Optoelectronics
Research Centre

UNIVERSITY OF
Southampton

What is Fibre Optics?

Dr Eric Numkam Fokoua

Email me at: Eric.Numkam-Fokoua@soton.ac.uk

I would love to hear from you!

Summary

A bit about me

Where does your internet live?

What is an optical fibre?

What next?

University of St Andrews

UNIVERSITEIT GENT

NANKAI UNIVERSITY 1919

Royal Academy of Engineering

LUMENISITY

UNIVERSITY OF Southampton

Lighting the Web!

Photography is a hobby…

Spectacular colours caused by refraction from the sticky spots on the web filaments

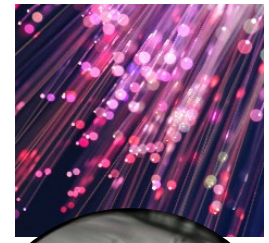
Normal garden spider *Araneus Diadematus*

The Optoelectronics Research Centre

UNIVERSITY OF Southampton

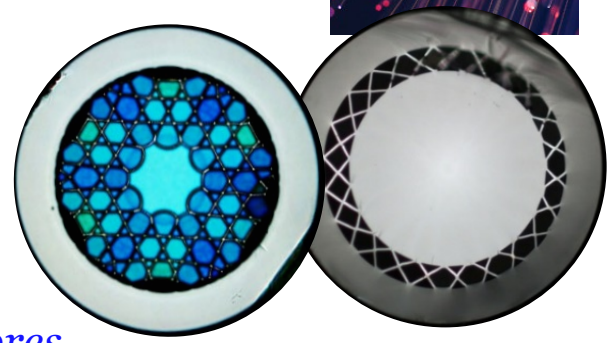
Photonics research institute built around 1800 m², £125M cleanroom complex

- Comprehensive fabrication capability across integrated photonics & electronics
- 944m² Class 100-1K Cleanrooms
- 564m² Class 10000 Cleanrooms
- 4 fibre draw towers /3 MOCVD lathes

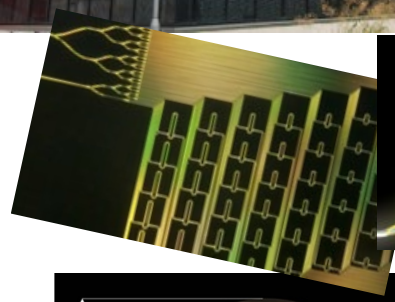


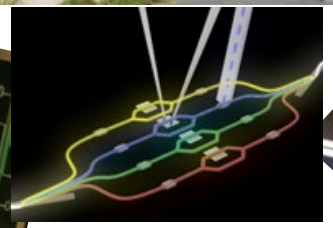
Key research in:

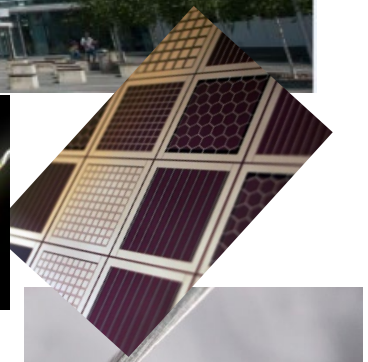
- Photonics
- Nanotechnology
- Advanced Materials
- *Advanced Optical Fibres*

