

Draft...Letter of Intent for Snowmass2021: CommF4 Physics Education Working Group

## **Study of New Mechanisms for Professorial Collaboration across Academia**

R. Ruchti, Notre Dame...

### Abstract:

The field of Particle Physics has successfully brought many young researchers through the post doctoral ranks, at which time these individuals are then searching for more permanent positions in academia, National Laboratories and in the private sector. In the domain of academia, many may consider positional opportunities at R1 universities as well as other institutions including undergraduate-serving colleges and universities as well as community colleges. For those seeking these latter positions, the potential exists to attract a broader geographic and demographic base of students to the particle physics field, and this affords the possibility of strengthening the participation of underrepresented groups in the particle physics research program.

### Content:

Among the facets of this proposed study:

1. A needs analysis to assess the needs of faculty at such undergraduate institutions in order for them to be successful in conducting vibrant research programs, whilst maintaining a significant teaching load characteristic of such institutions.
2. Survey of institutional collaborations of Undergraduate Serving Institutions (USI) with R1 and laboratory groups that have proven successful so far, to assess lessons learned.
3. Study of new models of collaboration or cooperation that would allow USI faculty and their students to collaborate in demonstrably effective ways in experiments - to be effective leaders, rather than simply being regarded as followers.
4. Survey of R1 institution physicists who might share an interest in collaboration with USIs.

<https://docs.google.com/document/d/1S0-pX9XqY1gaa38xa8A1mNh3hShELvjCkz-kZ6VLZwE/edit?usp=sharing>

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## **Study of Mathematical Preparation for Physics Students and Particularly for Those Interested in Particle Physics**

### Abstract:

To be successful research scientists requires significant preparation in mathematics at the high school, undergraduate and graduate levels. This study will survey and assess the current state of mathematics preparation, particularly in areas of applied mathematics and statistics which are central to the understanding of the physical significance of scientific results, as well as assessment of preparation for new techniques for data analysis, simulation and event reconstruction.

### Content:

Among the facets of this proposed study:

1. Study and assessment of mathematics preparation at the middle school and high school levels as a means of attracting students to physics and strengthening their preparation for high school physics as well as engineering and technology careers.
2. Survey and assessment of mathematics preparation for undergraduate degrees in physics and technology. This includes both R1 institutions and USIs.
3. Assemble and make available a repository of course and lecture materials that could be shared among institutions.
4. Survey and assessment of mathematics preparation for graduate students.
5. Advanced mathematical opportunities for postdoctoral fellows.

<https://docs.google.com/document/d/1QLwkAPuldfOM1MnoXoBRh5UUYgtFnmgSSDzoMB2a48c/edit>

## **Study of Particle Physics Preparation for Physics Students**

### Abstract:

Successful training of research scientists requires significant preparation in particle physics at the graduate level. But to engage students early, strong undergraduate course development emphasizing particle physics would be advantageous. This study will survey and assess the current state of particle physics preparation at the undergraduate and graduate levels with the aim of strengthening the overall teaching of the subject across R1 institutions and USIs.

### Content:

Among the facets of this proposed study:

1. Study and assessment of particle physics at the undergraduate level.
  - a. Are there high quality textbooks available?
  - b. Forming a repository of lectures and accompanying course materials that could be shared across colleges and universities.
2. Survey and assessment of particle physics at the graduate level.
  - A. Are there high quality textbooks available?
- a. Forming a repository of lectures and accompanying course materials that could be shared across colleges and universities.
3. Are there new models of summer schools and training that would improve upon current instructional methodologies?

[https://docs.google.com/document/d/1EvtmWCUMxineWaASDqduwfZh\\_XvwATGdVStVVR65mJ8/edit](https://docs.google.com/document/d/1EvtmWCUMxineWaASDqduwfZh_XvwATGdVStVVR65mJ8/edit)

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## **Study of the Potential for a new Masters Degree in Applied Physics**

R. Ruchti, Notre Dame...

### Abstract:

The field of Particle Physics has successfully brought many young researchers through the post doctoral ranks, but the process is not necessarily providing meaningful opportunity for participation from a broader demographic and geographic groups. To ameliorate and perhaps help correct this situation, a Masters Degree in Applied Physics is proposed with the aim of providing an advanced degree beyond bachelors level that would provide for a meaningful career path for students into a technological career in laboratories or the private sector, as well as the prospects for a springboard for those who find a PhD degree is possible, one they are engaged in such a program.

### Content:

Among the facets of this proposed study:

1. A needs analysis to assess the value and chances of success of such a program.
2. Compare such a program with current models of masters degrees in engineering and MBA degrees.
3. Would the private sector buy in and support such a degree opportunity for current students and for their employees seeking career improvement.
4. Would such a degree provide training opportunities for those seeking technical careers at laboratories or perhaps medical fields.
5. What is the curriculum for such degree(s) and could they be made available nationwide through shared curriculum?
6. Would universities and USIs buy in to such programs?

[https://docs.google.com/document/d/1hVX2uWzXLb5r4\\_fsLmerU4LmaJlkgB64noa73OdBfmw/edit](https://docs.google.com/document/d/1hVX2uWzXLb5r4_fsLmerU4LmaJlkgB64noa73OdBfmw/edit)