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The joint search for Gravitational Wave and Low Energy Neutrino signals from Core-Collapse Supernovae. Methodology and Status report

Abstract

The discovery of gravitational waves opens a new era in physics. Now it's possible to observe the Universe using a fundamentally new way. Gravitational waves potentially permit getting insight into the physics of Core-Collapse Supernovae (CCSNe). However, due to significant uncertainties on the theoretical models of gravitational wave emission associated with CCSNe, significant benefits may come from multi-messenger observations of CCSNe; such benefits include increased confidence in detection, extending the astrophysical reach of the detectors and allowing deeper understanding of the nature of the phenomenon. Fortunately, CCSNe have a neutrino signature confirmed by the observation of SN1987A. The gravitational and neutrino signals propagate with the speed of light and without significant interaction with interstellar matter. So that they must reach an observer on the Earth almost simultaneously. These facts open a way to search for the correlation between the signals. However, this method is limited by the sensitivity of modern neutrino detectors that allow to observe CCSNe only in the Local Group of galaxies. The methodology and status of a proposed joint search for the correlation signals are presented here.

June 28, 2016 - 2:30 pm
LNGS - "B. Pontecorvo" room