

PhD in Science Education

Measuring the Effectiveness of Teaching Einsteinian Physics at an Early Age

Since early in the twentieth century physicists have known that the geometry of the universe is the geometry of curved space, and that the quantum reality of the universe is weird and extraordinary. Both of these topics are seen as being "difficult" and have minimal coverage in school science curricula.

Curved space gives rise to surprising phenomena like the effect of gravity on clocks, and errors in standard geometrical formulae. Despite knowing that Newtonian physics is strictly incorrect, the teaching of physics at school has remained Newtonian, with little recognition given to the discoveries which are now 100 years old, and which are essential for understanding space engineering and modern electronics.

The premise of this PhD project is that it is possible, and indeed, beneficial, to begin to teach the new physics at an early age. This project will test the following:

- a) the ability of primary school students to understand curved space geometry, and to understand that flat space geometry is a special case, but one which for most purposes is a very useful approximation.
- b) the ability of secondary students to understand basic concepts of both quantum mechanics and Einstein's relativity, while also understanding that Newtonian physics is a useful approximation.
- c) whether this new approach to teaching physics helps to improve student attitudes to physics by presenting physics as a frontier of learning with many mysteries and problems still to be solved.

The PhD student will develop new curriculum materials with the help of physicists, and will work with a few selected school groups. The project will make use of exhibits and facilities at the Gravity Discovery Centre, (1 hour's drive north of Perth city centre) but will also involve working with students in the classroom. Interviews and questionnaires will be used to assess student attitudes and understanding.

The project will be supervised by Prof David Blair, a physicist, and Prof Grady Venville, Prof of Science Education, and will be based on pilot studies with children in 2011. It will involve teaching the conceptual ideas of Einsteinian physics, but requires only standard school mathematics and geometry.

The successful applicant must be a permanent resident, should have an Honours degree in science, a strong interest on physics, and ideally should have a Dip Ed. The project would be suitable for an experienced science teacher interested in obtaining an advanced qualification. The successful applicant will receive a tax free stipend of about \$30,000pa for 3 years.

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