

CAN WE BUILD A BLACK HOLE?



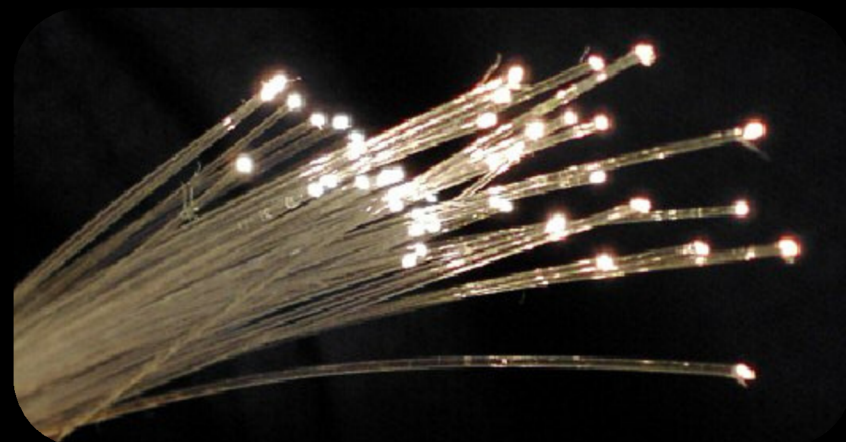
**VNiVERSIDAD
D SALAMANCA**

ROSA BERMEJO SABUGO
BSc Physics

An optical analogy allows us to reproduce black-hole horizons in the laboratory.

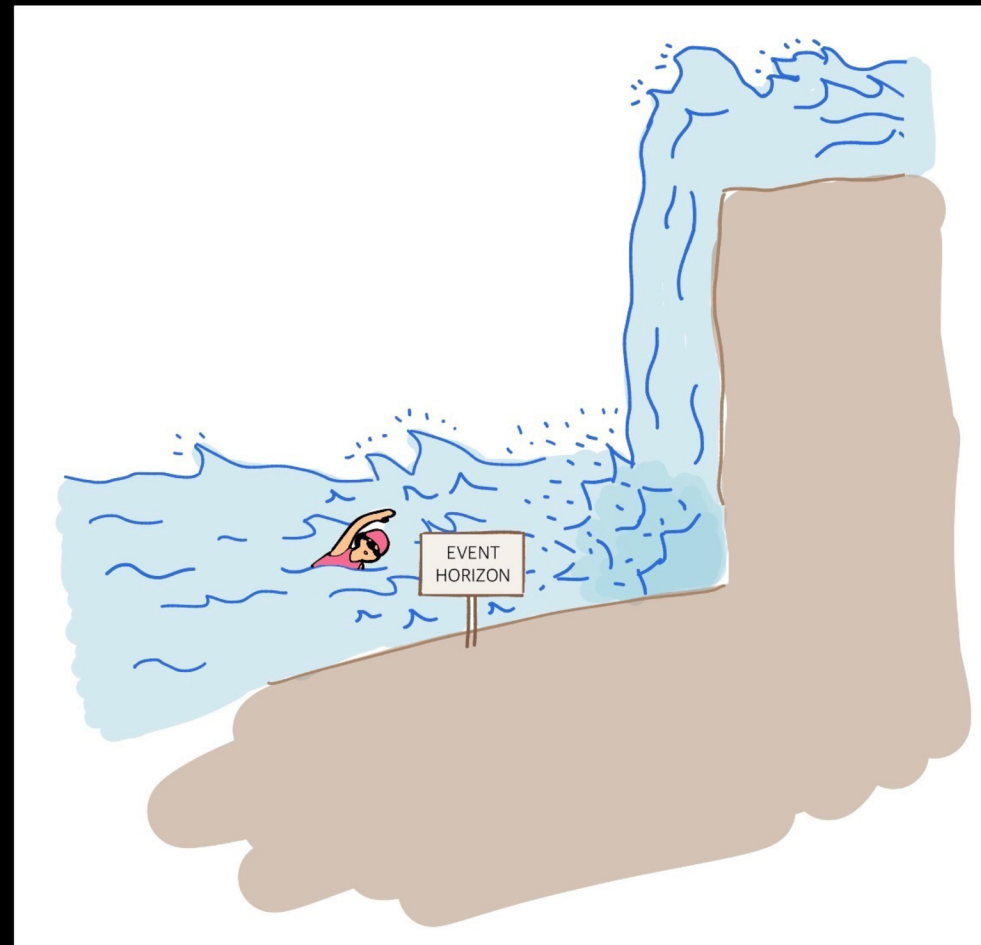
Instead of gravity, light propagation in an optical fibre creates the effect.

