

Referee Report to the 47th N.P. PAC at JINR

concerning 4.5 project EDELWEISS-LT

“Direct low-mass WIMP searches with HPGe Semiconductor Bolometers”

One of the open problems in physics and astronomy is the question of the nature of dark matter, known so far only by its gravitational impact in the universe, but not reproducibly established by any other interaction with ordinary matter. In this respect, the EDELWEISS experiment has played for many years an important role by searching for weakly interactive massive particles (WIMPs) using highly sensitive cryogenic high purity Germanium (HPGe) detectors in the well shielded environment of the Modane underground laboratory (LSM). With publication of the EDELWEISS-III results in 2016/17, this experiment has reached a sensitivity level for elastic scatterings in the low mass WIMP region 4-30 GeV which excludes any previously reported positive hints of signals by WIMPs. This result was achieved with 24 specially developed 800g “FID” (Fully Inter-Digitized) HPGe detectors with surface protection, operated at 18 mK, and used as cryogenic bolometers.

Now a new setup EDELWEISS-LT is being developed with special sensitivity to low WIMP masses below 10 GeV where from cosmological arguments WIMPs would be expected. Energy resolutions of 100 eV will be reachable using HPGe bolometers via the “Neganov-Luke” effect of internal amplification of the heat signal. In combination with ionization signals, sensitivities for WIMP-nucleon cross sections of $\sim 10E-43$ cm² will be reachable, 2-4 orders of magnitude lower than present limits at 5 GeV. EDELWEISS-LT will thus have a very high discovery potential for low energy WIMPs.

The Dubna group from DLNP for EDELWEISS has played for many years a significant role in the development, testing and running of the FID HPGe detectors, by numerous background and MC studies and by data analysis. EDELWEISS has reached worldwide a high visibility. The Dubna team, consisting of highly educated specialists in this field, made significant contributions and will be able to do so in the future. This work must therefore be rigorously continued with big effort.

I strongly recommend that JINR continues the full support of the Dubna team in the preparations and in the later execution of the EDELWEISS-NT experiment, with highest priority.

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