

ICEP Memorandum

February 2023

ICEP Workshop

The Jonathan F. Reichert Foundation is sponsoring a unique workshop to develop new materials for **Advanced Experimental Physics Education** which combine advanced Computational and Experimental Physics experiences. The workshop will be titled **ICEP, “Integrating Computational and Experimental Physics”**.

Background

Modern computing has for years served as an important bridge between theory and experiment. There can be no doubt about its impact on the discipline of physics, and many undergraduate programs have incorporated computational physics into their curriculum. But the tie to lab experimentation and how computational and experimental approaches complement each other is often missing from this instruction. A growing cohort of college and university physics faculty have lobbied for the addition of Computational Physics exercises as a standard component of undergraduate degree programs. These faculty have even created an organization called PICUP, which is actively creating and disseminating open-source material for Computational Physics exercises to be used by undergraduate majors.

In several informal discussions with TeachSpin’s technical staff, the idea of combining Computational and Experimental exercises was met with considerable enthusiasm by both the PICUP members and TeachSpin physicists. Several years have passed since these initial discussions occurred and no concrete programs, no publications, and no trials have developed. The time has come to re-energize these attempts.

At the November annual board meeting of the Reichert Foundation, a motion was discussed and unanimously passed for the Foundation to *fully fund* a small, invitation-only, in-person workshop in Buffalo, New York. It would be held in early summer 2023. This 3-4 day workshop would bring together faculty from both PICUP and Experimental Physics to create **ICEP** material for publication and dissemination to the physics community. This would be a face-to-face meeting of physicists who have considered the idea and have submitted, in advance, concrete proposals for specific **ICEP** exercises. This would be a working meeting to produce specific **ICEP** activities, either completely spelled out or in outline form, to be completed after the workshop meeting. It is also the aim of the workshop to create robust collaborations among the participants that will last and be creative for many years.

Outcomes

Like most “classic experiments”, successful **ICEP** exercises will not be easily created. The computational component needs to challenge the student’s computing talents and should be applied in cases where the standard analytical solutions do not apply. The experimental component should require a mastery of modern instrumentation, such as the lock-in amplifier

and the spectrum analyzer as a source of quality data that can be compared to the results of the computational calculations. These instruments should be available to schools at a reasonable cost. The success of such an exercise experience depends upon the student acquiring *ownership* of **both** the Computational and Experimental components at the **ADVANCED UNDERGRADULATE** level. This ownership is accomplished when the student chooses the parameters, manipulates the apparatus, and has hands-on experience with both parts of the **ICEP**.

The Workshop

All expenses of the participants' travel, lodging, and food will be borne by the Foundation, but no honorariums will be given. No outside "experts" will be brought in, and no special talks will be part of the program. This will be a 3-4 day working event with *concrete ICEP exercises* as the intended outcome.

TeachSpin will contact ALPhA to get its support and its membership list to provide contacts to solicit participation in the workshop. It will also contact AJP to explore the possibility of publishing of the outcome of the workshop. We will also contact AAPT and APS News to publicize this educational initiative.

Joining the ICEP Project

An application form, for those who wish to participate in the workshop, will be available in February. It will be on the Foundation's website, www.JFReichertFoundation.org, TeachSpin's website, www.teachspin.com, and other places.

The application will ask the faculty to outline *specific ideas* for one or more **ICEP** exercises as well as their advanced laboratory physics education experience. The committee has not yet been picked that will choose the 12 to 14 participants. Dr. David Van Baak, of TeachSpin, has agreed to chair the workshop and will serve on the selection committee.

The hope, the dream of the Foundation Board, is that this workshop will create a new paradigm for *advanced* experimental physics education – one suited for the next generation of physicists.

A tall order, but one that is within our grasp.

Jonathan Reichert, CEO, TeachSpin Inc.