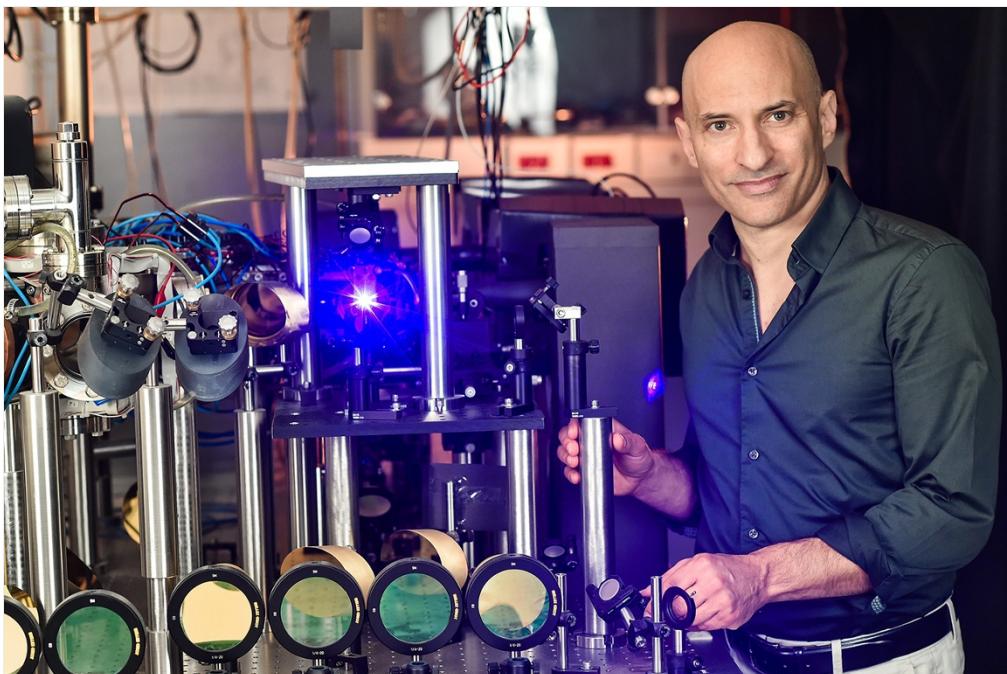


One-man band: the solo physicist who models black holes in sound

Working alone, Jeff Steinhauer has created a sonic analogue of Hawking radiation.

Ron Cowen

15 August 2016



Nitzan Zohar, Office of the Spokesperson, Technion

Jeff Steinhauer makes imitation black holes in the lab.

Jeff Steinhauer is no longer with the band. Years ago, the physicist played drums with a rock 'n' roll group at his department at the Technion–Israel Institute of Technology in Haifa. But lately, he has been busy on a solo project: to trap noise, not create it.

Working on his own since 2013, Steinhauer has been perfecting artificial, lab-made systems that suck in sound, rather than cosmic black holes trap light. The research involves the creation of atomic vibrations — sound waves — in accelerated, ultracold atoms. The sound waves cannot outrun the movement of the medium in which they were created: an analogue for the way in which the monstrous gravity of a black hole traps light radiation.

In a paper published on 15 August¹, Steinhauer — the sole author — reports that these imitation black holes nevertheless emit sound waves because of quantum-mechanical effects, in line with physicist Stephen Hawking's prediction², 42 years ago, that cosmic black holes emit light. Hawking radiation has never been observed. But Steinhauer's sonic analogue, if confirmed, might provide a way to explore the effect.



Artificial black hole creates its own version of Hawking radiation

For physicists, one of the most striking aspects of the report is that Steinhauer published the finding alone. Most other groups that work on similar systems have at least a few postdocs and graduate students, says William Unruh, a physicist at the University of British Columbia in Vancouver, Canada, who in 1981 first predicted the creation of a sound-wave analogue of black holes³. "It's unusual to have just one person working on it," he says.

To his own tune

But that's no surprise to several people who are colleagues of Steinhauer or who have worked in his department. They describe him as intense, private and relentless: a virtual one-man band in the laboratory. "He's pretty persistent and some might even say stubborn," says Unruh. "He's the biggest perfectionist I've ever seen," says Shahar Rinott, who earned a master's degree with Steinhauer at Technion and was one of six of Steinhauer's co-authors — all master's students who later left the lab — in a 2010 paper that reported

the first sonic analogue of a black hole⁴. Even a minor equipment malfunction that did not interfere with an experiment would lead Steinhauer to halt work until he understood what went wrong, Rinott says. (Ultimately, Rinott says that he chose to leave Steinhauer's lab because, when it came time for his PhD, he wanted a doctorate adviser who allowed him more independence).

Steinhauer says that he did not set out to work alone — and points out that, in the past few months, he has hired a postdoc. "I probably have a reputation that it's difficult to work in my lab," he says — adding that the masters'-degree students with whom he worked usually found it hard to learn the information needed for the experiments. But a one-man-lab has its advantages, he says: "I'm able to work on that one important project all day every day."

Steinhauer, who turns 50 this week, has always been persistent, independent and a risk-taker. In his office at the Technion, he still keeps a racing bicycle that he assembled as a teenager, growing up in Los Angeles, California. The bicycle was built from parts that he bought using an insurance payout, after a near-fatal car accident mangled his old bike and broke his front teeth.

After completing his PhD at the University of California, Los Angeles, in 1995, Steinhauer decided that he wanted to try to live in Israel, in part because of his Jewish roots. He hopped on a plane to Tel Aviv with no job to go to and a place to stay for a few days. "My mother thought I would come back after a few months," he says. But bar a year's postdoc position overseas in 2002, he has been there ever since.

In the basement of the Technion's physics building, Steinhauer still keeps his drum set. His favourite tune? 'Black Hole Sun', by US rock band Soundgarden.

Nature | doi:10.1038/nature.2016.20437

References

1. Steinhauer, J. *Nature Physics* <http://dx.doi.org/10.1038/nphys3863> (2016).
2. Hawking, S. W. *Nature* **248**, 30–31 (1974).
3. Unruh, W. G. *Phys. Rev. Lett.* **46**, 1351 (1981).
4. Lahav, O. et al. *Phys. Rev. Lett.* **105**, 240401 (2010).