

# The detection of gravitational waves: a scientific milestone

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The first direct detection of gravitational waves, predicted by Albert Einstein almost exactly one hundred years ago, marks a significant advance in the scientific cognition and technical mastery of the natural world.

The most precise scientific instruments ever built, the Laser Interferometer Gravitational-Wave Observatory (LIGO) detectors, have measured subtle ripples in space and time caused by the merger of two black holes into a larger one more than a billion light-years from Earth. This marks the beginning of the era of gravitational wave astronomy.

Groundbreaking research in lasers, vacuum technology, sensing and seismology over four decades contributed to the success announced Thursday. New mathematics was developed to pierce the background noise of the detector and extract a signal. Thousands of engineers and scientists solved innumerable technical challenges and reviewed the initial detection and its implications for months prior to the first release of scientific results.

The detection does more than simply verify the existence of gravitational waves. Computer modeling only possible in the last decade has predicted the shape of these waves from a variety of astrophysical sources as well as from a variety of theoretical models beyond the equations of general relativity as developed by Einstein in 1915-16. The particular shape of the waves in the detected “chirp,” however, correspond precisely to Einsteinian models of a merger of two black holes 1.3 billion light years away, with masses of 29 times and 36 times that of the Sun. Moreover, this is the first detection of black holes in this “intermediate” mass, heavier than most stars but lighter than the supermassive ones found in the center of galaxies.

Similar to the discovery a century and a half ago that various types of light are part of a broader spectrum of

radiation, the study of gravitational waves will allow for a fundamentally new way of observing the universe. Objects such as black holes, invisible when studied with light, are detectable with gravitational waves. The early universe, hidden from direct electromagnetic view, could be unveiled by finding primordial vibrations of spacetime caused by the Big Bang. Dark matter, which emits no light but is five times more common than normal matter, may be detectable by faint gravitational interactions. The initial findings are only a hint of what is to come.

The stunning confirmation of phenomena theoretically predicted 100 years ago stands starkly at odds with the incessant contemporary glorification of irrationalism, whether through the cultivation of backwardness and religious prejudice or the promotion of postmodernism and its rejection of objective truth. It is a powerful vindication of the materialist understanding of the world, that there are objective laws of nature and that humans can comprehend them.

The breakthrough announced Thursday is being celebrated and shared amongst millions of people around the world. The servers of *Physical Review Letters*, the journal in which the findings were published, crashed in the first few moments after the announcement as people from all walks of life rushed to learn about LIGO’s discovery. It is a moment of optimism—especially for a younger generation which has only known unending wars, inequality, poverty, austerity, domestic spying and police brutality—about the prospects for human progress.

There is also an instinctive understanding that the methods employed to find gravitational waves and make other scientific and technical advances could be used to solve social and economic problems. People ask, and rightly so, how is it that society can detect a signal that has an amplitude one thousandth the width

of a proton and yet cannot provide sufficient food, shelter, education or health care for the population of the planet?

This is a stark contrast between the way the LIGO project was organized and the everyday operations of world capitalism, a social system based on the ever-greater accumulation of private profit by increasingly catastrophic and parasitic methods. Thousands of scientists collaborated on a common project whose driving force was the pursuit of knowledge, not the amassing of insane amounts of personal wealth. Decisions were made based on objective criteria, with elaborate feedback mechanisms to insure against inadvertent errors, or any attempts to manipulate the results.

Then there is the irrationality of the capitalist nation-state system, with its wars, invasions, bombing, and mass flight of refugees, for whom the world has become a gigantic set of prison cages. The LIGO Scientific Collaboration includes contributors from Australia, China, Germany, Great Britain, India, Russia and the United States. In doing this work, every one of these scientists has to some degree rejected the constant mantra espoused by the ruling elites in every country of national chauvinism and reaction.

Such scientific advances as that announced this past week are rarer than they would be if the immense resources squandered on war and parasitism were directed instead to the conquest of knowledge of the material world, whether this relates to the movements of black holes a billion years ago or to the causes of cancer, a solution to global warming and the development of agricultural production.

Achieving this potential is possible only by resolving the basic social problem: the subordination of human activity to private profit. For this the international working class must become conscious of the *objective laws of capitalist development* —which are leading inexorably to world war and social revolution—and orient its activity accordingly.

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