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CONUS100: Precision neutrino physics with coherent elastic scattering of reactor neutrinos

Abstract:
Coherent Elastic Neutrino-Nucleus Scattering (CEvNS) was predicted in 1974, but it took until 2017 before it was first observed in the COHERENT experiment in pion decays at rest. Recently first indications were presented that solar neutrinos are detected in the direct dark matter experiments XENONnT and PandaX via CEvNS. Last but not least the reactor anti-neutrino experiment CONUS+ has recently observed the process already in its first data taking run which immediately leads (alone and in combination with other experiments) to interesting and very competitive sensitivity to physics beyond the Standard Model of particle physics. The ongoing operation of the upgraded CONUS+ detector will produce significantly better results already within a year. The main point of this proposal is to highlight that the underlying detector technology is mature and allows an upscaling to a CONUS100 experiment with O(100kg) detector mass. This can be achieved by a small collaboration with comparably moderate costs and within a few years. Simulations show that O(500.000) signal events could be detected within 5 years of data taking. This implies that the long lasting route towards an observation of CEvNS will foreseeably turn in the next few years into an exciting new area of precision neutrino physics with CEvNS. Each detection channel will by itself lead to very important results, but combinations will have a significantly bigger physics potential.

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