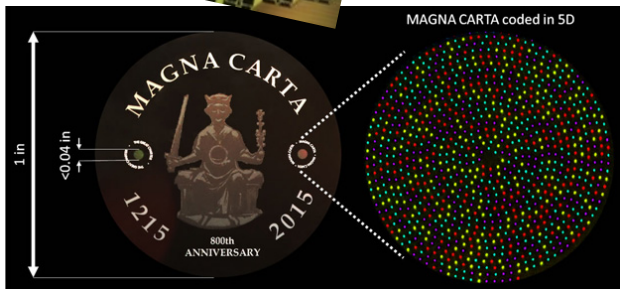


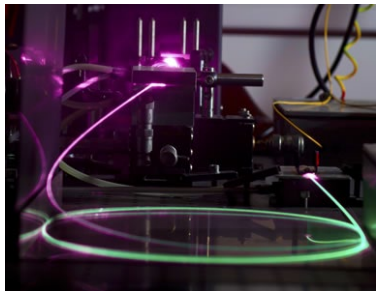
THE QUEEN'S ANNIVERSARY PRIZES
FOR HIGHER AND FURTHER EDUCATION
2017

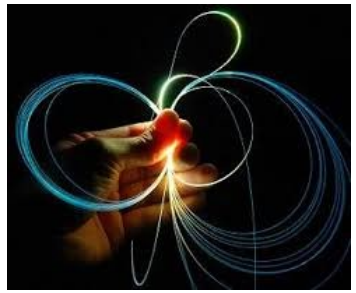








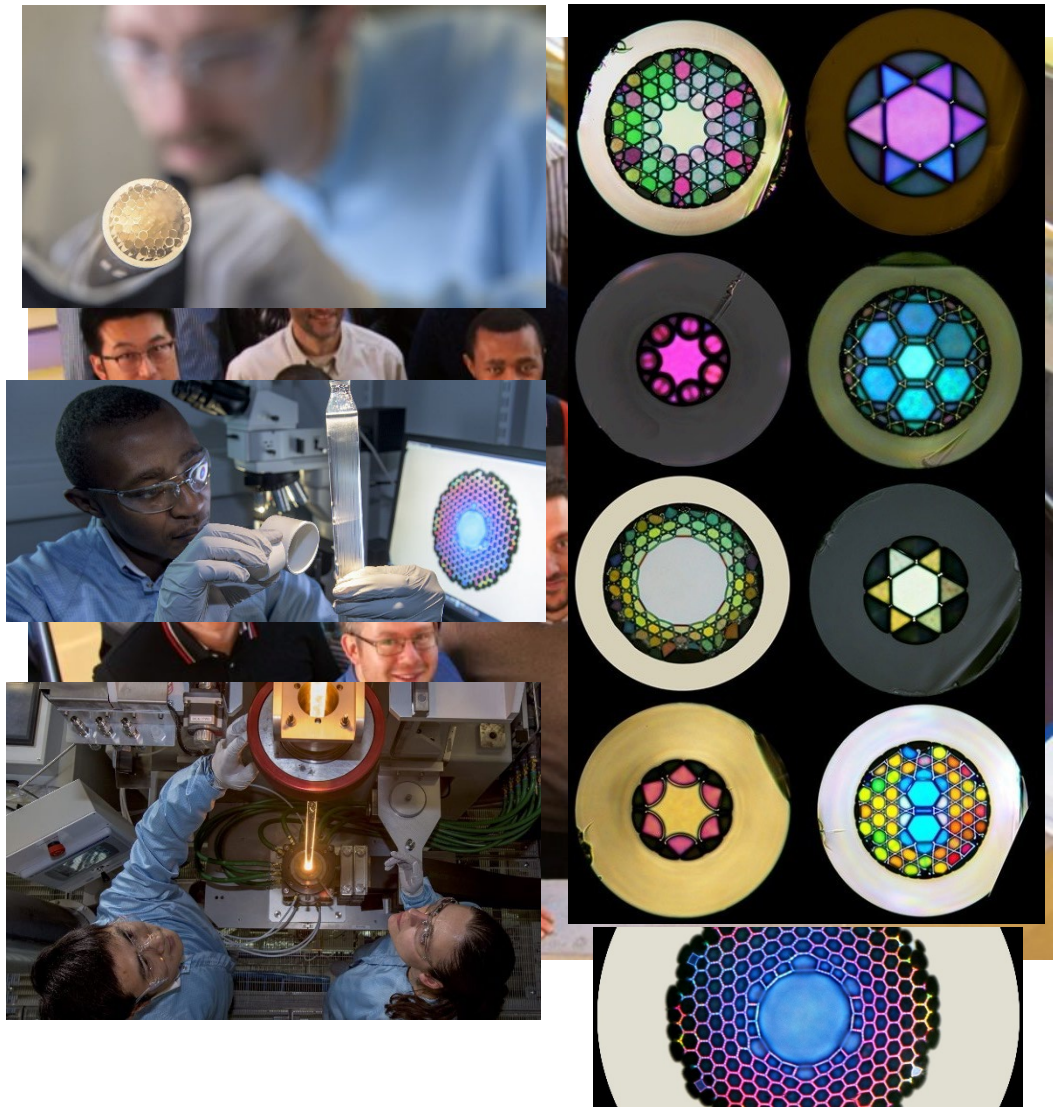




Light

https://www.orc.soton.ac.uk/

Micro-Structured Optical Fibres Group

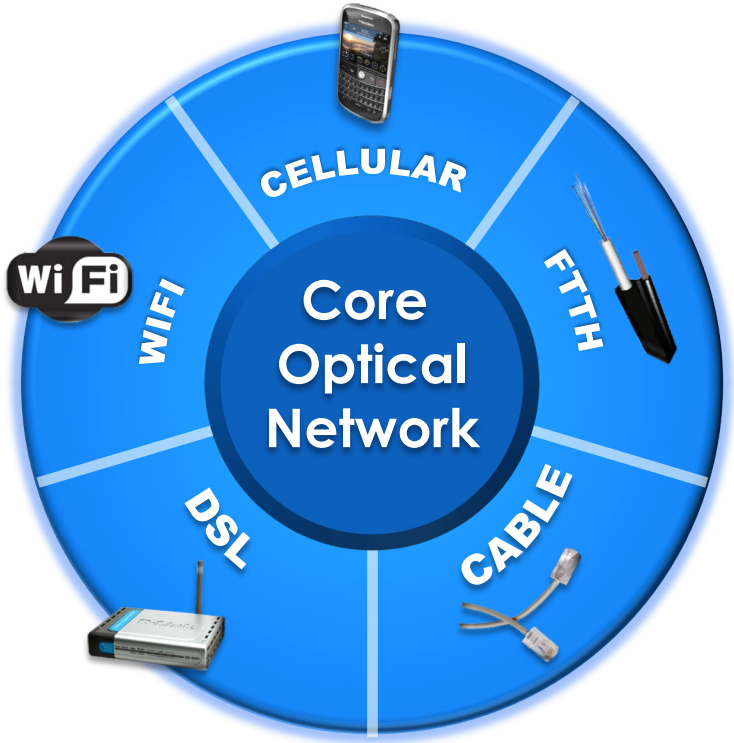


My colleagues and I design, make and study all types of optical fibres and use them for many applications:

- Making sensors
- Making very powerful lasers to cut, weld and machine car parts for example
- **Making the internet possible**

We are an information society…

- 50% traffic growth year on year
- All of the data has to go across the core network …

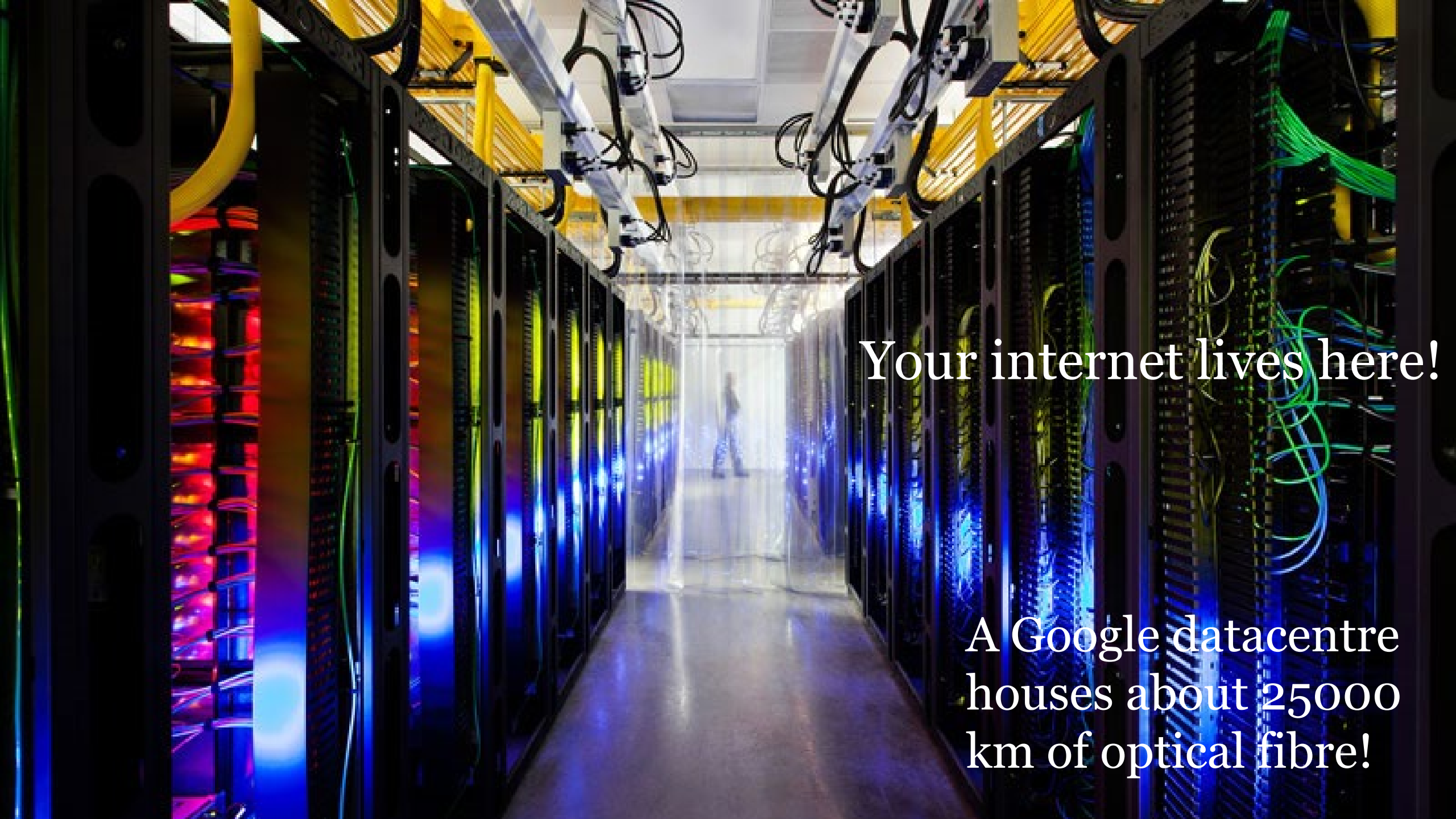


We want...

