

Physics Colloquium

Michigan Technological University

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4:00 PM Fisher Hall 139

The HAWC Contribution to the Puzzle of Dark Matter

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Abstract:

Dark matter particle candidates naturally emerge at the weak scale in extensions to the Standard Model of particle physics. When these particles interact, they can produce high-energy gamma-rays either directly or through particle cascades. The search for these gamma-ray signatures provides limits on the dark matter cross-section for dark matter to annihilate and for the decay lifetime of the dark matter. Moreover, several current studies have found tantalizing evidence that we may be seeing the first glimmer of gamma-rays from dark matter annihilation in our own Galaxy.

I will discuss the expected astrophysical signatures of dark matter annihilation in the gamma-ray sky, at lower-energy (GeV) and higher-energy (TeV) gamma-ray experiments. A particular focus will be on the search for dark matter signatures with the High Altitude Water Cherenkov (HAWC) observatory, which is looking for gamma rays from the most massive dark matter particles, with masses greater than $1 \text{ TeV}/c^2$. With a field-of-view capable of observing $2/3$ of the sky each day, and a sensitivity capable of detecting the Crab nebula in one day, HAWC is able to map out the TeV sky in detail. The large sky coverage of HAWC enables the observation of many different astrophysical sources expected to contain large densities of dark matter, including dwarf spheroidal galaxies, galaxy clusters, and the Milky Way itself. The predicted HAWC sensitivity to dark matter as well as some early results from the partial HAWC detector will be shown.



Bio:

Dr. Harding is a postdoctoral research associate at Los Alamos National Laboratory and is the chair of the particle physics working group of the HAWC experiment. He received his bachelor degree in Physics and Mathematics from the University of Idaho in 2006 and his Ph.D. in Particle Astrophysics from the University of Maryland in 2012. After receiving his Ph.D., he performed research at the University of California, Irvine, and is currently doing postdoctoral research at Los Alamos National Laboratory. The majority of his research has been devoted to the phenomenology of dark matter and blazar studies by astrophysical gamma-ray experiments. He has

searched for dark matter signals in data from multiple experiments, including the Fermi Large Area Telescope (Fermi-LAT) and the High Energy Spectroscopic System (H.E.S.S.) experiment. Most recently, he has been leading the dark matter searches as a member of the HAWC collaboration.

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