The experiment provides a way to test ideas that are impossible to observe directly in astrophysical black holes.

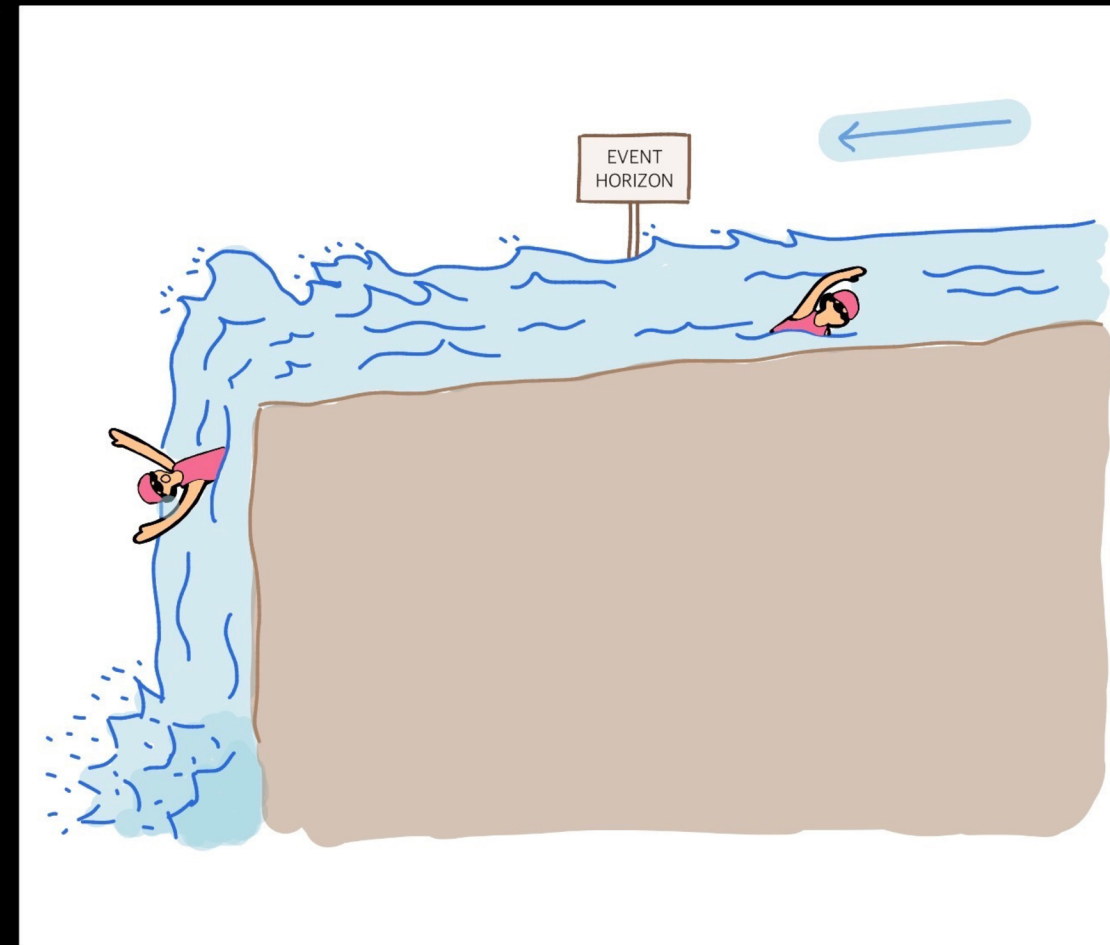


WHAT'S THAT ABOUT?