- Any content on any screen
- Instant downloads
- Storage in the cloud
- Video teleconferencing for free
- Streamed HD 4k 8k video
- … and we are all becoming content providers as well as consumers

UNIVERSITY OF Southampton

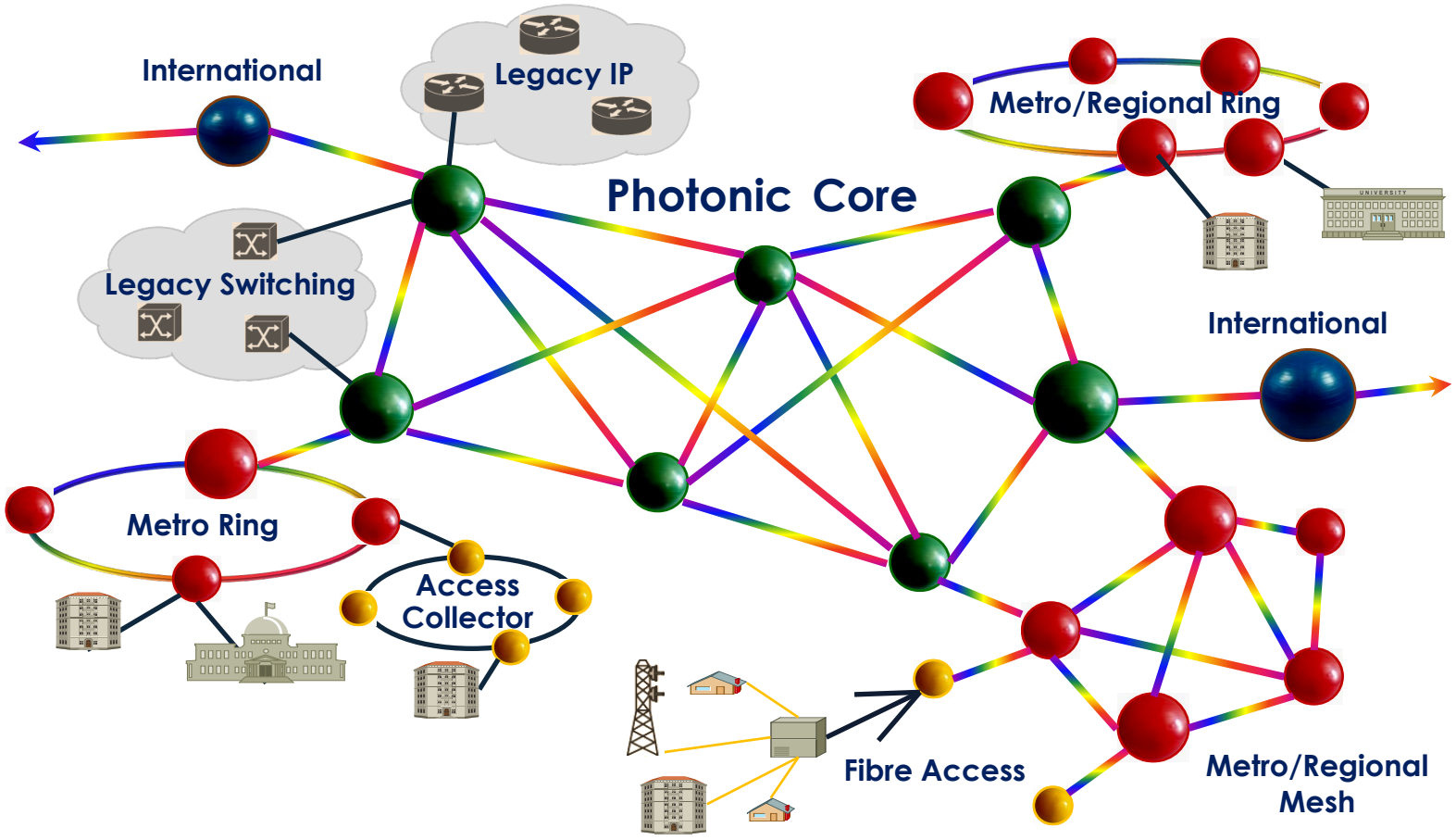
Long Ago, People Danced @ Concerts, Now They Video / Click / Share / Tweet…


Your internet lives here!
A Google datacentre houses about 25000 km of optical fibre!

Making a google search ....

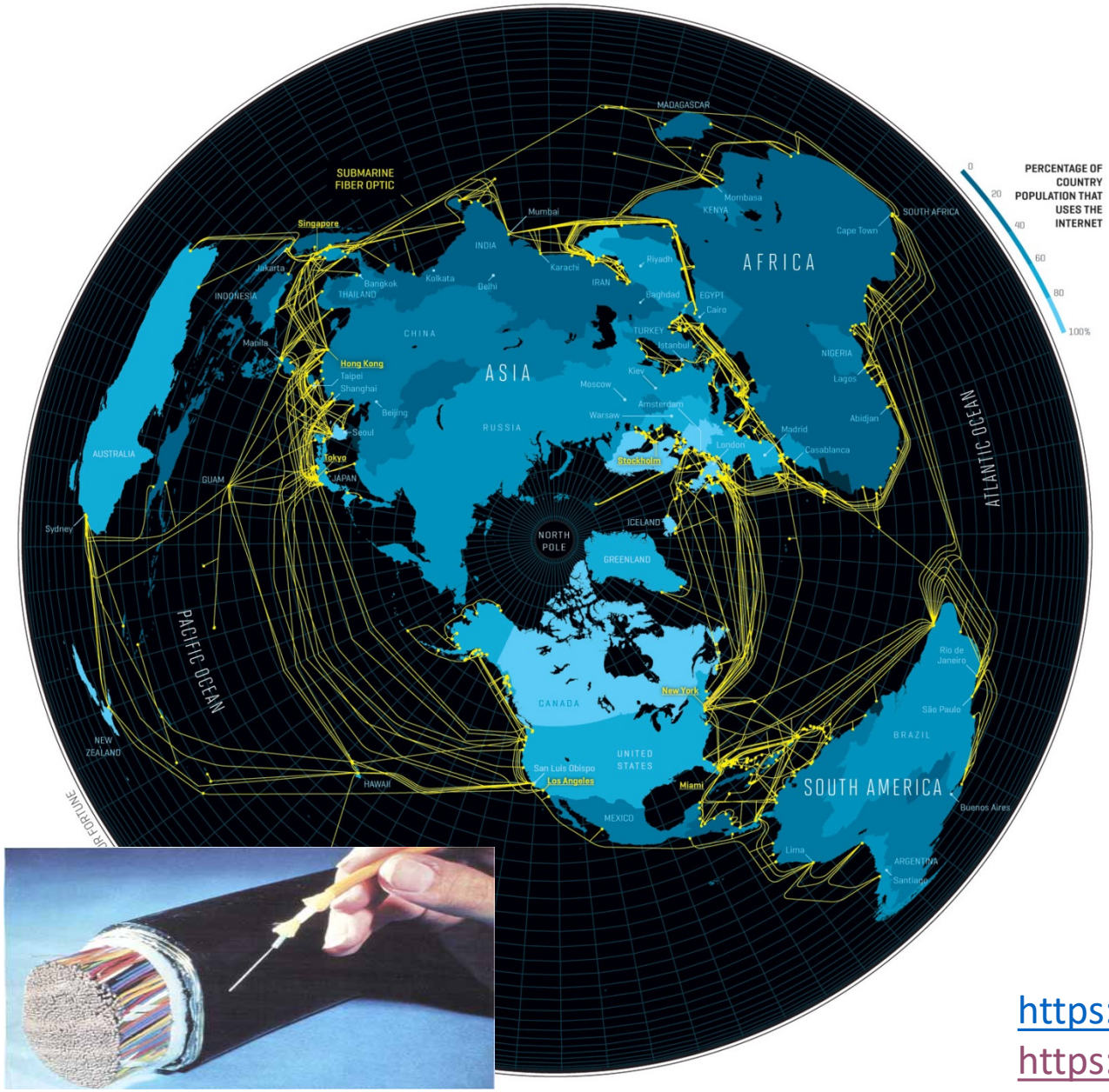
Optics everywhere in communications!

