UC RIVERSIDE | UNIVERSITY OF CALIFORNIA
Department of Physics & Astronomy

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July 15, 2018

Dear Moore Foundation Lectureship Awards Committee,

On behalf of myself and Co-PI Dr. Daniel Whiteson (UC Irvine), I give my strongest support for the proposed lecture program by Dr. Ben Nachman on machine learning in high-energy physics.

Dr. Nachman is known in our field for his expertise in statistics and collider phenomenology. He has risen to be one of the top young researchers in experimental high-energy physics and is unsurprisingly a leader in the application of machine learning techniques to collider physics.

The lecture program will push the boundaries of the nascent field of machine learning in particle physics by focusing on applications beyond colliders to dark matter searches and theoretical studies. We have already identified three examples at the intersection of our research expertise:

1. Using machine learning to 'paint' galaxies onto self-interacting dark matter haloes to study structure formation in these theories.
2. Applying machine learning techniques to under-constrained systems to understand the kinematics of the missing particles in MT2/Razor searches for dark matter at colliders.
3. Using generative adversarial networks to explore how experimental results (e.g. the Higgs mass) constrain high-dimensional, non-linear parameter spaces of new physics models.

The primary road-block to progress the lack of overlap between particle theorists (dark matter in particular) with machine-learning-in-physics experts to identify fruitful opportunities. These lectures will initiate a set of conversations to share these tools and develop intra- and cross-campus collaborations in these directions.

The participants will include dark matter model building experts—especially in the field of self-interactions and astro-particle physics (led by PI Tanedo), collider physicists (led by co-PI Whiteson), and machine learning engineers at the respective campuses (UCR Data Science Center, UCI Data Science Initiative). Dr. Nachman is uniquely situated to connect these communities and guide our collaborative development.

We are confident that these lectures will be just the first step towards a sustained exchange between these groups. The support of the Moore foundation will encourage further institutional support from our campuses to develop this research collaboration.

Sincerely,

Philip 'Flip' Tanedo, UC Riverside