THE UNIVERSITY OF KANSAS

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Dear Summer School Organizers,

I am very happy to write a strong supporting letter for **Mr. Zhongtian (Cosmos) Dong** who has applied for the 2023 Quantum Computing Boot Camp.

I am a professor in the department of Physics and Astronomy at the University of Kansas (KU), and Zhongtian (Cosmos) is finishing his third year as a PhD student, working under my supervision. His dissertation topic is not determined yet but would be phenomenology of new physics beyond the standard model. This year is the right time for him to attend a summer school and I would like to strongly recommend him. I believe that the school will complement his current research focus. He needs to broaden his horizons beyond what he is working on. This year's Quantum Computing Boot Camp will provide him with the perfect opportunity to do this.

He has published two papers on application of machine learning in particle physics. His first paper is about solving combinatorial problems which arise at the Large Hadron Collider (LHC) experiments. He used machine learning techniques and compared his results against kinematic methods (non ML methods) in literature. He investigated various architectures including attention based network and Lorentz Boost Networks (LBN). In his second paper, he examined the usefulness of symbolic regression on some analytical expressions that appear in collider physics, using an existing code, called PYSR. He is currently involved in a couple of projects. One project is entitled by 'When the Machine Chimes the Bell', where he examines the quantum entanglement and violation of Bell's inequalities using top quark production at the LHC. In the analysis, we use recent techniques such as boosted top tagging, and use LBN. This study is almost finished and should appear on arXiv soon. The other project is about 'Solving combinatorial problems with quantum algorithms', which is continuation of this first paper on the combinatorial problem. This time, he is comparing quantum machine learning algorithms against classical machine learning algorithms.

Although he is using some ML methods for his studies in particle physics, he did not really take any classes on machine learning. He did participate in 'Summer School on Machine Learning for High Energy Physics 2021' but it was an online class due to COVID-19 and topics were focused on physics rather than machine learning. I think this year is the best time for him to broaden his backgrounds toward more formal education on quantum computation. Quantum Computing Boot Camp 2023 would provide the perfect environment.

He is in an excellent academic standing so far (3.98 GPA). He is sufficiently advanced to understand the lecture material. He has advanced backgrounds on machine learning and is familiar with Keras and PyTorch. He has basic knowledge on quantum algorithms and familiar with Qiskit. His general mathematical backgrounds should be good as well. He should have good backgrounds on algebra, group theory and mathematical physics. He has taken courses that are required to be a theory student such as particle physics and quantum field theory. He has some background knowledge on the standard model and collider physics. Also he is familiar with particle physics simulation tools including MadGraph5, CalcHEP and analysis tools.

I fully understand that often preference may be given to senior students due to limited space in the program, but would like to mention that students like Cosmos, who finished course work, took basic particle physics classes and quantum field theory, and are already doing research, would benefit the most out of the summer school. Being exposed to various topics this year and having discussion with all lecturers on advaned topics in quantum computation would have significant impact on his potential during his remaining PhD time, especially for next couple of years. This is the time that students develop their intuition about their PhD topics and go deeper into their own research. I would argue that this year's school would give him the most valuable experience and can tell you that he is ready to study advanced topics.

I therefore urge the organizing committee to accept him to the school - you will not be disappointed! Please do not hesitate to contact me if you have any questions about Mr. Dong.

Yours faithfully,

K.C. Kong
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