UNIVERSITY OF Southampton



Under the sea, over continents, under cities and roads, maybe to your home!

The undersea network



4 billion km of total installed fibre by 2015
(100000 times the Earth circumference)

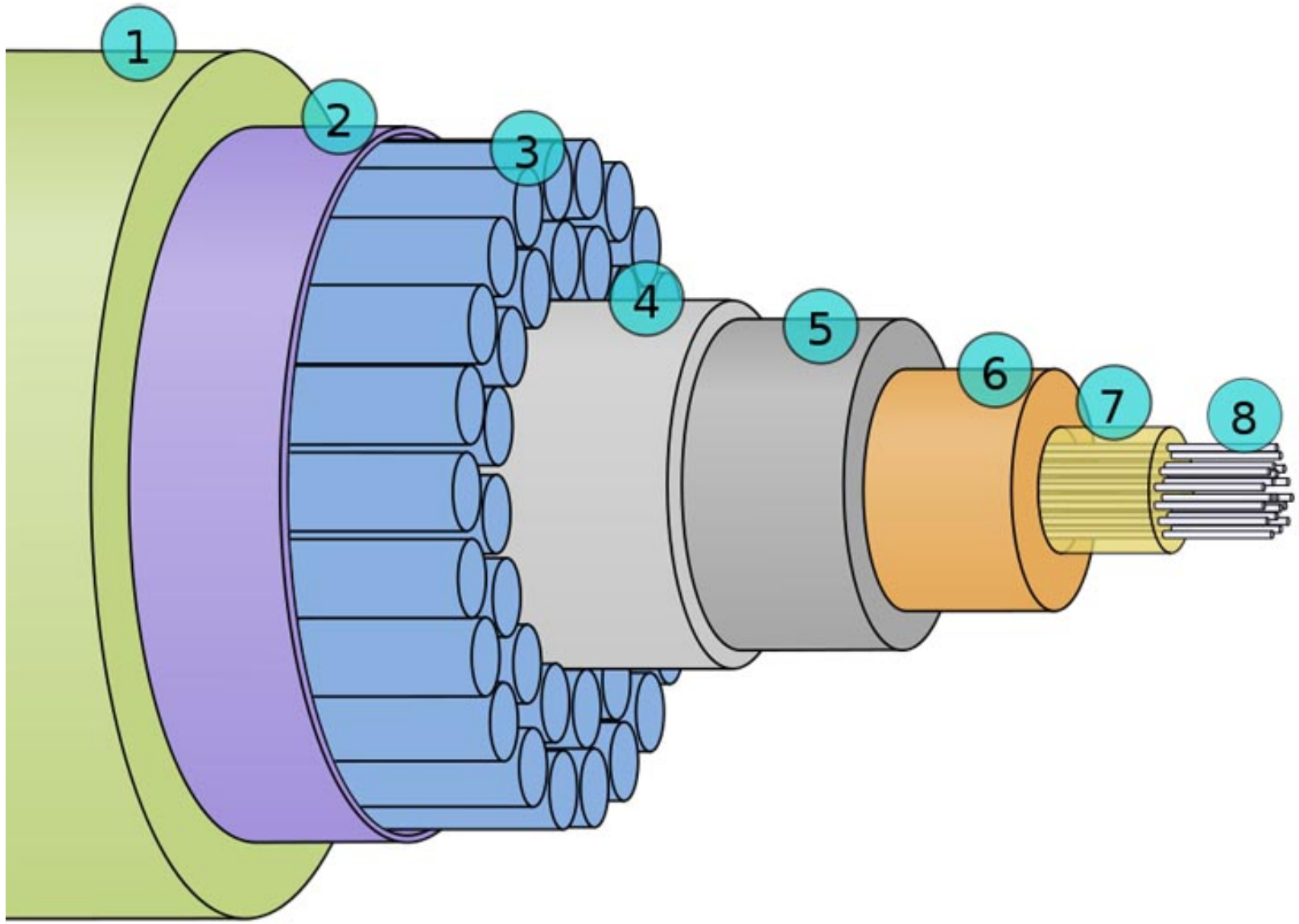
400 million km of fibre fabricated in 2019

Worldwide Internet traffic: 50 EXAbytes per year (10^{18}), the equivalent of 150 billion books transmitted every day

Aggregate data capacity transmitted in a single fibre:

