OOKAMI PROJECT APPLICATION

Date: **April 2 2021**

Project Title: Particle-in-cell Simulation of Neutrino Flavor Transformation

Usage:

Ⅹ Testbed

☐ Production

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Usage Description:
Emu is a particle-in-cell neutrino kinetics code built on the performance portable high performance computing framework AMReX. Emu has been tested to perform efficiently and scale well on CPU (NERSC Cori) and GPU (Bridges-2, Summit) nodes. We would like to test the code on A64FX hardware and use the results to make performance enhancements and enhance performance portability. If we get good performance we may apply for a production allocation.

Computational Resources:

It is currently interesting to simulate in 1D, 2D, and 3D. We recently published 1D simulations (https://arxiv.org/abs/2101.02745) and are actively performing 2D and 3D simulations. As such, we can make use of modest and very large amounts of computer time. Assuming performance scales with theoretical peak performance compared to NVIDIA V100 GPUs, a *production* 1D simulation would require about 1 A64FX hour, a 2D simulation would require 128 A64FX hours, and a 3D simulation would require about 16,000 A64FX hours. Performance tests will require a factor of 80 less, or approximately 2 hours (2D) or 200 hours (3D).

Total node hours per year:
2000

Size (nodes) and duration (hours) for a typical batch job:
1 node (1D) - 32 nodes (3D), 1 hour (testing) - 24 hours (production)

Disk space (home, project, scratch):
10 GB (home), 2 TB (project/scratch)

Personnel Resources:
We should not need additional assistance, apart from a pointer to a recommendation for profiling software that has proven useful on Ookami.

Required software:
python3, g++, git

If your research is supported by US federal agencies: