



De Oosterpoort, Groningen Friday, 7 April 2016

Plenary Lecture – Physica Lecture

Jo van den Brand (Nikhef & VU University Amsterdam) - Gravitational waves: Physics at the Extreme

Abstract:

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Last year, the LIGO Virgo Consortium achieved the first detection of a gravitational wave. 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. These observations demonstrate the existence of binary stellar-mass black hole systems. 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.

The scientific impact of the recent detection 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 Advanced Virgo, the Italian-French-Dutch detector near Pisa, which will come on-line this year. The lecture will close with a discussion of the largest challenges in the field, including plans for a detector in space (LISA), and Einstein Telescope (ET), a large underground observatory for gravitational waves science.