- 1986: 1 Gigabit/s
- 2018: 10 Petabit/s

https://www.submarinecablemap.com/#/
https://www.infrapedia.com/app



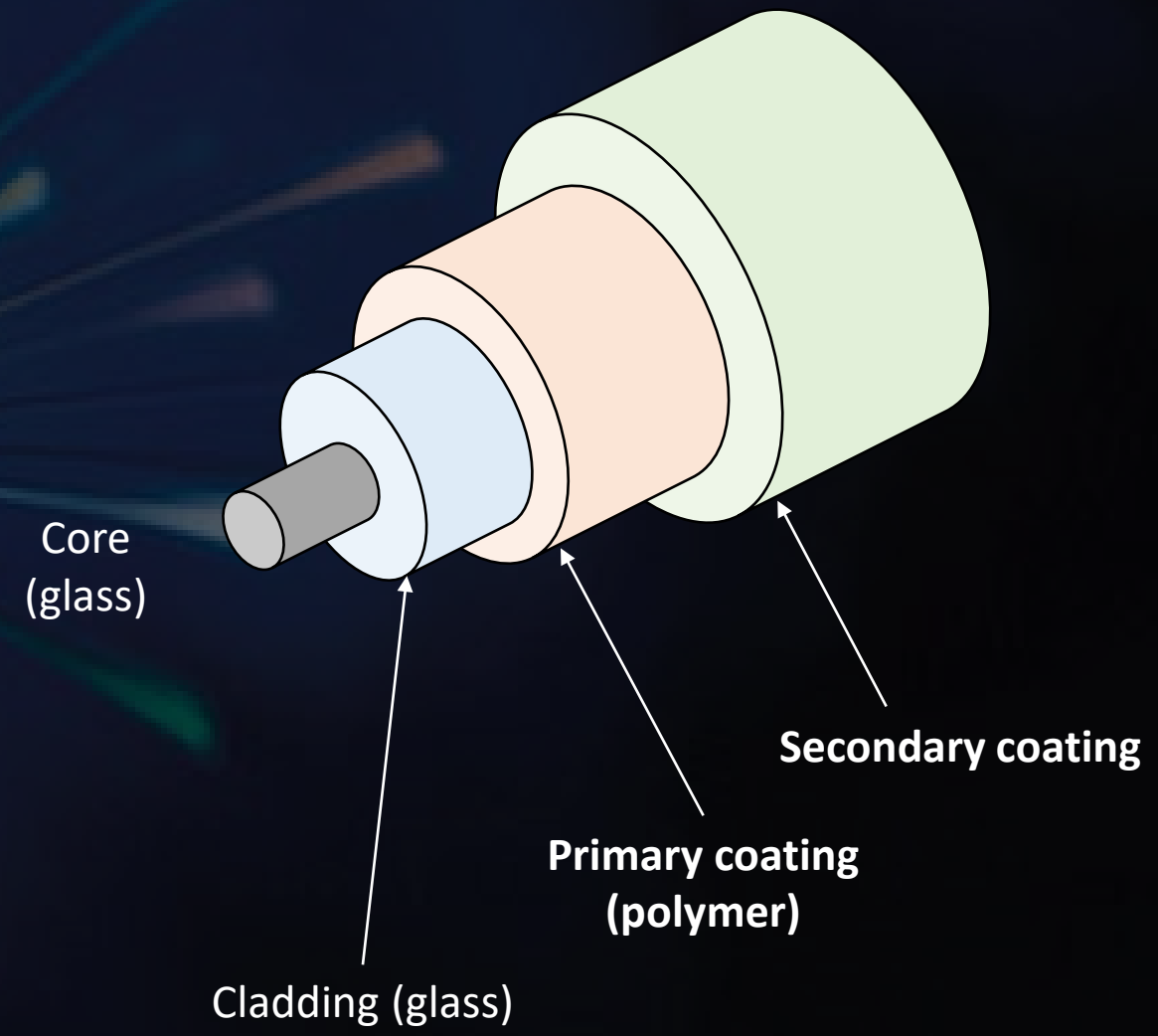
A cross section of the shore-end of a modern submarine communications cable:

1 – Polyethylene
2 – Mylar tape
3 – Stranded steel wires
4 – Aluminium water barrier
5 – Polycarbonate
6 – Copper or aluminium tube
7 – Petroleum jelly
8 – Optical fibres

If you want to watch a cool video on this → https://www.youtube.com/watch?v=M7stcJ65_X4

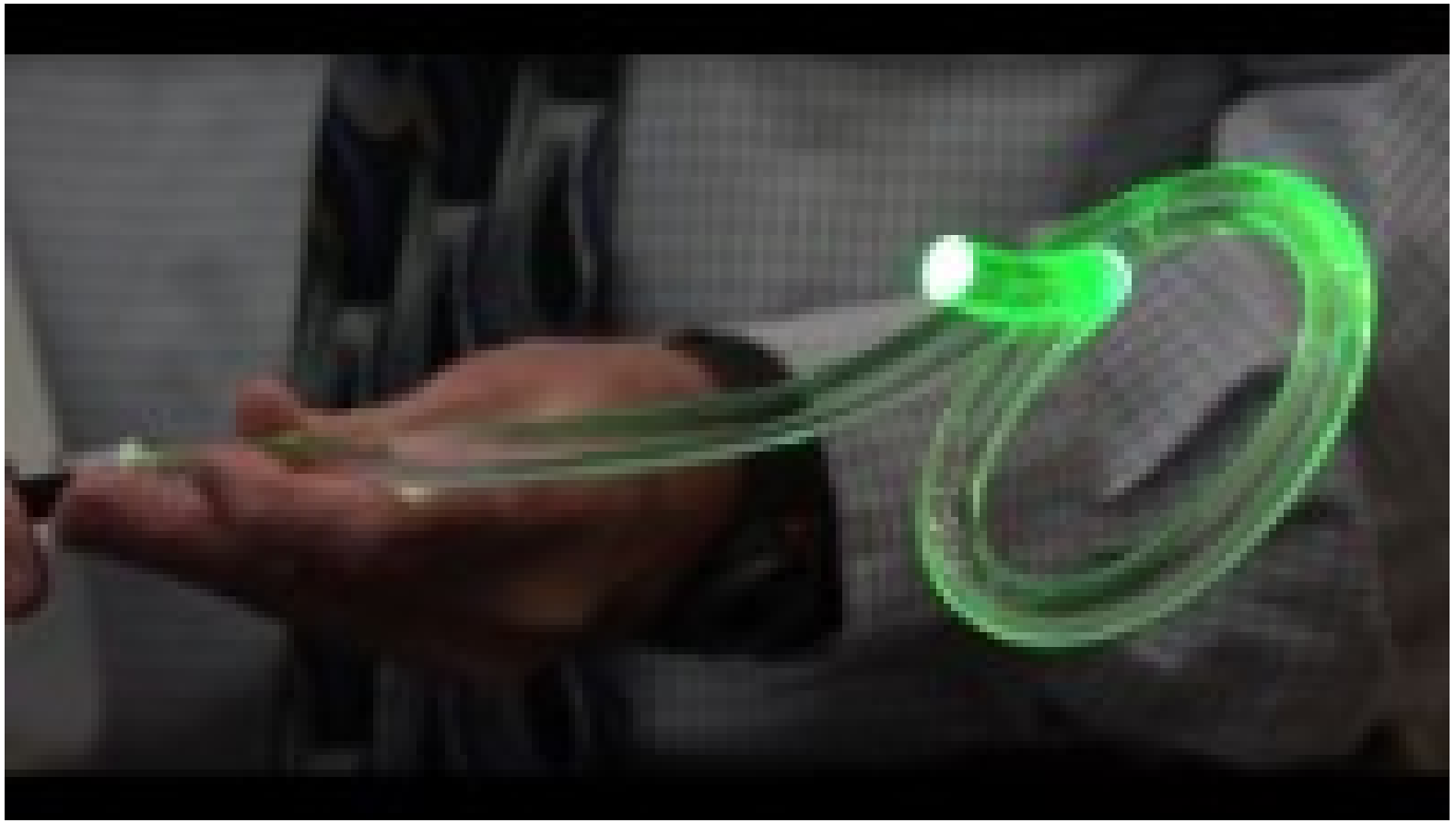
Optical fibre

- Extremely transparent, < 0.2dB/km
  1% of light left after 100km!
- Huge bandwidth, a single fibre can carry 100 million zoom calls



