

Research into the Teaching and Learning of Einsteinian Physics in International Contexts

Abstract

This symposium brings together research conducted in Germany, Norway and Australia on the teaching and learning of Einsteinian physics. Despite Einstein's theory of general and special relativity now being known and celebrated by the science community for more than one hundred years, relativistic concepts are usually only taught to some students in the final years of high school or more often in university, to those taking advanced physics classes. As a consequence, seventeenth century concepts about gravity, space and time are still taught in schools as if these were the way that today's scientists also perceive reality, thereby denying secondary school students our most ways of understanding the Universe. In countries where Einsteinian physics is taught in the secondary school curriculum, such as Norway, there is often a problem with teachers lacking the confidence and pedagogical and subject expertise to engage their students and support their learning of Einsteinian physics. Since conceptual demands both on students and teachers are high, this symposium provides an opportunity to present and discuss novel teaching approaches to Einsteinian physics at secondary school level that are conceptual rather than mathematical.

The four contributions address these issues from multiple perspectives by presenting: 1. A teaching strategy for general relativity relying on the geometric approach of sector models that provide a graphic tool to represent curved spaces and spacetime true to scale. 2. A short course on Einsteinian physics motivated by the remarkable properties and origins of the element gold that aims at capturing students' interest and helping them to engage with relativity in a meaningful way. 3. A simple and concise conceptual and quantitative model to help explain gravity as elucidated by general relativity whilst avoiding advanced university mathematics. 4. A content structure for general relativity based on the Model of Educational Reconstruction that offers important help for teachers in identifying central aspects of general relativity that can be communicated without mathematical formalism.

The symposium is designed for colleagues interested in the teaching and learning of relativity at secondary school level. A goal of the symposium is to provide a coherent set of contributions that encourage a fruitful debate on how to bridge research and practice in the teaching of Einsteinian physics. All four contributions exemplify research activities that are pooled by the International Einsteinian Physics Education Research (EPER) collaboration that aims to develop new learning approaches and to disseminate learning resources, best-practice examples and research results concerning students' understanding and learning in Einstein physics across a range of countries.

Key words

Einsteinian Physics, Relativity, Gravity, Secondary School Physics

(436 words)