LNGS SEMINAR SERIES

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Digital data-acquisition possibilities for the LUNA $^{22}Ne(p,\gamma)^{23}Na$ experiment

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The stable nuclide ^{22}Ne plays an important role in astrophysical novae, and in supernovae where it provides neutrons for neutron-capture driven nucleosynthesis. In a hydrogen-rich scenario, ^{22}Ne is mainly destroyed by the $^{22}Ne(p,\gamma)^{23}Na$ reaction. Only upper limits exist on the cross section of this reaction at relevant energies.

Currently, a systematical study of this reaction is being performed at LUNA. The experiment, which is based on a windowless gas target system, takes place in two phases. The recently completed first phase concentrated on the study of selected low-energy resonances using two high-purity germanium detectors The second phase, started in November 2014, using a 4π bismuth germanate summing crystal, will push the lowest energy limit even further down.

This new scintillator based measurement setup will require a new data acquisition system: In order to restore the full energy of the gamma peak, the signals of the eight BGO crystals have to be summed up. Classically, this task is done by a carefully executed gain matching of the photomultiplier tubes and an analog summing circuit. However, the recent developments in the field of digital data-acquisition made such systems obsolete.

A digitizer-based system can considerably simplify the experimental setup and make the measurement more robust. However, the shift between the analog and digital world is not always smooth. In my talk, I would like to explore the advantages and disadvantages of such systems with respect to the BGO phase of the $^{22}Ne(p,\gamma)^{23}Na$ experiment.

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