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# From gravitational black holes to analogue gravity

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Black holes are intriguing and singular objects; Einstein did not even believe in their existence. However, the first observation of a rotating black hole in our universe has been recently reported and is an undeniable confirmation of their presence.

In 1974, Hawking predicted that black holes are not completely black, but emit a thermal radiation at a certain temperature $T_{\mathrm{H}}$, the so-called Hawking temperature[1]. However, the Hawking radiation is very faint and would be completely lost in the Cosmological Microwave Background.
A new breakthrough occurred in 1981, when Unruh showed that the dynamics of sound waves propagating in a convergent fluid flow was equivalent to the one of a massless scalar field propagating in a curved spacetime[2]. He then suggested to use hydrodynamic analogues of gravitational black holes to detect the elusive Hawking radiation.

In this talk, we pedagogically present how the transition from a subsonic to a supersonic flow can mimic an acoustic black hole for sound waves. Then, we discuss the recent experimental detection of spontaneous Hawking radiation in a Bose-Einstein condensate[3]. We show in particular how quantum fluctuations in these quantum systems can be related to emission of analogue Hawking pairs. We finally provide a theoretical interpretation of experimental observations[4].

**References**


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4. M. Isoard, N. Pavloff, *Departing from thermality of analogue Hawking radiation in a Bose-Einstein condensate*, arXiv:1909.02509 (2019).


## Field

Black holes/acoustic flow

## Language


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