From:	Boyle, Peter
To:	Capasso, Frances
Cc:	Izubuchi, Taku; Szafron, Robert; Dawson, Sally
Subject:	LDRD
Date:	Friday, May 27, 2022 7:39:31 PM

Dear Fran,

I'd like to express interest in the LDRD A round:

Title: Towards a Brookhaven integrator for precision physics on GPUs

Abstract:
Precise theoretical predictions for future colliders are hindered by the speed of numerical integrators.
This proposal aims to apply methods used in lattice gauge theory, to importance sample the Feynman path integral, to numerical integration in precision physics.
A key limiting factor in numerical integrators such as the popular VEGAS package are the constraints in parametrising the probabilistic sampling of the integral. These are structured to use a weighting function that is easy to sample but does well describe sharply peaked functions of up to 20 variables.
Metropolis methods, originally developed within theoretical physics, are currently used in lattice gauge theory to importance sample up to 1 billion variables the distribution of QCD.
We will combine these methods with more powerful adaptive sample probability distributions that can better match the Feynman amplitudes being integrated.
We will also combine lattice techniques for programming modern GPU computers with the problem of numerical integration to pave the way towards a Brookhaven integrator.

Investigators: Robert Szafron, Peter Boyle, Taku Izubuchi

Best wishes,

Peter, Robert and Taku