FONDAZIONE BRUNO KESSLER
MAGAZINE

The sociology of gravitational waves

February 14, 2019

At what speed do the "social ripples" produced by a great scientific discovery move? A book describes the exemplary case of gravitational waves

Space-time ripples cover long distances: produced by spectacular astrophysical phenomena like the violent fusion between two black holes or two neutron stars, they reach us practically undisturbed, after having traveled millions or billions of light-years. For a little over three years now, we have been able to observe them here on **Earth** thanks to instruments equipped with extraordinary technology, the culmination of an experimental effort that has lasted **fifty years**.

The discovery of gravitational waves – to which the third meeting of the cycle "Building the future" with **Giovanni Andrea Prodi** is dedicated – was truly one of the greatest scientific efforts ever achieved. That offers us the opportunity to reflect on an aspect that is often neglected but that is actually essential in modern science: at what speed do the "**social ripples**" move, that lead to the acceptance of a scientific discovery by, first of all, the researchers who made it, and then from the rest of the scientific community and the public?

If asked, **Harry Collins**, a British sociologist and director of the University of Cardiff's Center for the Study of Knowledge, who has closely followed the "hunt" for the elusive space-time ripples for over forty years, living in close contact with the researchers involved in the experiments and dedicating to the "**sociology of gravitational waves**" a number of scientific papers and four books.

The latest of these, Gravity's kiss (published a few months ago in Italy by Cortina Editore with the title *Un bacio tra le stelle*) analyzes with almost surgical precision the complete scientific and social path that led, after the observation of the first gravitational wave signal (detected on September 14, 2015 by the American LIGO experiment), to the official announcement of the discovery, on February 11, 2016. From a privileged observatory: Collins is in fact a member of the **LIGO-Virgo** collaboration (made up of over a thousand researchers) who made the discovery, and as such had access to its internal e-mail system. And the **e-mails** exchanged between scientists, collected and published by Collins anonymously, are the highlight of the book: a real diary that recounts five months of high tension, where scientific details mix (often falling into the background) with the **contrasting emotions** expressed by researchers struggling with the

adrenaline of a possible historic discovery. All in a very complex context, which also derives from the very particular history of this research field: already in the past, since the sixties with pioneer Joseph "Joe" Weber, the observation of gravitational waves had been reported but **none of these** had obtained the recognition of the scientific community.

Most of the collaborators had understood right away that the signal observed in September 2015, extremely strong and clean – representative with very little probability of error of a gravitational wave produced in the fusion process between two black holes – was **real**. Despite this, the fear that this could be another umpire alarm did not abandon the community: it could be a "**blind injection**", i.e. an artificially injected signal to test the experimental process (as it had already happened on two previous occasions). And some doubted that it was black holes that produced the waves, theorizing a different source. Moreover, not a few collaborators considered it risky to announce the discovery on the basis of a **single observation**, although unequivocal (recalling previous cases such as the famous Blas Cabrera's magnetic monopole, also in the field of physics). In this case, the problem was solved by itself with the observation, at the end of 2015, of a second signal (kept hidden at the time of the announcement of the discovery, in February).

Soon, once the data from the statistical point of view were analyzed more thoroughly and the solidity of the discovery certified, the community's attention turned to **how to better communicate** the discovery to the scientific community, avoiding the risk of disputes. So here comes the maniacal attention to the text of the paper that described the discovery (later published in the journal "Physical Review Letters"), where each word was weighed in a process that sometimes almost reached the surreal.

The result, however, was achieved: except for some borderline physicists with a dubious reputation, the mainstream scientific community accepted the discovery without any dispute. And even the lay **public** has welcome the news with a warmth and interest that is very rare for a scientific discovery. In short, the "social ripples" of the discovery have reached the various recipients (internal researchers, scientific community and general public) almost **instantly**, without obstacles. According to Collins, a case far from obvious in science, and even more so in the context of the controversial history of gravitational wave research.

Another aspect on which the sociologist has focused is the important topic of **secrecy**: in the five months that preceded the announcement of February 2016, the researchers of the collaboration kept the news of the possible discovery **strictly confidential**, not only toward the press (tickled by the output of numerous rumors) but also toward astrophysicists who could have exploited the data related to the discovery in some way, for example by publishing papers based on data analysis conducted in parallel (or even in advance) with respect to the authors of the discovery. Posing a serious ethical problem: to what extent can one push to preserve the secrecy of a scientific discovery before it is announced? Is it right **to lie**, denying that there is anything at all (as some scientists had to do, even with colleagues)? Would it not be better to admit that there is something, specifying at the same time that only **at the end** of the data analysis it will be possible to talk about discovery? In the latter case, the risk would be that of an embarassing situation, if the analysis does not confirm the discovery. A risk that many scientists prefer not to run, but that according to the author would not add any shame (the history of science is full of missed discoveries).

A problem that however, at least in this field, no longer arises: after the first historic revelation of September 2015, in fact, **ten other signals** of gravitational waves (now ordinary) have been observed, and there is no longer any need for secrecy. On the contrary, today the data of the experiments are made public **in real time**, and are available to anyone. A nice example of open science.

PERMALINK

https://magazine.fbk.eu/en/news/the-sociology-of-gravitational-waves/

TAGS

- #fisica
- #onde gravitazionali
- #sociologia

RELATED MEDIA

- Un bacio tra le stelle, Harry Collins: http://www.raffaellocortina.it/scheda-libro/harry-collins/un-bacio-tra-le-stelle-9788832850390-2852.html
- Costruire il futuro: https://costruireilfuturo.com/streaming/

AUTHORS

- Matteo Serra