Usually only 125μm diameter

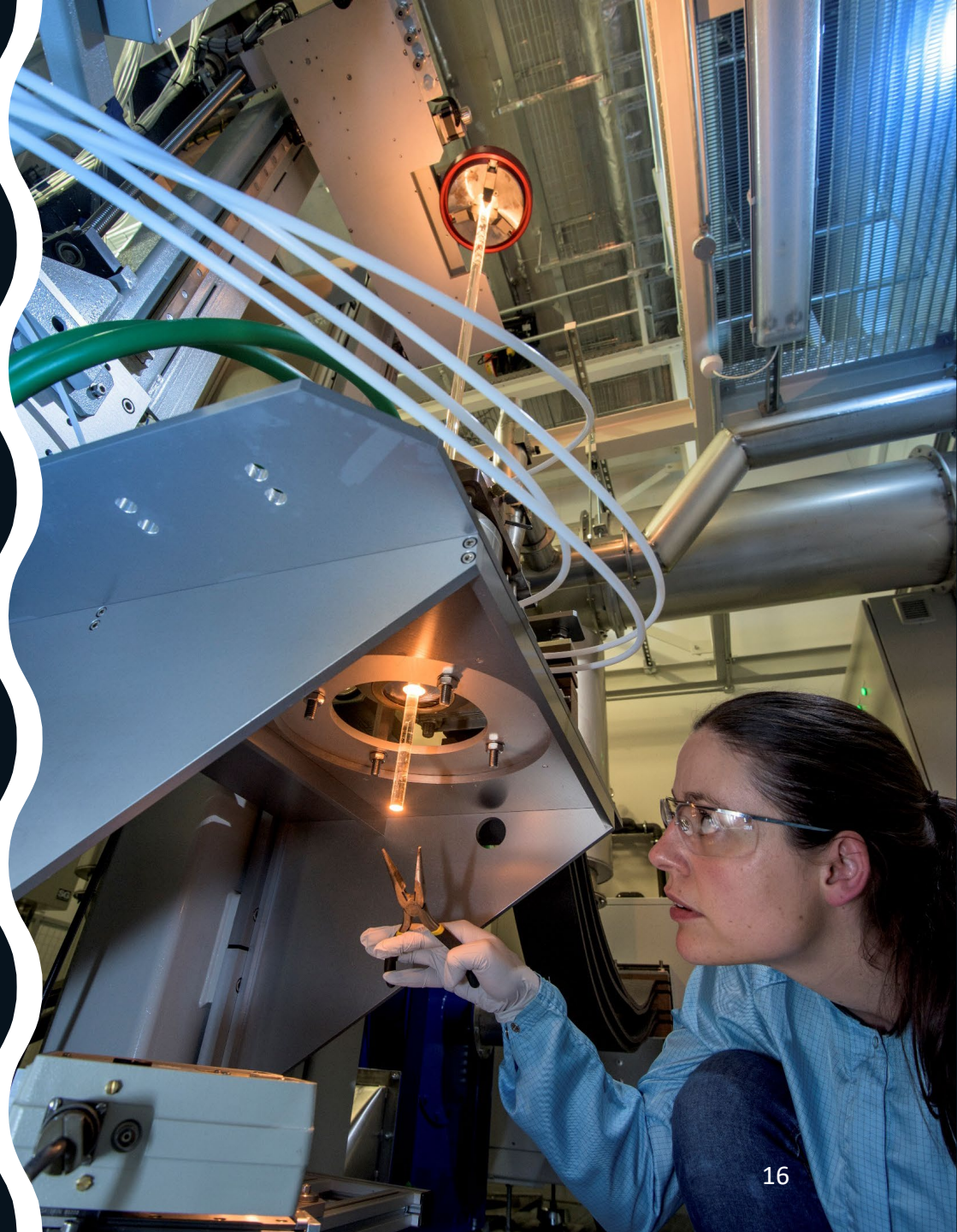
How does it work?



https://www.youtube.com/watch?v=Lic3gCS_bKo

How are they made?

- Start from a fatter version of the desired structure called a preform
- Mount the preform on an optical fiber draw tower
- Control the speed at which the preform is fed and that at which the fibre is drawn

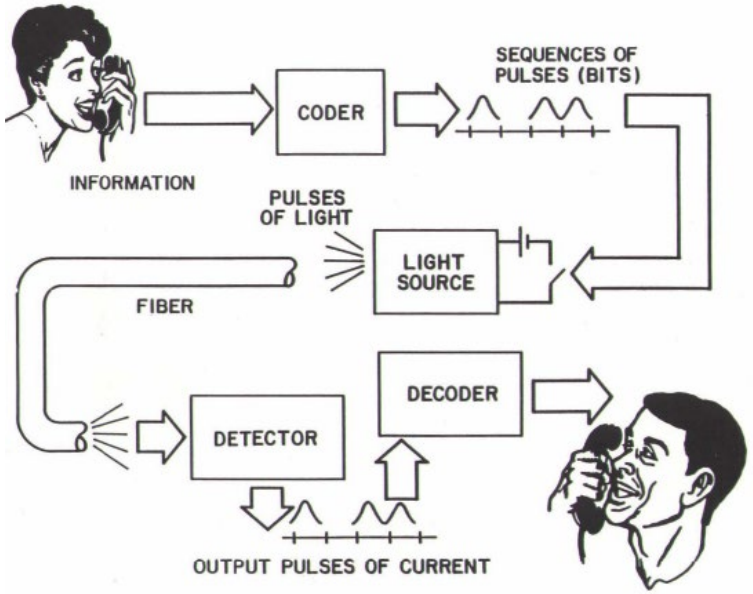


How are they made?

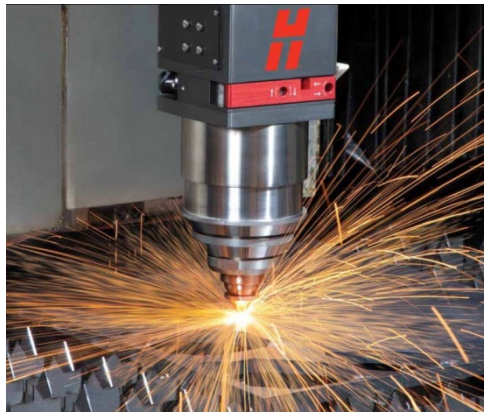
What else can you do with an optical fibre?

