To boldly go where no camera has gone before

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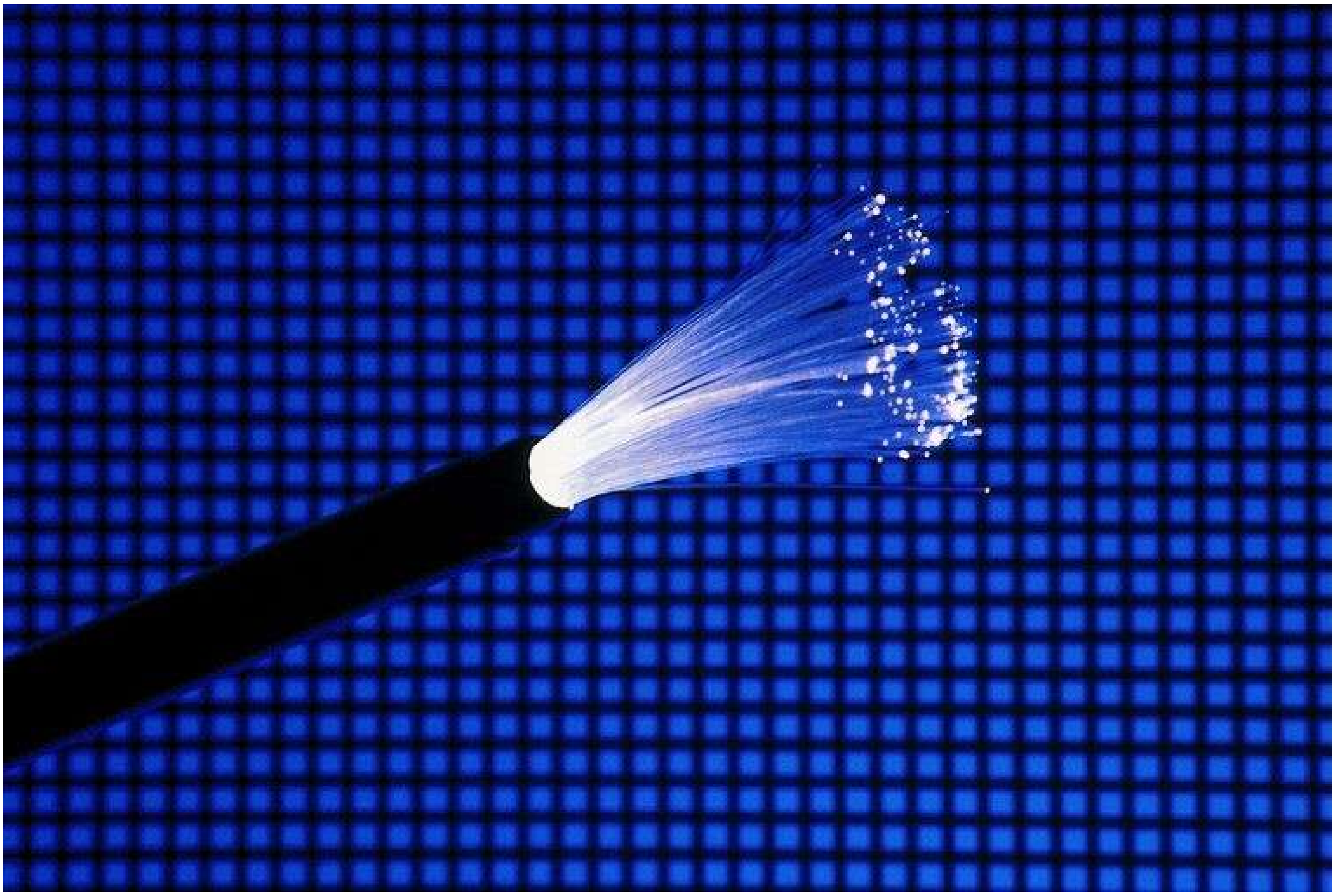
St Andrews University scientists have made an important breakthrough in fibre optic techniques that will allow doctors to reach previously inaccessible areas in the human body.



The technique uses an extremely small and flexible single strand of fibre optic cable. sometimes as tiny as 0.05mm.

This breakthrough, which was spearheaded by Dr Tomáš Čižmár of the School of Medicine and Professor Kishan Dholakia of the School of Physics and Astronomy, means that doctors are now able to use minimally invasive methods to examine hard to reach places in the human body.

Dr Čižmár explained to *The Saint* exactly how the new tool worked and why its discovery is so revolutionary for medicine: "Essentially, the narrowest endoscopes used currently have a cross-section of about 1 mm. The new fibre based endoscope can be as small as 50 microns (0.05 mm)."

He added: "This reduces the footprint of this tool to such a scale where it can be applied through any soft tissue without risking too much collateral damage via the narrowest of medical needles."

This innovative tool has only recently been developed as previously, scientists had trouble receiving the images as a result of the light in the fibre optic cable scattering and producing unreadable data.

However, the two scientists were able to find a way to characterise this randomisation of light, and to successfully predict the way in which the images were scrambled.

Dr Čižmár compared the technique to the game Plinko: "…[This game is] where you let chips fall down through a system of obstacles that randomize the chip's trajectory. Transmitting light in multimode fibre is somewhat similar, we send photons into one end and they leave the other end of the fibre entirely scrambled. Using laser light makes this however deterministic as all the photons are identical," he said.

"In…Plinko this would mean that when you send the chip from one place it would always end up in the same compartment. So characterizing the way the fibre randomizes light means sending chips through all the openings at the top of the Plinko board and looking where they end up. Once we know what the fibre does to the photons we can send images through the fibre and from the scrambled photons figure out what the original image looks like."

Dr Čižmár has been working on this project since 2009, and was very pleased to have finally achieved this breakthrough: "How much it means? Well science is not like a sport where we receive big awards for our achievements but we certainly do enjoy the journey to get there. Every result like this opens up new windows of opportunity and it is fascinating to see how fast we are progressing even in these rather uncertain times."

He added: "Research is however not cheap and when it comes to money we all need to be very practical. This breakthrough will likely help myself and the University to secure funding for further research in this and other areas."

The University of St Andrews is supporting this discovery fully, and recently stated that it hopes to help this research be: "…taken to the next level – that of real life applications – opening the door to improved diagnosis and understanding of a wide range of diseases."

Meanwhile, the tool itself is still in the development stage, with scientists working to better its speed and flexibility. Dr Čižmár said: "The technology has a few limitations, particularly in speed and flexibility, but I am already working on a few paths to improve this."

"The other big area is, naturally, the practical exploitation of this new technology in Medicine and Biology. But I cannot say exactly what way the research will go, as…you start working on something interesting, very often something even more interesting occurs…", he concluded.