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Neutrino Follow-Up Analysis of GRB 221009A with KM3NeT

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Gamma-ray bursts (GRBs) are powerful explosions emitting high-energy photons, followed by a less energetic afterglow emission. They occur at a rate of a few per day in the observable Universe. After more than fifty years of detecting and characterising GRBs in the electromagnetic spectrum, they are considered potential sources of extragalactic cosmic rays. While no neutrinos have been detected so far in coincidence with these violent phenomena, numerous models predict neutrino emissions by different mechanisms.

On October 9th, 2022, multiple facilities, including the Swift and the Fermi satellites, detected an extraordinarily bright burst, referred to as GRB 221009A, for which the LHAASO observatory reported photons detection up to ~10 TeV energies. This energetic transient event presented an exceptional opportunity for the search for neutrinos in temporal and spatial coincidence.

The KM3NeT undersea neutrino telescope was operating with 21 lines of the ARCA detector and 10 lines of the ORCA detector at the time of this event, allowing for a real-time search for neutrinos from GRB 221009A. Later, a refined study including reprocessed data and systematics effects was conducted covering multiple time windows in a wide energy range, from MeV up to a few PeVs. In this talk, I will review the main results of the analyses, focusing on how KM3NeT performs the follow-up of GRB phenomena in a multi-messenger context.

Primary author: PALACIOS GONZÁLEZ, Juan (IFIC (CSIC-UV))

Co-authors: SÁNCHEZ LOSA, Agustín (IFIC); ZEGARELLI, Angela (Istituto Nazionale di Fisica Nucleare); FILIPPINI, Francesco (Istituto Nazionale di Fisica Nucleare); Dr SALESA GREUS, Francisco (IFIC); ILLUMINATI, Giulia (Istituto Nazionale di Fisica Nucleare); VANNOYE, Godefroy (Aix Marseille Univ, CNRS/IN2P3, CPPM); Dr LE STUM, Sebastien (CPPM); DORNIC, damien (cnrs)

Presenter: PALACIOS GONZÁLEZ, Juan (IFIC (CSIC-UV))

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