

Paul W. Hess



Graduate Institution: Harvard University

Graduate Discipline: Atomic, Molecular, and Optical Physics

Hometown: Simsbury, CT

Relevant SC Research: High Energy Physics

Research Interest:

There are many profound questions, such as the origin of our universe's matter/anti-matter imbalance, which can be studied using optical spectroscopy techniques on atoms and molecules. These experiments are on a much smaller scale than those studying similar physics at particle colliders, and this combination of fundamental questions and intimate experiments is very appealing to me. In particular, these questions can be linked to an asymmetry in the shape of the electron, which manifests itself as the electron's permanent electric dipole moment (eEDM). Currently, I am searching for the signals of an eEDM in the molecule thorium oxide (ThO), where the presence of an eEDM would shift this molecule's energy levels by a measureable amount. This molecule has a host of features beneficial to this type of measurement, which means my experiment has a very good chance of setting a new limit of precision in the search for this yet undiscovered moment of the electron.

About Me:

As an undergraduate at Williams College, I received a B.A. in Astrophysics and received highest honors on a precision measurement thesis with Professor Tiku Majumder in the physics department. I am currently finishing the fourth year of my Ph.D. at Harvard, working with Professor Gerald Gabrielse on the Advanced Cold Molecule EDM (ACME) experiment, a collaboration between the

Professors Gabrielse and John Doyle at Harvard, and Professor David DeMille at Yale. At Williams I was inducted into the Phi Beta Kappa and Sigma Xi societies, and I am currently a member of the American Physical Society (APS).

I found teaching at both Williams and Harvard extremely rewarding, where I gained experience teaching both laboratory and blackboard review sections. I have been able to work closely with undergraduates, supervising several students' semester long research projects in my group. If I continue in academia, I plan to apply for teaching positions at small liberal arts colleges, where I can continue to provide meaningful first research experiences to talented undergraduates.

I have had the good fortune to expand my knowledge of AMO physics by attending several international conferences while at Harvard. In 2010 I attended the International Conference on Atomic Physics (ICAP) in Cairns, Australia, with stimulating discussion of atomic transitions punctuated by snorkeling on the Great Barrier Reef. In 2011 I attended the APS Division of Atomic, Molecular and Optical Physics (DAMOP) in Atlanta, and in July 2012 I will attend another ICAP in Paris, France. These most recent trips have been supported by my SCGF research grant, and allowed me to present my work in talks and posters around the world.

I attend meetings of the Harvard Energy Journal Club (HEJC), where we discuss

energy technology and its environmental impact, and I have led several sessions on transportation technology and the dynamics of the power grid. This spring I traveled to Colorado and Wyoming with 15 other HEJC group members to visit sites related to the energy industry. The highlights included the transmission control center for the entire Denver grid and the largest coal mine in the U.S. I am excited about combining what I learn in my research and the HEJC in a future career, whether that means finding unique applications of atomic and optical physics, or using my experimental physics skill set more broadly.

Playing Ultimate Frisbee has been one of my hobbies since college, where I played with William's ultimate frisbee team all four years. I am still play ultimate all year round, and have been the captain of Harvard's Dudley House intermural ultimate team for the past three years. I am also a shameless art history and architecture nerd, and I love traveling to see the world's famous buildings in person. Some highlights include the enormous wooden temple Todaiji in Nara, Japan, and the soaring heights of gothic French churches, especially Rouen Cathedral.



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