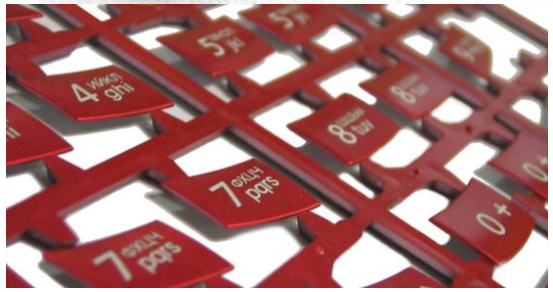
UNIVERSITY OF Southampton

Telecommunications

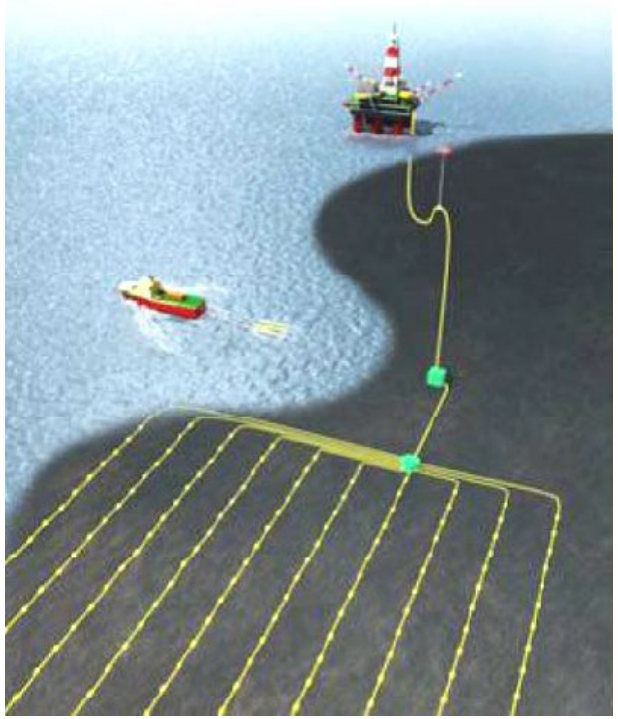


Manufacturing & Defence



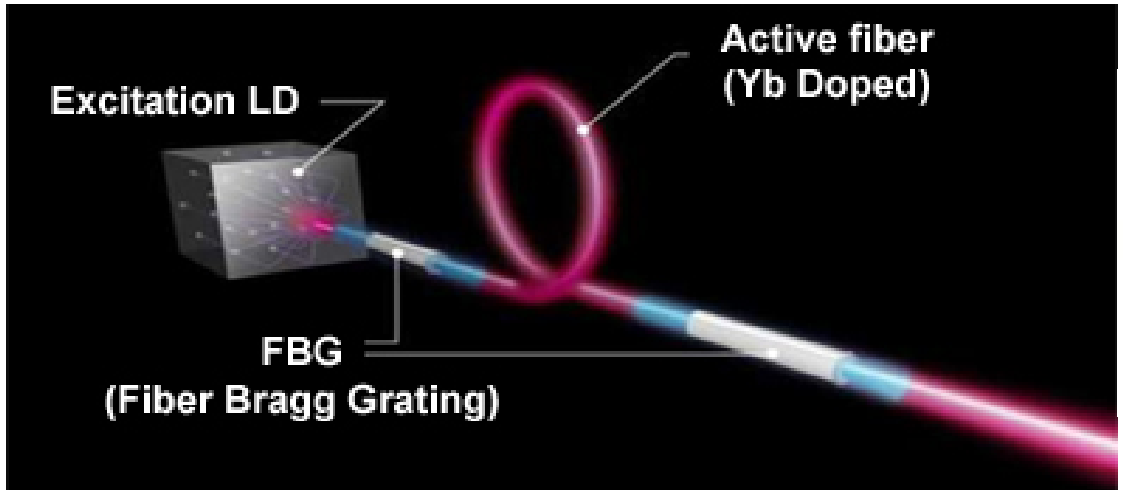


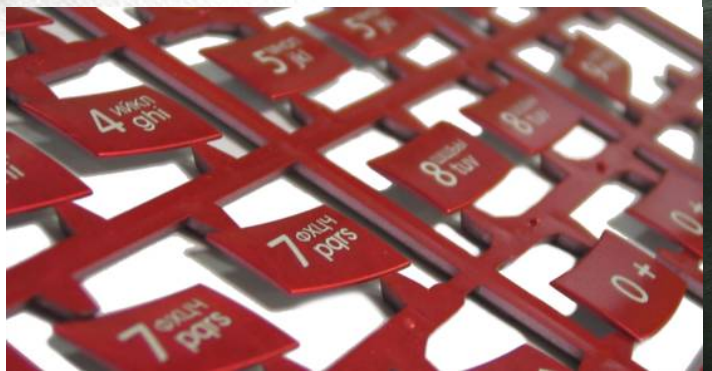
Sensing

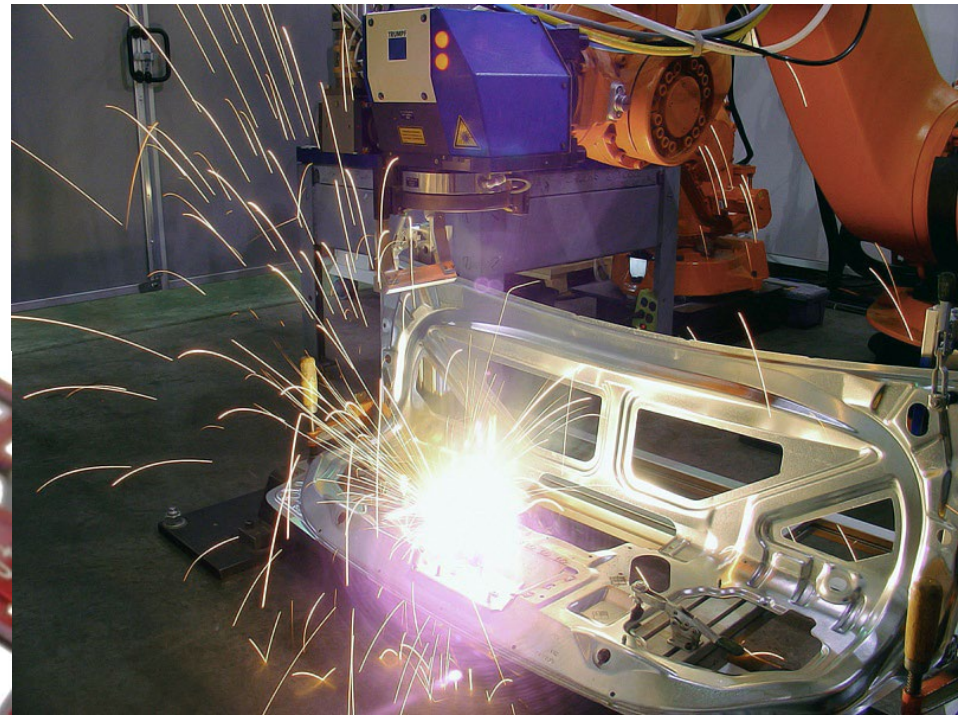


Powerful lasers inside fibres

UNIVERSITY OF Southampton





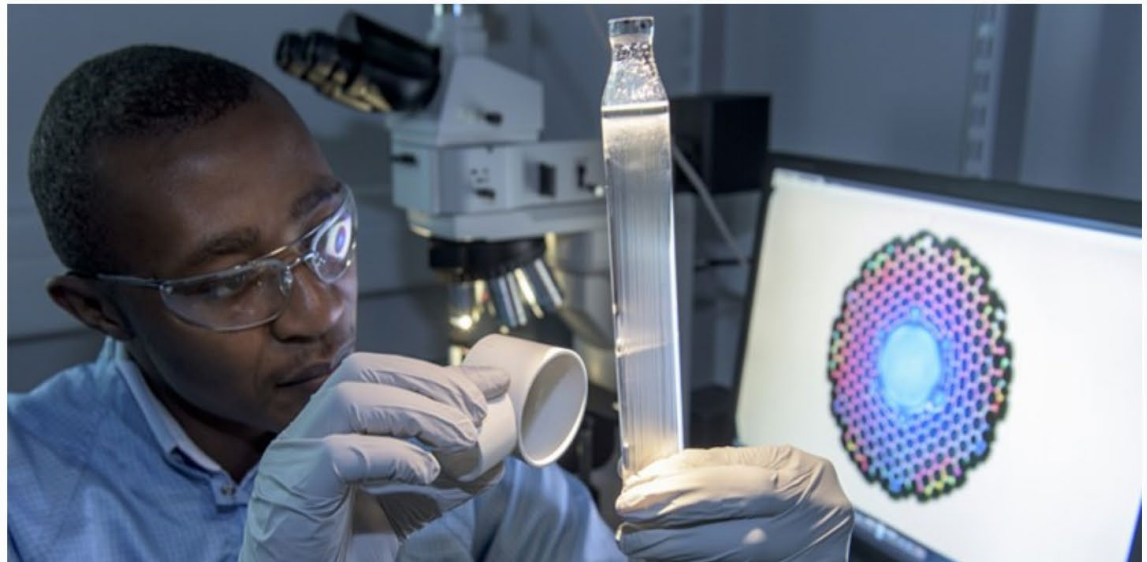


FEATURE OPEN

Is Nothing Better Than Something?

Jeff Hecht

The idea of guiding light through hollow pipes dates to the 19th century, but solid-core fibers made much better optical