A Parallax Lab for Astronomy 101 Classes: Background and Summary

The WorldWide Telescope Ambassadors and faculty and staff at Bucknell University have developed a hybrid lab involving both hands-on and virtual activities that focuses on the concept of parallax. This lab, designed for non-science undergraduates in an introductory astronomy class, combines real-time modeling in a terrestrial environment with detailed visualization using virtual environment software. Students are therefore able to both explore parallax as it is viewed astronomically and develop physical intuition for the concept by measuring it in real time.

Why make a lab about parallax?

The concept of parallax is an important one in the subject of astronomy. It gives us a powerful tool for accurately measuring the distances to astronomical objects, without needing to leave the orbit of Earth (or even its surface). In this lab, we have integrated visualization activities with hands-on, real-world exploration of physical models in order to give students a deeper conceptual understanding of parallax and to help students develop intuition for the large-scale geometries present in astronomy in general (and parallax in particular).

Why use WWT?

The WorldWide Telescope (WWT) visualization software is an ideal platform for widely-usable and engaging labs because it is a free resource available to any school or any member of the public, with the potential to reach an ever-broadening and diverse audience, including populations that are traditionally underserved in STEM education. WWT represents real astronomical data in a three-dimensional environment that students can investigate from a variety of physical perspectives. They can virtually "fly through" astronomical structures and thus use the same techniques they use in their local everyday environment to develop an accurate mental model on an astronomical scale.

In this lab, students use WWT to transfer their parallax intuition from the terrestrial to celestial environments. Using the pseudo-3D multi-perspective capability of WWT, students view the well-known asterism the Big Dipper from Earth, and from another location six parsecs from Earth. Over this large baseline, the parallax shift is quite obvious, and students can discriminate between nearby and faraway stars. They make detailed measurements of the parallax shift, and determine the distances to several Big Dipper stars.

Where does this lab fit into an Astro 101 course?

We have designed this lab to fit into an Astro 101 course whenever the topic of parallax is discussed. It also highlights the ability to use indirect measurements to determine the distances to and sizes of objects in space. This lab also deals with geometric topics such as drawing triangles and large distances.

What is included in this lab?

This lab begins with a virtual tour in WWT, during which students visually explore the concept of parallax and how it is observed in space. The students are then instructed to take measurements of distant campus objects in order to calculate the distances to and heights of these objects. A lab write-up guides students through the activities and includes spaces for calculations and reflection.

At Bucknell University, where this lab was developed, students complete a pre-lab reading and an online reading quiz before coming to lab, and a post-lab quiz before leaving lab. This lab is structured for a three-hour lab section, but suggestions have been included for modularizing and shortening the activities (see instructor notes).

This distribution contains the following files:

*Parallax Lab Background and Summary.pdf (*this document)
Parallax Pre-lab reading and quiz.docx (Bucknell version in editable format)
Parallax Lab Write-up for Students.docx (Bucknell version in editable format)
Parallax WWT Tour.wtt
Parallax Post-lab quiz.docx (Bucknell version in editable format)
Parallax Lab Instructor Notes.pdf