TELEPORTATION **SCOTT SNOWDEN** RECKONS IT WILL BE A WHILE BEFORE INSTANTANEOUS PARTICLE TRANSFER BECOMES A REALITY

To beam or not to beam

When you're running late for something important, it's likely you've wished you could flick a switch, disappear and then rematerialise across town at your destination in a flash. Teleportation has been the stuff of sci-fi for decades but it's the subject of some intense, and fruitful, scientific research.

There and back

It might be a long time before this concept, certainly as we've seen it in the likes of Star Trek and The Fly, ever materialises. But there have been some dramatic advances in the development of teleportation.

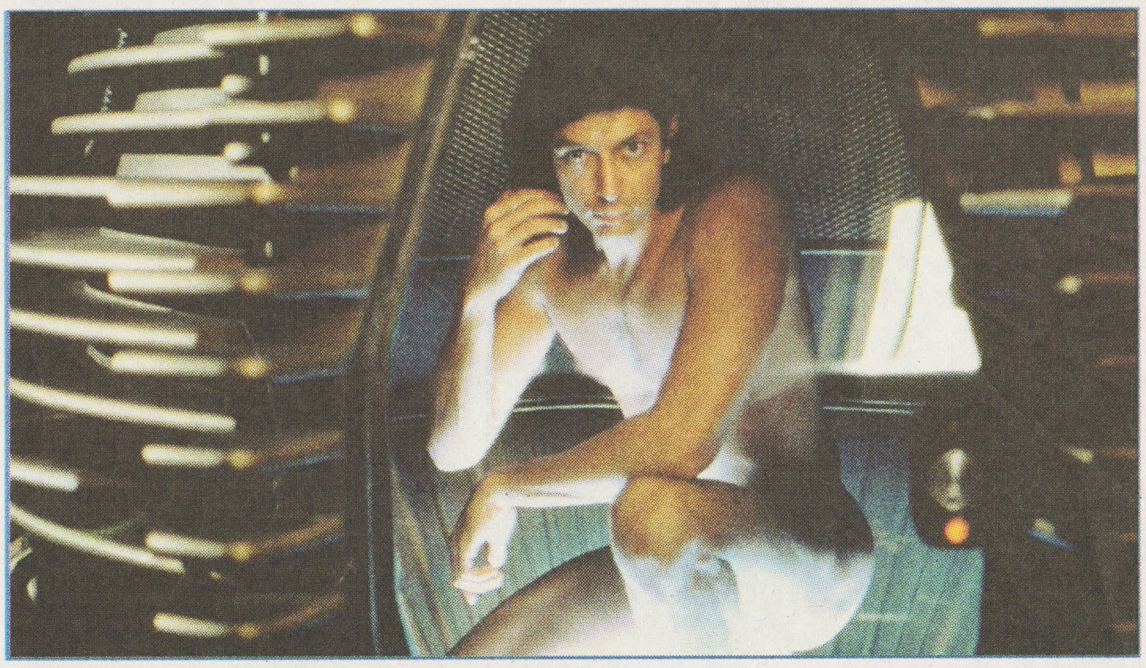
It has been a hot topic among physicists working in the field of quantum mechanics (the study of matter at an atomic level) for some time. Instead of physically moving the particles themselves, scientists have managed to transport the quantum states those particles are in.

These states describe the exact characteristics of a particle so, in theory, a body could be reconstructed particle by particle if enough quantum states were teleported, producing an exact copy down to the last molecule.

About 40 laboratories worldwide have been attempting to break down and then reconstruct the photons (particles of light) of a beam of laser light after pioneering work in 1998 at the California Institute of Technology showed it should be possible.

Then, two years ago, scientists at the Australian National University (ANU) disassembled laser light and recreated an exact replica one metre away. This was crucial in confirming that, in theory, teleportation is possible, at the very least for tiny sub-atomic particles.

