Date: Nov. 6, 2015
To: Center for the Liberal Arts
From: Marc Sher, Physics
Re: Report on CLA Faculty Innovation Grant

For the past couple of decades, the sophomore level course in Physics, Modern Physics (Physics 201) has been the gateway for physics and chemistry students to upper level science courses, and covers relativity and quantum mechanics. It generally has about 60 students, and meets for four hours a week (MWF 10, F 2), even though it has only three credits. Historically, the Friday afternoon session was a tutorial to help students get the basic math needed for their upper level classes.

However, we recently started a new Math Physics course taken in the following semester, and the new curriculum gave us the opportunity to use the Friday session to "reach out" to other domains. There are many aspects of the history and philosophy of science that are covered in the course, and the new curriculum gave a way to formalize this. The CLA funds were used to support a junior in history who took the course (getting an easy A) last summer. He produced nine documents consisting of 3-8 pages each. Every Friday, the material in these documents are discussed, and students write half-page "thoughts" about the reading to hand in the following Monday.

The topics were:
1. Michelson-Morley -- the experiment that showed that absolute space and time did not exist.
2. Time travel --- the historical development of stories about time travel, ranging from H.G. Wells to Back to the Future to Interstellar.
3. Einstein as celebrity -- Einstein was the first scientist to grab the attention of the general public. Why? What was special about that time?
4. Cosmology – The scientific evidence for the very early universe has become overwhelming in recent years. What are the social and historical implications of these developments?
5. Early quantum theory – The whole concept of wave-particle duality is the most important development of science in the 20^{th} century. How did it develop in the early stages?
6. Bohr and Germany - A major issue in the development of quantum mechanics involved the international politics of the 20's and 30's, especially in the way physicists responded to the Weimar culture.
7. DeBroglie and Schrodinger - The culmination of the early development of quantum mechanics and the competition between the Germans and French/Swiss/Austrians as WW2 approached.
8.The Manhattan Project - includes a discussion of secrecy in the scientific community and focuses on the ethical issues involving the use of the bomb.
9. Big Science -- Some physics papers now have 7000 authors, and experiments can cost billions. How is that affecting the scientific community?
In addition, several lectures were held on the philosophical issues in quantum mechanics, including one on "The Nature of Physical Reality".

The responses from the students have been terrific. They ask many questions and seem very excited to see this material in a course on a topic that previously seemed fairly dry. The course this fall was a "beta test", and it has worked beautifully. Early next semester I will prepare an application to make this a COLL200 course that reaches out to both ALV and CSI. I would guess that over 25% of the material reaches out to other domains.