

Craig Group
(Physics)

Mead Honored Faculty Proposal
“Dream Idea”

I am a relatively new faculty member here in the physics department of the University of Virginia. I am an experimental high-energy particle physicist. The goal of this field is to provide a complete description of how the universe was created and how the fundamental laws that govern its evolution behave. To study these elementary particles and forces, researchers use high-energy particle accelerators and collide particles in a controlled environment and study the results of the collisions. This research can only be done at a few laboratories around the world. While I had an offer of a permanent position at one of the premier laboratories in this field, I chose to join the faculty at UVA because in addition to my research the opportunity to teach and interact with students is very important to me.

In recognition of the objectives and ambitions of the Mead-Colley Funds I propose to engage undergraduate students majoring in physics with a new program within our Physics department. Over the last two years I have lectured to 200 pre-med students per year on the topic of introductory physics. One of my favorite parts of this experience has been the incorporation of numerous physics demos into the lectures. Even though I have been doing physics for more than 15 years, I was surprised to find that many of these demos were entirely new to me! I really enjoyed the chance to think about and investigate these demos for myself and this led to the idea that our undergraduate physics majors might also enjoy this opportunity. So, my dream proposal is to organize a series of meetings with physics majors where we investigate the demos, and think about how they work. In addition, we will discuss new ways to use and ways to improve the demos that we already have and the possibility of building additional demos that are not yet available in our department.

In order to recruit students for the program, I plan to attend one of the earliest weekly meetings of the Society of Physics Students, explain my idea, and personally invite these students to participate. In addition, I will send an email invitation to the full list of undergraduate physics majors (more than 100 students). We will meet in the evening in the physics building about once per month from September to March, about 6 meetings.

As a conclusion to the project a few students will be encouraged to present a demo at the annual “Physics Day Show”. The “Physics Day Show” is a performance that is open to the general public that illustrates basic physics principles through demos held each spring by the physics faculty. The “Physics Day Show” occurs at the end of April, so I expect to have a few extra meetings in April to prepare for our presentation. So, in total, we will have between 8 and 10 meetings.

At the first meeting, I plan to provide a long list of demos and ask the students which ones they want to investigate. For the Physics day show, with an audience of 200+ elementary-school aged children, we need demos with a stimulating observable (sight or sound). Some of my favorites are: demonstrating the energy storage of a capacitor (it makes a big spark!), using an electric field to filter the particulates out of a smokestack (useful for reducing pollution), and shrinking and expanding balloon animals using liquid nitrogen (everyone likes balloon animals and liquid nitrogen!). Of course, college physics majors might be interested in more subtle demos based on more difficult physics principles that aren't appropriate for the show, and there will be fine for that too. A typical meeting will consist of pizza or some other take-out food, a discussion of a few demos that will be set of for that day, time to handle the demos, and finish with a discussion of potential improvements to the demos or new demo ideas based on the physics principles of the demos from that day.

I plan to use the funds to purchase food to attract the students to the meetings and also to buy materials needed to modify existing demos and/or build new demos. Since the students will help decide the content of investigations, a detailed budget is not available at this time. However, the budget is flexible in that we will only take on projects that we have the funding to support.

In summary, my "Dream Idea" is to arrange for a series of evening meetings, including dinner, for approximately 10 undergraduate physics students and myself. These meetings will include hands-on investigation of a series of physics demos selected by the students. In addition to discussions of physics principles, we will discuss ways to improve the demos or ways to create new demos based on the same physics principles. The series of meetings will conclude with a contribution from the students to the annual "Physics Day Show" in late April.