C2GT: exploiting CNGS neutrinos in the Gulf of Taranto

Contribution to the Villars meeting of the SPSC

Abstract

The discovery of finite neutrino mass underscores the importance of neutrino physics for making progress beyond the Standard Model. Six years after the first claim of neutrino oscillation, the gross structure of the neutrino mixing matrix is known from experiments. Attention now focuses on the possibility of CP violation in the neutrino mixing matrix, and on the mixing angle θ_{13} which is small but must be non-zero for leptonic CP violation to occur. We propose an attractive medium-term objective for European neutrino physics: a precise measurement of $\nu_\mu \rightarrow \nu_\mathrm{e}$ oscillations, using the CERN Neutrino beam to Gran Sasso (CNGS) in an off-axis configuration. Monochromatic neutrinos of 0.8 GeV energy are detected through quasi-elastic charged current interactions in a moveable underwater Cherenkov detector of 2 Mt fiducial mass, installed in a deep-sea trench in the Gulf of Taranto, off the south coast of Italy. The detector has a least distance of 1200 km from CERN and can be positioned at different baselines over a range of several hundred kilometres, allowing for a direct demonstration of neutrino flavour transitions with no need for absolute flux normalisation. The experiment provides a precise measurement of the oscillation parameters Δm^2_{23} and $\sin^2\theta_{23}$, and will determine $\sin^2\theta_{13}$ with a sensitivity of about 0.002. We present the experiment's layout, simulations of its performance, and detector R&D work.

Contactperson: F. Dydak (*friedrich.dydak@cern.ch*)