



Whittier
College

Jordan C. Hanson, PhD

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Barbara Ondrasik '57 and David Groce Fellowship

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Greetings,

My name is Jordan Hanson, and I am an assistant professor in the Department of Physics and Astronomy. I am recommending Raymond Hartig for the Barbara Ondrasik '57 and David Groce Fellowship. Raymond is an especially gifted Whittier College physics and mathematics double major who has been performing research with me for more than a year. I first met Raymond in the Fall of 2019 as his freshman mentor, and I have since become his adviser.

My research focuses on two projects: the ARIANNA project and IceCube-Gen2 Radio, both high-energy particle detectors based on the Askaryan effect. The goal of the research is to isolate signals from neutrinos and protons from other galaxies. For technical reasons, these projects operate in Antarctica, where we find the largest volumes of clean, cold ice on planet Earth. The ice must serve as the detection medium for high-energy sub-atomic particles from space that interact with solid matter. The nature of the Askaryan signal from neutrinos and cosmic rays is a radio-frequency electromagnetic pulse, and the detector modules are designed to record them.

Raymond would like to use this prestigious fellowship to help me study the Askaryan effect. Last summer, under the Fletcher-Jones Fellowship, Raymond and I used mathematical physics techniques to develop new equations for the Askaryan effect produced by neutrinos that interact in ice. The major tasks left undone were to establish the overall strength of the electromagnetic fields given the neutrino energy, and to compare our model to other models before publishing. Our goals this summer are (1) to establish the overall amplitude, (2) compare our model to other models, (3) to incorporate our model into the simulation code (NuRadioMC) that is currently being used to design IceCube-Gen2 Radio, and (4) to publish with peer review. I emphasize publishing, since we are very close already to this goal.

I have taught Raymond in Calculus-based physics 1 (PHYS150), Calculus-based physics 2 (PHYS180), Computer Logic and Digital Circuit Design (PHYS306), and History of Science in Latin America (INTD290). Thus, I know how Raymond can work independently on long-term math and physics projects, both in classes and in research. Raymond has persevered despite the pandemic, and has helped me a great deal. I have been teaching him how to use complex calculus, and with his programming skill. This pre-training takes place outside of regular coursework, but he completes it nonetheless.

In closing, I highly recommend Raymond Hartig for the Ondrasik-Groce Fellowship. Feel free to email me with any questions.

Sincerely,

Jordan C. Hanson, PhD