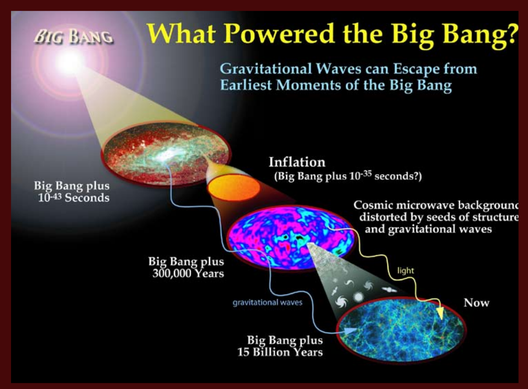
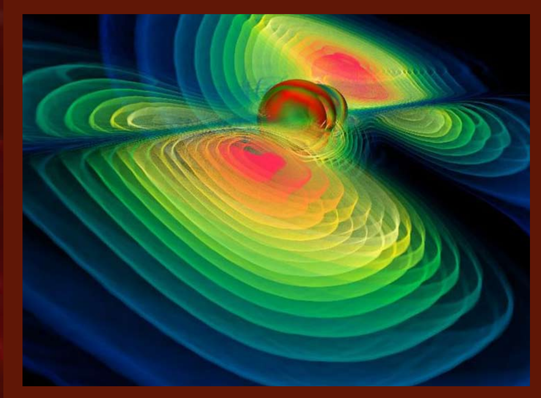
Gravitational wave programme at Nikhef

> http://www.ego-gw.it

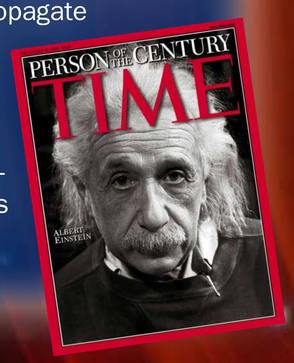


There are important open questions in physics and astronomy that Virgo and LIGO can address: Should we not now investigate general relativity experimentally where it has never been tested before: in the so-called strong-field regime? Can we do this by observing the gravitational waves generated when two black holes or neutron stars merge?
Will this be how we first detect gravitational waves directly? What will be learned when we do detect them directly?
Will it be found that there are deviations from Einstein's general relativity?
Can we detect the gravitational waves generated at the moment of inflation, the Big Bang? If so, will we learn about particle energy scales vastly higher than those attainable in present accelerators?
Do atoms behave in unexpected ways when they are at the high temperatures and pressures associated with the strong gravitational field near a black hole? Shouldn't a more complete census of black holes be made?



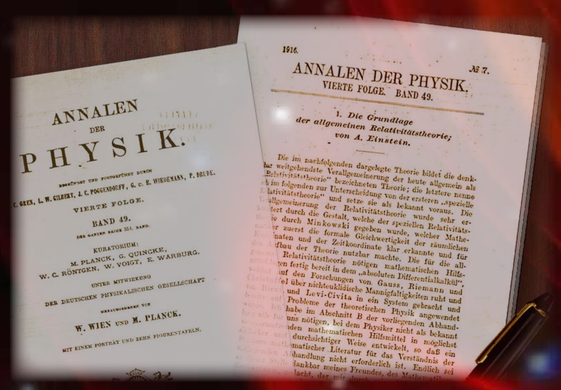
^Modeling the complexity of the merging of two black holes (Image: MPI for Gravitational Physics/ W.Benger-ZIB)

Gravitational waves (GW) were predicted by Einstein's general relativity (GR).
GW are fluctuations in the curvature of spacetime which propagate as waves, traveling outward from an accelerated system. Gravitational waves are emitted by energetic objects or events in the universe.



Advanced interferometers such as Virgo and LIGO will open a new window on the universe by detecting GW. This provides unparalleled opportunities for making precision measurements in the regime of strong and dynamical gravitational fields. Such measurements would unveil any flaws in the otherwise solid and successful edifice of GR and guide the way to the true theory of gravity which reconciles the principles of relativity and quantum mechanics. Because GWs penetrate all regions of time and space with almost no attenuation, interferometers can sense waves from the densest regions of matter, the earliest stages of the Big Bang, and the most extreme warpings of spacetime near black holes.

^Installation of advanced new optics by Nikhef personnel for the Virgo+ upgrade.



The French – Italian – Dutch Virgo experiment in Cascina near Pisa.

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