Quantum noise in LIGO

Rainer Weiss

Massachusetts Institute of Technology, Cambridge, NW22-283,MIT,185 Albany St, Cambridge, 02139, USA

The understanding of how the noise due to the quantum nature of light and matter enters the interferometric detection of gravitational waves came slowly. The work of Horace Yuen, Carlton Caves and Marlan Scully in the late 1970's and early 1980's provided the insight into how the vacuum fluctuations enter the instrument. They also showed how the generation of paired photon states derived from the vacuum fluctuations could be used to suppress the quantum noise. The talk will describe some of this history and subsequent experimental work. The development of practical techniques to reduce the quantum noise, first on the GEO detector at the Albert Einstein Institute in Hannover and at the Australian National University, are now being applied to both the LIGO and VIRGO detectors. The sensitivity improvements are significant.