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## Search for sub-millicharged particles at J-PARC

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Electric charge quantization is a long-standing question in particle physics. While fractionally charged particles (millicharged particles hereafter) have typically been thought to preclude the possibility of Grand Unified Theories (GUTs), well-motivated dark-sector models have been proposed to predict the existence of millicharged particles while preserving the possibility for unification. Such models can contain a rich internal structure, providing candidate particles for dark matter. A number of experiments have searched for millicharged particles ( $\chi$ s), but in the parameter space of the charge ( $Q$ ) and mass ( $m_\chi$ ), the region of  $m_\chi > 0.1$  GeV/c<sup>2</sup> and  $Q < 10^{-3}e$  is largely unexplored.

SUB-Millicharge ExperimentT (SUBMET) has been proposed to search for sub-millicharged particles using 30 GeV proton fixed-target collisions at J-PARC. The detector is composed of two layers of stacked scintillator bars and PMTs, and is proposed to be installed 280 m from the target. The main background is expected to be a random coincidence between the two layers due to dark counts in PMTs, which can be reduced significantly using the timing of the proton beam. With  $N_{\text{POT}}=5 \times 10^{21}$ , the experiment provides sensitivity to  $\chi$ s with the charge down to  $7 \times 10^{-5}e$  in  $m_\chi < 0.2$  GeV/c<sup>2</sup> and  $10^{-3}e$  in  $m_\chi < 1.6$  GeV/c<sup>2</sup>. This is the regime largely uncovered by the previous experiments.

### In-person participation

Yes

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