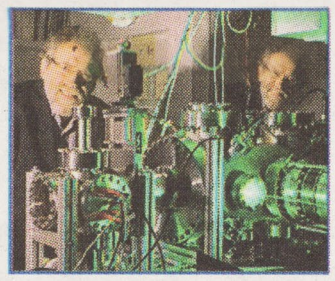
Scientists continued to research the idea and, this June, two teams of researchers working independently in the US and Austria performed successful teleportation on electrons for the first time. This has much bigger implications.



Trip the light fantastic: Jeff Goldblum in The Fly has a go at teleportation, with horrific results

Appliance of science

The two groups used different techniques for achieving teleportation but both followed the same basic principle. Both relied on an aspect of physics called 'quantum entanglement' – a phenomenon whereby two particles can be tied together even when they are far apart. Whatever happens to one particle immediately affects the other, wherever in the universe it may be.



Despite differences in the methods used by US and Austrian scientists, including Anton Zeilinger (below), similar values of fidelity – a measure of how closely the quantum states of the duplicate and original ions match – were reached.

But the most recent advance in teleportation took place just last month, when physicists in Austria carried out teleportation with particles of light over a distance of 600m.

The Austrian team encoded their quantum information using a property known as polarisation (this describes the direction in which light particles oscillate) and sending them through a fibre-optic cable through the tunnel under the River Danube.

Teleportation could even be harnessed for fast, powerful computers or communication networks. In the River Danube tunnel, the fibre-optic link was exposed to environmental factors that could interfere with the process.

But, in future computers, the information about the state of the particles would form qubits (the quantum equivalent of the digital bits 1 and 0) of data processing through the machines.

These computers, based on beams of light and their quantum and mechanical properties, will be trillions of times more powerful than we have today. The first steps have been made towards quantum computing.

The next step towards worldwide quantum communication would be to attempt the teleportation of quantum states between particles using a satellite link.

Safe passage

ANU physicist Ping Koy Lam says quantum teleportation could make encrypted or coded information 100 per cent secure because, even if intercepted, the message would be unintelligible unless it was intended for a specific recipient.

But for a human to be teleported, a machine would have to be built that could pinpoint and analyse the trillions of atoms that make up the human body.

Quantum teleporting is problematic for humans because the original is destroyed in the process of creating the replica, says Lam.

This raises the question of whether the teleported human would actually be the original person or merely a facsimile. After all, our memories and thoughts can't simply be reproduced. Can they?

QUANTUM PHYSICS CUE CARD

Atomic power

Photon: An elementary particle of energy that makes up light. It is not matter as such but a force carrier particle and has its own properties.

Proton: A sub-atomic particle of matter that, combined with a neutron, makes up the core of an atom.

Electron: A sub-atomic particle that orbits the neutron/proton core of an atom.

Atom: A unit of matter, the smallest unit of any element (such as hydrogen or carbon, for example), having all the characteristics of that element and consisting of a dense, central, positively charged proton/neutron nucleus surrounded by a system of electrons.

MATTER MAYHEM

Star Trek

Red Dwarf

Spaceballs

Yeah, teleportation is cool – unless you mess it up. And that happens quite a lot in the crazy brains of sci-fi writers...

Star Trek
The definitive use of teleportation in sci-fi. Skippers from Kirk to Janeway have been getting beamed up for decades. There have been a few accidents, though, including a poor Vulcan being reduced to an illogical heap of gloop in the first movie and the creation of a devious duplicate Commander Riker in The Next Generation.

Spaceballs
Under-rated Mel Brooks' mickey-taking exercise aimed at the sci-fi fraternity features the beaming of President Skroob from one room to the next. He rematerialises with his head on backwards, forcing him to ask: 'Why didn't anyone tell me my ass was so big?'

Red Dwarf
Numerous attempts at teleportation resulted in the crew of the eponymous Jupiter Mining Corporation vessel being transported variously to a parallel dimension where females are the dominant species and to a planet populated by warmongering wax droids. Surely even Bognor would have been better.

The Fly
Kooky scientist Jeff Goldblum steps into a teleportation device and forgets to slap on the insect repellent. The result is a slow transformation from man to fly, in which our hero develops superhuman abilities before succumbing to a hairy back, extreme violence and a predilection for vomiting on his food before he eats it.