waveguides. Now the emerging technology of hollow-core fibers has resurrected an old idea.



Download PDF
Comment

Online Extras

> References and Resources

Share this Article

Also in this Issue

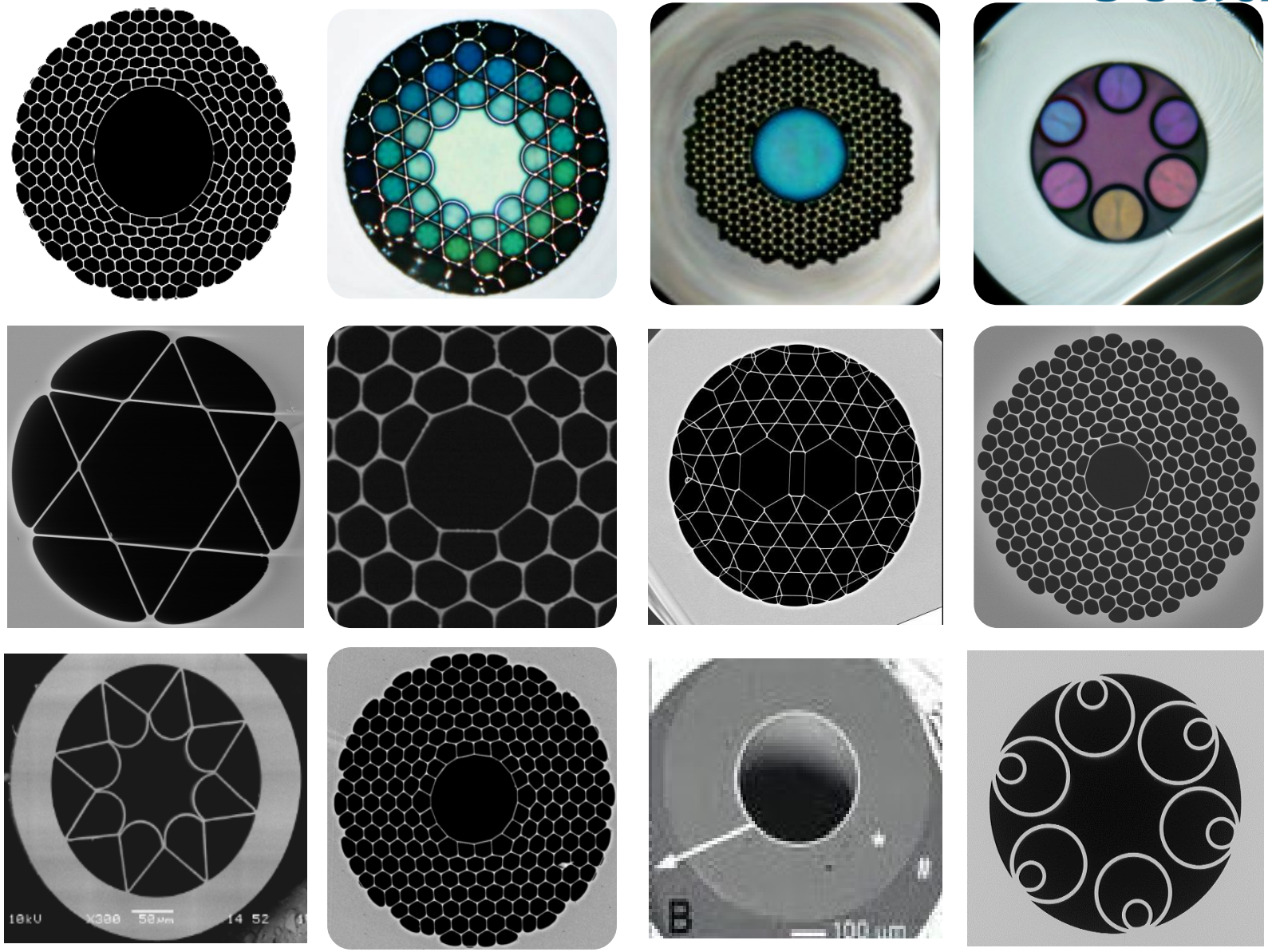
Silicon Carbide: From Abrasives to Quantum Photonics

Tim's Vermeer, Reconsidered

Recent Headlines

What next?

UNIVERSITY OF Southampton



Some advice if I may…

- A career in engineering is extremely rewarding
- Try first, try often and learn from your mistakes
- Treat everyone kindly
- Success comes from hard work – there are no shortcuts