

Referee report

on proposal of JINR participation in the project COMET@J-PARC

Discovery of neutrino oscillations allowed to establish the fact that the lepton flavor number is not conserved. That means that neutrinos are massive, and the Standard Model (SM) must be extended. Nevertheless, up to date this is the only experimental fact. At the same time in extended versions of SM it is natural to expect lepton flavor violation in a charged sector. The found smallness of the neutrino squared mass difference leads in SM to very low probability of the lepton flavor violating processes in a charged sector which is practically unreachable at experimental facilities. On the other hand, beyond SM the processes with charged leptons could occur with higher probability due to interactions at characteristic energy scale Λ . This carries the fundamental sense of experimental search for lepton flavor violation in processes with charge leptons, where this search is the important low-energy test of SM and the method to look for New Physics. One of the most promising reactions is coherent neutrino-less muon-to-electron conversion in nuclei ($\mu^- \rightarrow e^-$).

Currently there are two competitive projects on measurement of ($\mu^- \rightarrow e^-$) conversion: Mu2e in Fermilab (USA) and COMET in J-PARC (Japan). Both projects have extremely high sensitivity of measurement and plan to lower the existing upper limit of the conversion in nuclei by 3-4 orders of magnitude.

Experiment COMET at J-PARC is focused at search for coherent neutrino-less conversion $\mu^- + \text{Al} \rightarrow e^- + \text{Al}$ in a muonic atom of aluminum at the level of a single-event sensitivity (SES) $3 \cdot 10^{-17}$, corresponding to a 90% confidence level $< 10^{-16}$. The Phase-I of COMET has aims to study of experimental conditions and different sources of background, and to search for the $\mu^- \rightarrow e^-$ conversion with intermediate sensitivity of SES $\approx 3 \cdot 10^{-15}$, which is 200 times better than the current limit.

The purpose of the current project is participation of the JINR physicists in COMET Phase -I, and R&D work for Phase -II. This group includes scientists from Russia and from the JINR member states as well. The main efforts of the JINR group will be in participation in creation and maintenance of the straw tracker, electromagnetic calorimeter, participation in simulation and data analysis. In the reported period (2014-2016) the group successfully fulfilled its obligations concerning construction of the detector.

Summarizing, and taking into account undoubtedly valuable expected scientific results, I recommend to extend the participation of the JINR team in the experiment COMET@J-PARC for the period of 2017-2019.

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