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Light vector bosons and the weak mixing angle in the light of new reactor-based CEνNS experiments

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After the first CEνNS detections, further experiments with different technologies have been established and the question arises how to further exploit this signal for a wide variety of investigations in the future. In this context, nuclear reactors with their intense emission of low-energy antineutrinos in combination with high-purity germanium detectors have already shown their potential for CEνNS studies and represent a scalable technology for future precision experiments. Such measurements are interesting because deviations from the CEνNS prediction of the Standard Model could indicate the existence of new neutrino interactions. In particular, a light vector boson may imply corrections to the Weinberg angle, so increasing the precision of this observable will help to probe additional U(1) extensions of the Standard Model. In this talk, we discuss the potential of future germanium-based reactor experiments for precision measurements of the weak mixing angle as well as for the search for a new light vector boson that may exist. Using a data-based reactor antineutrino prediction, we present the experimental sensitivity for both topics with particular emphasis on their interrelation. In addition, the effects of characteristic experimental parameters such as detector mass and energy threshold are presented. In this way, we show where improvements in detector design could have the strongest impact on physics investigations.

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