

## **Black hole revelation may upset understanding of the universe**

By Oliver Moody, The Times, 25 April 2016

Stephen Hawking may at last be in line for a Nobel prize after another scientist claimed to have found evidence to back his boldest and most far-reaching theory.

### **Vindication of Hawking's 42-year-old discovery**

If the findings are confirmed, they will not only be a vindication of Hawking's 42-year-old discovery but could open up a topsy-turvy vision of the universe in which black holes can cough themselves into nothingness, and all of history and memory may be an illusion.

In 1974 Hawking calculated that tiny particles should be able to rob black holes of an infinitesimally small fraction of their energy and then flee the crime scene — meaning that the black holes would slowly evaporate over time, vomiting out all the dust, light and passing stars they had swallowed in a trickle of heat.

The trouble is that this “Hawking radiation” is usually so delicate as to be all but impossible to detect across many thousands of light-years. Yet Jeff Steinhauer, professor of physics at the Technion university in Haifa, believes he has got around this problem by creating a laboratory-sized “black hole” made out of sound, and watching particles steal energy from its fringes.

In a paper posted on the physics website arXiv, he describes how he cooled helium to a shade above absolute zero and churned it around fast enough to make a barrier that no sound should be able to cross; the equivalent of a black hole's event horizon. Professor Steinhauer said he had found signs that phonons, the very small packets of energy that make up sound waves, were leaking out of his sonic black hole just as Hawking's equations predict they should.

### **The results are controversial**

Physicists are now trying to work out if the observations could be down to something else, such as tiny vibrations caused by flaws in the set up.

Silke Weinfurter, a physicist at the University of Nottingham who is trying to detect Hawking radiation outside a blackhole barrier in fast-flowing water, said Professor Steinhauer's experiment was not conclusive. “The experiments are beautiful,” he said. “Jeff has done an amazing job, but some of the claims he makes are open to debate. This is worth discussing.”

In his Reith lectures, delivered at the Royal Institution this year, Hawking said that he expected to win a Nobel if a particle accelerator such as the Large Hadron Collider at Cern produced “micro black holes”.

He said that the violent death of black holes that formed in the early life of the universe could have left large smears of intense Hawking radiation bouncing around between stars today.

Other have pinned their hopes on the discovery that particles around waves in water, laser beams in glass and tremors in ultra-cooled “superfluids” can behave exactly as they would around the edges of black holes.

## **A vista of philosophical bedlam**

If Hawking turns out to be right, his theory opens up a vista of philosophical bedlam. In a world where everything a black hole eats is ultimately converted into pulses of light, the physical links between the past and the future can be snapped. “Information” — a technical term for the complex handshakes of subatomic particles that hold acorns, tax accountants and galaxies together — would be wiped from the record.

“This raises a serious problem that strikes at the heart of our understanding of science,” Hawking said in his second Reith lecture. “If information were lost in black holes, we wouldn’t be able to predict the future, because a black hole could emit any collection of particles. If determinism, the predictability of the universe, breaks down with black holes, it could break down in other situations. Even worse, if determinism breaks down, we can’t be sure of our past history, either. The history books and our memories could just be illusions.”

Hawking is now hard at work on resolving this paradox. In the meantime, he will certainly not give up his hopes of a Nobel: Peter Higgs, who predicted the existence of the Higgs boson, had to wait 49 years for his medal.

*The Times*