FAKULTÄT für PHYSIK
LUDWIG-MAXIMILIANS-UNIVERSITÄT
MÜNCHEN/GARCHING

PHYSIK-DEPARTMENT
TECHNISCHE UNIVERSITÄT MÜNCHEN
MÜNCHEN/GARCHING

MLL-KOLLOQUIUM

Donnerstag, 19.12.2019, 16^{15} Uhr

Hörsaal der LMU in Garching, Am Coulombwall 1
Treffen zum gemeinsamen Kaffee 16 Uhr

Dr. Tina Pollmann

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Direct Dark Matter Search with the DEAP-3600 Detector

What is Dark Matter? Cosmologists require approximately 25% of the total energy density in the universe to be Dark Matter, while particle physicists have been looking for new particles that are predicted by theoretical models meant to complete the Standard Model, and that often have the correct properties to be the cosmological Dark Matter. So far, attempts to pin down the nature of Dark Matter in a laboratory measurement, or to even just prove that it exists, have not been successful. The DEAP-3600 experiment is looking for the signature of Dark Matter particles from our galactic halo scattering on the detector's 3.3 ton liquid argon target. Located in an active mine at a depth of 2 km, the DEAP-3600 detector has been taking data for 3 years and is among the most sensitive currently running detectors for detecting Dark Matter in the form of weakly interacting particles of masses above 30 GeV/c^2.
If Dark Matter takes the form of a weakly interacting massive particle (WIMP), the interaction cross section between WIMPs and atomic nuclei is extremely small. Experimenters must go to extreme lengths to build sensitive detectors that nevertheless are free of background events from natural radioactivity.
This talk will present the design and underground construction of the DEAP-3600 detector in the light of achieving stable, background-free operation, as well as the analysis of the data taken so far. Liquid argon is a bright scintillator with a scintillation pulse shape that is different for different types of excitation. Analysis results demonstrate the power of pulse shape discrimination in liquid argon to reject backgrounds due to beta and gamma radiation, which enters the detector due to natural radioactivity in detector components. This clears the path to building even more sensitive Dark Matter detectors in the future, and makes liquid argon an attractive target material for other types of detectors.

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