

SPACE EDUCATION AND OUTREACH SYMPOSIUM (E1)
In Orbit - Postgraduate Space Education (4)

Author: Mr. Dawoon Jung
International Space University (ISU), France, dawoon.jung@community.isunet.edu

Dr. Hugh Hill
International Space University (ISU), France, hill@isu.isunet.edu
Dr. Fridger Schrempp
Deutsches Elektronen-Synchrotron, Germany, fridger.schrempp@desy.de

HANDS-ON VIRTUAL COSMOLOGY WITH GRAVITATIONAL LENSING IN CELESTIA.SCI

Abstract

This paper describes a project undertaken at the International Space University (ISU) Master of Space Studies program between 2013-2014. The project aimed to create an open-source, interactive tool for Masters-level students with no background in physics to be able to play with 3d simulations of gravitational lensing. Gravitational lensing (GL) is a phenomenon by which light rays are bent by gravitational sources due to General Relativity. While existing work in the field has focused on the use of GL as a tool for mapping dark matter and detecting exoplanets, we aimed instead to help students understand intuitively how General Relativity and GL works and how it can be applied in cosmological and exoplanetary research. Similar software in the past has been used to teach concepts of Special Relativity and black holes. We implemented GL in *celestia.Sci*, a 3d, interactive simulation of Space extending from the scale of spacecraft around Earth and the Solar System, into deep space and the cosmological regime. Educational exercises were designed around the new feature, and a workshop for ISU students was created to allow hands-on experience with detecting exoplanets via GL. Finally, the open-source nature of the software allows us to reach a potentially wider audience by allowing any user on the Internet to freely download the source code and exercises, understand the program logic, and run the exercises for him or herself. The end result is enhanced user understanding of an important astrophysical phenomenon, and an increased appreciation of astrophysics, astrobiology and the visual beauty of Space.