Simulating the Universe with a Deck of Cards: an Exploration of the Scientific Method

By

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Host: Dr Ho Shen Yong

Abstract

In this workshop we will simulate the universe with a (possibly) stacked deck of playing cards. We will draw cards one at time for the deck. The deck, in common with the universe, may have some patterns or organising principles that determine the order in which the data (the cards) appear. We will attempt to determine what if any principles are true for the deck of cards. This will turn out to allow us to have a surprisingly accurate discussion of what the scientific method can do and, perhaps more importantly, what the scientific method cannot do. The activity that we will be doing is suitable for students at a variety of levels, and has also proved effective with science teachers also at a variety of levels.

Short Biography

David Harrison was the recipient of the Canadian Association of Physicists Gold Medal for “Excellence in Teaching Undergraduate Physics” in 2012. Prior to that, Dr. Harrison won the Ontario Confederation of University Faculty Associations Award for Outstanding Contributions to University Teaching in 1976 and he was given the University of Toronto Dean's Excellence Award six times from 1991 to 2008. David did his graduate studies in Experimental High Energy Physics and was awarded PhD from University of Toronto in 1972. Since then, he has taught undergraduate Physics at University of Toronto at all levels. David was always intrigued by how people learn Physics and devoted his professional life seeking to understand how learning occurs. He has been particularly interested in the challenges of teaching:

The (1000 student) service course for students in the life sciences, most of whom will be applying to a professional faculty such as Medicine.

Modern Physics to students in non-science programs. This has involved trying to implement ways to discuss these topics at a meaningful level with absolutely no mathematics.

There has been a revolution in physics teaching in the past 15 years or so, informed by the results of Physics Education Research. David is a passionate advocate of this research-based pedagogy both at University of Toronto and more broadly both in Canada and internationally.

One project involving this reformed teaching was an effort to re-structure the pedagogy of the large (1000 student) first year service course at University of Toronto. This was an immense project involving many people over a period of years, and cost well over one million dollars. David was the lead on this and it has been a huge success.

David has also been involved in the use of computers and multi-media for science teaching for decades. This has included writing almost 100 Flash animations, which have now been translated into Spanish, Portuguese, Greek, Dutch, Hungarian, Polish, Catalan, and Basque. He has also been involved in making the Python programming language an integral part of the undergraduate Physics curriculum at University of Toronto.