



April 28, 2023

Dear members of the selection committee,

It is my great pleasure to write a recommendation letter for Muhammad Asaduzzaman who is applying for the quantum computing boot camp at JLAB. I met him for the first time in 2019 while visiting Syracuse and he struck me immediately as a very promising young theorist. He has become an essential member of our QuLAT collaboration. He is extremely reliable, works hard and can take initiative.

As a graduate student at Syracuse, Asad has done very interesting work related to holography and quantum gravity with Simon Catterall and other collaborators. He has three published papers in this area. The first one is a tensor network implementation of a lattice gauge theory formulation of two-dimensional gravity (Phys. Rev. D 102, 054510). The second one is about holography on tessellations of the two-dimensional hyperbolic space (Phys. Rev. D 102, 034511). The third one (Phys. Rev. D 106, 054506) discusses a holographic approach of the Ising model on the hyperbolic plane. Simon Catterall will discuss this work in more detail in his letter.

After completing his Ph. D. in summer 2022, he came at the University of Iowa as a postdoc. This was a smooth transition and he has done extremely well in dealing with the new responsibilities. Funding for his position is not guaranteed for the next academic year. In addition, as he is staying in the same collaboration, it would be in his own interest to broaden his research experience. For these reasons, I suggested that he applies to selected institutions that would provide outstanding research experiences in new directions.

Asad has an extensive experience in computational methods. He had a (virtual) summer internship at Argonne National Lab in summer 2020. It was a great learning experience for him to interact with James Osborn. He learned many new techniques in lattice gauge theory, quantum information and tensor network methods. He has successfully applied for computing time on quantum computers at Azure (Microsoft). He is learning the new QuEra interface available through Amazon Web Services and will be able to run actual simulations with Rydberg atoms when the service becomes publicly available.

Recently, he has completed a quantum simulation of a 1+1 dimensional model with staggered fermions with a quartic coupling and a  $SO(4)$  symmetry. He

learned new methods very quickly and is very good at cross checking his numerical results. He adapted a code that I had written to incorporate extra degrees of freedom and has built the implementation with state of the art IBM quantum computers using QISKIT. The work has been posted as arXiv:2208.05906 and is published in Phys. Rev. D. 106, 114515.

He is currently leading a three step calculation of the phase shifts for this model. He has been coordinating the effort with graduate students at Syracuse U., U. Maryland and U. Iowa. He has been supervising closely a graduate student at U. Iowa. He can take initiatives constructively with the group.

He has given excellent talks at recent international conferences. It is very easy and pleasant to work with him. He is well organized and works hard. It is very easy to communicate with him. He is well-balanced and has a pleasant personality. I give his application a very strong recommendation. Please feel free to contact me if you have questions (tel: 319-335-1991, email: yannick-meurice@uiowa.edu).

Sincerely,

A handwritten signature in black ink, appearing to read 'Y Meurice', with a horizontal line underneath.

Yannick Meurice  
Professor