To infinity and beyond: Teleporting humans into space

July 30 2013

In the science fiction show, Star Trek, teleportation is a regular and significant feature. But how much time and power is required to send the data needed to teleport a human being?

University of Leicester physics students James Nelms, Declan Roberts, Suzanne Thomas and David Starkey have calculated the answer to this very question.

A group of four fourth year MPhys students have calculated that the energy required to teleport one person is shown to be dependent on bandwidth – which means a decrease in time creates an increase in power consumption.

Their paper, *Travelling by Teleportation*, was published in the latest volume of the University of Leicester's *Journal of Physics Special Topics*.

The journal is published every year, and features original short papers written by students in the final year of their four year Master of Physics degree.

The students are encouraged to be imaginative with their topics, and the aim is for them to learn about aspects of publishing and peer review.

In this particular paper the students investigated the teleportation of a human being from a location on the Earth's surface to a space in circular orbit directly above it.

To begin the teleportation process, every human that is teleported will need to be represented in transferable data.

At a basic level, the transferable data of a human would be represented by the DNA pairs that make up genomes (which contain the entirety of an organism's hereditary information) in each cell.

The total data for each human cell was calculated as approximately 10^{10} bits (b), and one cell contains enough information to replicate any other type of cell in the body.

Mentally rebuilding a person is not so simple. The full information of the traveller's brain is required, which brings the total information content up to around 2.6×10^{42} b.

After the students calculated the basic data of the human being, they were then able to calculate both the time and power required to teleport the human from Earth to the chosen point in space.

It was found that the time to complete a fully successful human teleportation from Earth to space was questionable. In fact, assuming the bandwidth used is 29.5 to 30 GHz, the students discovered that the data transfer would require up to 4.85×10^{15} years.

The universe is thought to be around 14 billion years old (14×10^{9} years old), and so it would take around 350,000 times longer than the universe to transport the information of a single human – it would probably be quicker to walk!

Calculations showed that the energy required to send one person through the means of teleportation is shown to dependent upon bandwidth, which means a decrease in time creates an increase in power consumption.

Unfortunately, quick and energetically cheap teleportation at this current moment in time is beyond our means, and will be for a very long time.

One of the students, David Starkey, reflects on the Physics Special Topic Journal article: "We decided to investigate the practicalities of teleportation as a means of everyday travel.

"We employed several approximations to determine the amount of data required in bits to fully store a human genetic code and neural information, and the signal to noise ratio of typical signalling equipment. We also assumed that the maximum data sampling rate, the Nyquist limit, was reached by both transmitter and receiver.

"Our results indicate the time scales to complete a full teleport of an individual are a little too lengthy at this time. Current means of travel remain more feasible."

Course leader Dr Mervyn Roy, a lecturer at the University's Department of Physics and Astronomy, said: "A lot of the papers published in the Journal are on subjects that are amusing, topical, or a bit off-the-wall. Our fourth years are nothing if not creative!

"But, to be a research physicist - in industry or academia - you need to show some imagination, to think outside the box, and this is certainly something that the module allows our students to practice.

"Most of our masters students hope to go on to careers in research where a lot of their time will be taken up with scientific publishing - writing and submitting papers, and writing and responding to referee reports.

"This is another area where the module really helps. Because Physics Special Topics is run exactly like a professional journal, the students get the chance to develop all the skills they will need when dealing with high

profile journals like *Nature* or *Science* later on in life."

Provided by University of Leicester