

## The 2008 Anglia Region Christmas Lecture

### *Rock Guitar in 11 Dimensions*

On Friday evening 21<sup>st</sup> November 2008, some 340 ITP members, their family and friends enjoyed a fantastic Family Christmas Presentation by Dr Mark Lewney. Mark introduced his audience to the physics of vibrations, string theory and everything from nano-size to several-universes-large. Mark ended with a space-time visualization of the Universe and the exciting opportunities about to be unfolded by the Large Hadron Collider in Geneva. The answer was neither 42 nor the end of the World – but it might herald the end of physics as we know it...



As you can tell, this was no ordinary lecture. It was loud fun, musical, entertaining and extremely interesting. From start to finish the audience were captivated by the presenter and his subject while he kept us racing ahead. The maths might be way over our heads but he got the concept across in a highly entertaining manner.

As the audience entered the John Bray Auditorium at Adastral Park, they were greeted by powerful guitar music and the distorted rock sounds only achievable with guitar feedback and overdriven amplifiers, as perfected by Jimi Hendrix and performed by Mark Lewney. This was indeed good stuff and very much appreciated by an audience of all ages and tastes.

Once everyone had arrived Mark led them into a subtle but educational presentation of vibrations, atomic and quantum particles and how the whole universe is made of music in 11 dimensions. Using music, humour and a lot of serious enjoyment he took us through a journey which started with a demonstration of a pulse of air (using an air bazooka) and ended almost all the way to understanding string theory, or Calabi–Yau and Higgs fields -a giant leap indeed. By the end of the talk some of us thought we knew all about strings and the universe.

Concepts of sound and motion, the human voice, the conversations of whales, sonic waves from a bullwhip to waves from earthquakes introduced the audience to general vibrations of waves under constraints of length, mass and tension. The complexities of musical harmonics and the notion of simple sine waves opened new ways of looking at the universe. The excursion from the physics of guitar strings to string theory was painless as Mark explained concept after concept with fun and demonstration. Visualising the guitar string shrinking to a point under infinite tension was easy and with a tension of the order of  $10^{39}$  tons we had arrived at the superstring.

Mass of course was embedded with the energy stored in, wait for it, lots of dimensions. Ten dimensions plus time making up the same 'space-time' used by Einstein. Even now with the audience immersed in mind bending concepts, the demonstrations came thick and fast and all fully interspersed with music and sound and more music.

***String Theory is a theory of physics where all "particles" that make up matter are comprised of strings that exist in an 11-dimensional (according to M-theory, the leading version) universe. These strings vibrate at different frequencies which determine mass, electric charge, colour charge, and spin. A string can be open (a line) or closed in a loop (a one-dimensional sphere, like a circle).***



Mark Lewney



Guitar designed by Jim Fogarty

Mark actually gave two lectures, or more to the point performances, that day - the ITP Christmas Families Presentation and one at East Bergholt High School on Friday lunchtime to an audience of Sixth Form Students. The ITP Annual Schools lecture was equally well delivered and received by the enthusiastic students.



Mark at East Bergholt High School

But as with all good things, an end had to come and the lecture finished with the now typical mind bending splash of sound by Mark on his superb guitar.

ITP (Anglia Committee)

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