White hole



Black hole



A swimmer moving against an increasingly fast river represents light escaping gravity.

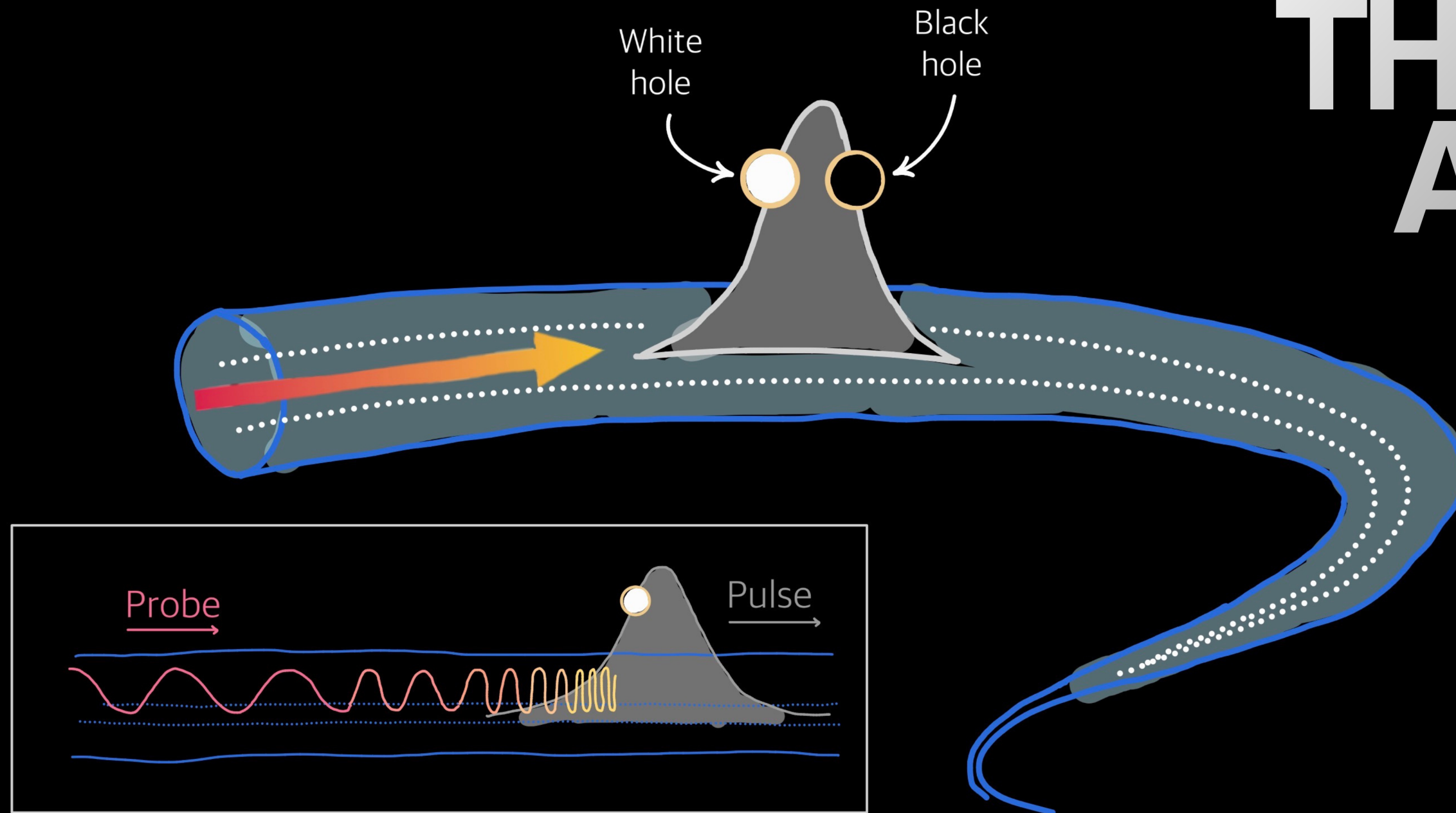
As the current becomes faster than the swimmer, a point of no return appears: the *event horizon*.

