Abstract Submitted
for the DNP19 Meeting of
The American Physical Society

Measuring the efficiency of counter-flow heat exchangers for the nEXO cryogenic system[1] SHOHAM WEISS, Undergraduate Researcher, LIANG YANG, Research Professor — Neutrino-less double beta decay is a still undetected phenomenon. Its detection could shift our understanding of particle physics. In double beta decay, two neutrons decay into two protons, two electrons and two neutrinos. Theoretically, the two neutrinos could annihilate, and the decay would be neutrino-less, thus confirming that neutrinos are "Majorana" particles. This decay is detected using enriched xenon, which decays into barium through double beta decay and possibly through the neutrino-less version. A 5-ton detector called the next Enriched Xenon Observatory (nEXO) is being planned, hoping to observe this phenomenon. The big chamber contains impurities that seep into the xenon, so we recirculate the xenon through a purifier. The purifiers work with gaseous xenon and the detector works with liquid xenon. Thus, we need to evaporate xenon to purify it, then condense it to detect any decay. The current process of evaporating and then condensing is inefficient. Our research investigates using heat exchangers to save power in the recirculation process. The heat exchanger is used to transfer heat from the hot xenon entering the chamber into the cold xenon exiting the chamber. This would be instead of heating one and cooling the other separately and thus save power. Our setup recirculates xenon and compares the cooling power used with a heat exchanger versus without a heat exchanger. Our results show that using a heat exchanger is 90% efficient and would be a good addition to nEXO.

[1]Acknowledgments: This material is based upon work supported by the National Science Foundation under Grant No. 1654495, the United States Department of Energy under Grant No. DE-SC0014332, and the Department of Physics at the University of Illinois at Urbana-Champaign. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the funding agencies.

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Date submitted: 23 Aug 2019 Electronic form version 1.4