Abstract Submitted
for the CUWIP22 Meeting of
The American Physical Society

PyNu: Developing a Search Pipeline for Gravitational-Wave and Neutrino Coincident Events in the Era of Multi-Messenger Astrophysics
VIVIANA CACERES, University of Puerto Rico at Mayaguez, HANNAH GRIGGS, SHAMITA HANUMASAGAR, LAURA CADONATI, Georgia Institute of Technology, LIGO COLLABORATION — Numerical relativity predicts that the merger of two binary neutron stars (BNS) or a binary neutron star and a black hole (NSBH) emits large amounts of neutrinos, in addition to a gravitational wave. However, a joint detection of astrophysical neutrinos and a gravitational wave produced by a compact binary coalescence (CBC) has not been made. We modify the gravitational wave pipeline PyCBC, used with LIGO data, to search for a CBC coincident in time with neutrinos detected by the Ice Cube Neutrino Observatory. We reduce the amount of data used in a search run and the PyCBC waveform template bank used to include only neutron star mergers. We also inject a BNS waveform into data from LIGOs second observing run to study the limitations of the pipelines detection capabilities. The search runs took between 12 and 24 hours, and injected signals were clearly detected up to a coincident signal-to-noise ratio of approximately 7. Further modifications to the pipeline will include reducing the on-source window and considering the neutrino arrival direction, which are expected to make the pipeline quicker and more efficient when running.

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Date submitted: 10 Jan 2022 Electronic form version 1.4