

'Sleeping beauty' studies ahead of their time

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Second life **No-one noticed your research? Don't worry, it could be big in 50 years.**

In a study published today, US researchers show that changes in society and advances in understanding can breathe new life into sometimes long-forgotten science papers such as Einstein's take on quantum mechanics.

The finding, published in the *Proceedings of the National Academy of Sciences* (<http://dx.doi.org/10.1073/pnas.1424329112>) (PNAS), has implications for the increasing focus on citation impact as a basis for promotion, tenure, hiring decisions, institutional ranking and research funding grants.

Dr Alessandro Flammini and colleagues at the Centre for Complex Networks and Systems Research at the [University of Indiana](http://www.iu.edu/) (<http://www.iu.edu/>), show so-called "sleeping beauties" of the science world are more common than previously thought.

And increasingly papers that do gain a second life are being used in disciplines outside the field of the original paper.

According to the study authors, a sleeping beauty in science refers to a paper whose importance is not recognised for several years after publication.

Its citation history exhibits a long hibernation period followed by a sudden spike of popularity, the authors note.

For the study, the authors analysed the citation history of more than 22 million scientific papers published in all disciplines of natural and social sciences over a time span of more than a century.

The results show many sleeping beauties become highly influential more than 50 years after their publication.

Top sleepers

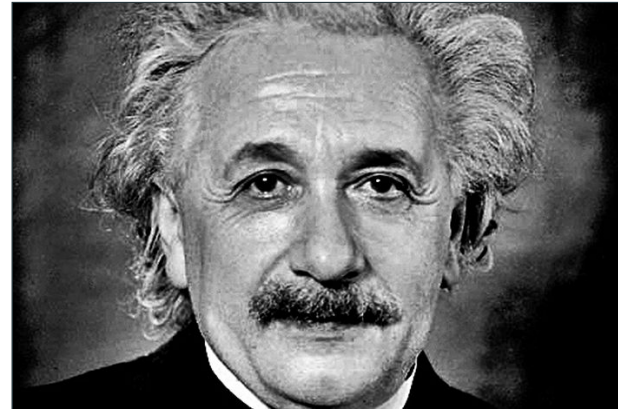
The fields of physics, chemistry, and mathematics produce top sleeping beauties at higher rates than other scientific fields.

Flammini says top sleeping beauties often achieve delayed exceptional importance in disciplines different from those where they were originally published.

"This suggests that a 'premature' topic may fail to attract community attention even when it is introduced by authors who have already established a strong scientific reputation," he writes.

Among the most famous examples of this effect is a paper written by Albert Einstein in 1935 with his associates Boris Podolsky and Nathan Rosen, known as the EPR paradox that attempted to demonstrate quantum mechanics to be an incomplete theory.

The article [Can Quantum Mechanical Description of Physical Reality Be Considered Complete?](http://journals.aps.org/pr/abstract/10.1103/PhysRev.47.777) (<http://journals.aps.org/pr/abstract/10.1103/PhysRev.47.777>) was relatively dormant after initial citations until 1994.



A paper on quantum mechanics written by Einstein in 1935 was largely forgotten until 1994 (Wikimedia Commons)

From that year, citations rose from around 10 a year to almost 100 annually in the mid-2000s as research interest in quantum mechanics grew.

Particularly interesting is the category of multidisciplinary sciences, which ranked third in the number of sleeping beauties and includes journals like *Nature*, *Science*, and *PNAS*.

Flammini says delayed recognition of these works signals that such contributions may be perceived by the academic community as too premature or futuristic.

Further journals in the multidisciplinary sciences subject category are more likely to attract publications that become field-defining even decades after their appearance, he adds.

This view is supported by the latest study that shows for 80 per cent of sleeping beauties, more than 75 per cent of delayed citations are in interdisciplinary fields.

Flammini says the study gives support to the view that the current trend to measure scientific impact through short-term citation metrics is misleading.

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