SPACE EDUCATION AND OUTREACH SYMPOSIUM (E1)
Lift-Off - Secondary Space Education (2)

Author: Mr. Peter Amidon
School for Independent Learners, United States

Ms. Monica Ebert
School for Independent Learners, United States

COMPUTER SCIENCE APPROACH TO LEARNING ASTROPHYSICS: STUDENT DEVELOPS OPEN SOURCE SOFTWARE FOR ASTRONOMY CURRICULUM

Abstract

Computer science and programming skills are essential for 21st century research and technology development and can enhance traditional curriculum to give students the opportunity to develop a technical background in any fundamental research area. We present an experience report in which one high school student, while learning astrophysics, develops a computational system to statistically produce Hertzsprung-Russell diagrams from a probabilistic description of stellar formation and modern theories of stellar evolution. This provided a setting which motivated the student to develop a deeper understanding of the relevant areas of astrophysics in particular; we hope that following a similar plan can help other students develop both an understanding of astrophysics and an interest in the application of modern computational tools to the field.

The computationally-inexpensive nature of this technique allowed the student to work only with readily-available resources; this should also make it easy to reproduce our results. The student's simulation software, along with detailed documentation, has therefore been made available under the GNU General Public License, version 3.0; in an educational setting, our publicly-released materials can be used as scaffolding for an interdisciplinary project based on our methods. In addition, since our system works by evolving stars through time to reach a final HR diagram, we believe that visualizations of the intermediate time-steps can be combined into educationally-useful images and animations detailing the process of star evolution through the HR diagram. These visualizations should be simple to produce from our open-source system, as we have included a debugging tool designed to create these animations. Using this software, a student can visualize Hertzsprung-Russell diagrams over time and stellar evolution, developing skills relevant for professional research in the field of Astrophysics.