A reversed flow illustrates the analogue of a white hole.

UNDERSTANDING THE EVENT HORIZON

$$u = \frac{c}{n + \omega \, dn/d\omega}$$

CREATING THE OPTICAL ANALOGUE



A high-intensity laser pulse travels through a photonic crystal fibre.

The optical Kerr effect changes the fibre's refractive index around the pulse.

A probe pulse slows down until it matches the pulse velocity, forming analogue horizons.

WHY IS THIS IMPORTANT?

Stephen Hawking predicted that black holes emit thermal radiation.

$$T_H = \frac{\hbar c^3}{8\pi G M k_B}$$

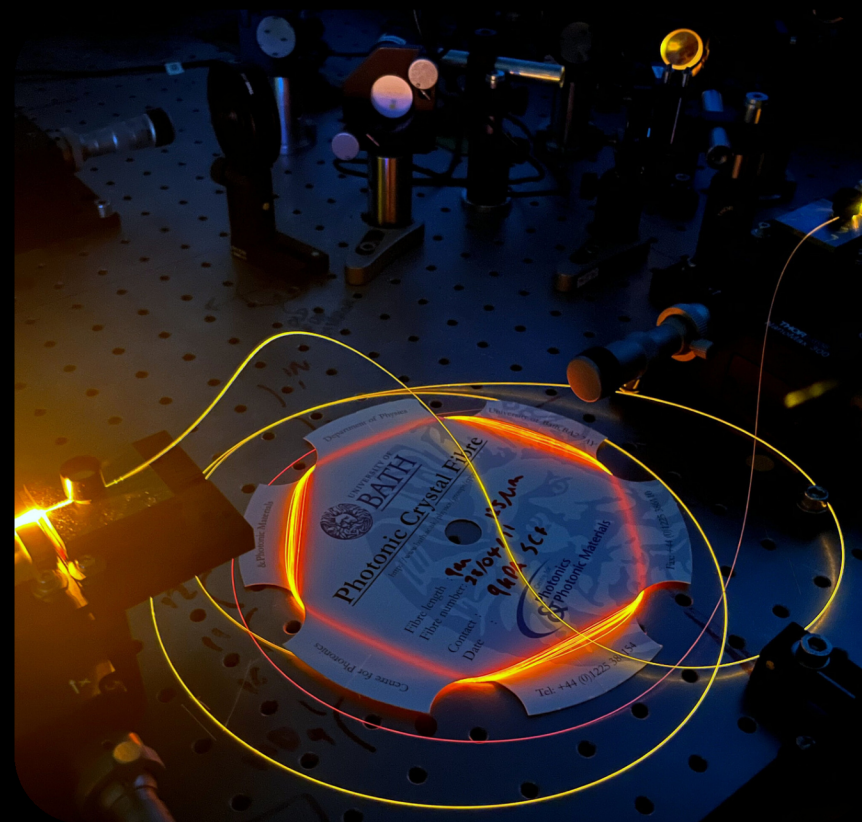
- The expected signal is far too weak to detect from astrophysical black holes.
- Optical analogues may reproduce the same physics under controlled laboratory conditions.





CONCLUSION

Black-hole analogues do not reproduce gravity itself, but they mimic event horizons.



Optical fibres provide a practical platform to study horizon physics.

These experiments could offer indirect evidence supporting Hawking radiation.

Drori, J., Rosenberg, Y., Bermudez, D., Silberberg, Y., & Leonhardt, U. (2019). Observation of Stimulated Hawking Radiation in an Optical Analogue. [arXiv:1808.09244 \[gr-qc\]](https://arxiv.org/abs/1808.09244)

**Thank you for your
attention!**



**VNiVERSiDAD
D SALAMANCA**

ROSA BERMEJO SABUGO
BSc Physics