

# Solvay Colloquium



## Professor Jo van den Brand

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### Gravitational waves science from LIGO and Virgo to Einstein Telescope

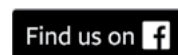
The LIGO Virgo Consortium achieved the first detection of gravitational waves. A century after the fundamental predictions of Einstein, we report the first direct observations of binary black hole systems merging to form single black holes. The detected waveforms match the predictions of general relativity for the inspiral and merger of a pair of black holes and the ringdown of the resulting single black hole. Our observations provide unique access to the properties of space-time at extreme curvatures: the strong-field and high velocity regime. It allows unprecedented tests of general relativity for the nonlinear dynamics of highly disturbed black holes. Last year the gravitational waves from the merger of a binary neutron star were observed. This discovery marks the start of multi-messenger astronomy and the aftermath of this merger was studied by using 70 observatories on seven continents and in space, across the electromagnetic spectrum.

The scientific impact of the recent detections will be explained. In addition key technological aspects will be addressed, such as the interferometric detection principle, optics, and sensors and actuators. Attention is paid to the largest challenges in the field, including plans for Einstein Telescope, an instrument that will allow us to observe black hole coalescence in the entire visible Universe. Einstein Telescope will be an underground observatory housing multiple (cryogenic) interferometers for gravitational waves science.

**Tuesday 27 November 2018 at 4.00 P.M.**

COFFEE AND TEA WILL BE SERVED AT 3.45 P.M.

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