preflight training emphasizes the two primary data types recorded by the SDSS, photometric and spectroscopic. The reading shows how each type of data is accessed through the Navigate tool in SkyServer and provides an overview of how to locate more detailed descriptions through the QuickLook tool.

Key Vocabulary	**Comments**
photometric data spectroscopic data **Supporting Vocabulary**	Although the telescope/camera or telescope/spectrograph system is mentioned in this Preflight, the emphasis here is on the data output and where the data are located.