



2014 REQUEST FOR PROPOSALS – COMPREHENSIVE SITES

PHYSICS TEACHER EDUCATION COALITION (PHYSTEC)

INTRODUCTION

In the United States there are over 27,000 teachers of high school physics who serve students in over 20,000 public and private high schools. While many of these high school physics teachers are excellent educators, fewer than half of U.S. physics teachers have a major or minor in physics or physics education. Each year, about 3000 teachers find themselves at the front of a physics classroom for the first time, yet only 1400 have a relevant major or minor. In many states, weak standards for certification or endorsement to teach physics hide the fact that many teachers of physics lack the content knowledge and focused pedagogical preparation necessary to provide an excellent physics education for *all* students. The scarcity of qualified physics teachers is exacerbated by an annual increase in both number and fraction of high school students who take physics.

The Physics Teacher Education Coalition (PhysTEC) has the mission of improving the education of future physics and physical science teachers. The PhysTEC project has the following goals:

- Transform physics departments to engage in preparing physics teachers
- Demonstrate successful models for increasing the number of highly-qualified physics teachers
- Spread best-practice ideas throughout the physics teacher preparation community

To date the project has funded 32 institutions as PhysTEC Supported Sites to build physics and physical science teacher education programs. These Supported Sites have demonstrated significant successes in increasing the number of highly-qualified physics teachers (for details, see www.PhysTEC.org). A coalition of over 280 PhysTEC Member Institutions is served by an annual national conference and other opportunities to improve and promote physics teacher education (see www.PhysTEC.org). In addition, transformation of physics departments is addressed by a national advocacy campaign, which includes partnerships with organizations with aligned goals.

PROGRAM DESCRIPTION

The project seeks to add several more PhysTEC Supported Sites through a Request For Proposals (RFP). *Comprehensive* sites will be funded with a goal of establishing model programs that address the entire teacher education continuum and graduate a relatively large number of physics teachers. This document describes the call for *comprehensive* sites. A separate document available at www.PhysTEC.org/solicitation describes the call for *recruiting grants*, which are smaller awards focused solely on increasing the number of physics teachers.

Comprehensive sites

Comprehensive sites are expected to embrace the goal of increasing the number of highly qualified secondary physics teachers. These sites will implement programs that address the entire teacher education continuum, including recruiting, early teaching experiences, a

The Physics Teacher Education Coalition is a joint effort of the American Physical Society and American Association of Physics Teachers, with support from the National Science Foundation and APS Campaign for the 21st Century.

pedagogically sound curriculum, and induction and mentoring of new teachers. A significant aspect of *comprehensive* sites is the Teacher in Residence (TIR), an expert physics teacher who serves as an ambassador for teaching in the physics department and plays a central role in program operations. Each site will implement these elements within a particular local context, giving rise to different exemplars for improving physics teacher education. PhysTEC will also support course reform to improve the quality of physical science education for pre-service elementary teachers.

Comprehensive sites are envisioned to have impact beyond the local institution, and will be held up as national models in areas of success. These sites must have a significant campus commitment to sustaining the project beyond PhysTEC funding, demonstrating the viability of institutional change toward improving teacher education. Institutions will be asked to document project advances and setbacks in order to provide experience and information for others to adopt or adapt program elements developed as part of the project. For more information on comprehensive sites and examples of project reports, see www.PhysTEC.org.

Considerations for potential *comprehensive* sites

Comprehensive sites are expected to graduate relatively large numbers of teachers. Recruiting is an increased emphasis in the 2014 solicitation as PhysTEC seeks to build models for institutions that dramatically increase the number of physics teachers. At the same time, institutions should realistically assess their potential to recruit more physics teachers. The most accessible pool for recruiting future teachers is physics majors. Note that data we have collected from institutions around the country indicate it is unusual for more than about 10-15% of physics majors to become teachers. Beyond the physics department, students in closely allied disciplines offer further opportunities for recruiting physics teachers.¹ These disciplines can include, for example, applied physics, astronomy, materials science, math, chemistry, and some branches of engineering. Education majors, physics graduate students, and career changers have also contributed to the ranks of PhysTEC teachers. Institutions should have a plan for how they will bring students from other disciplines into a teacher education program. Institutions that are most successful at increasing the number of physics teachers have multiple pathways into the physics teacher education program for students at various stages in their academic career.

Just as important, institutions should carefully consider their capability to sustain efforts after PhysTEC funding ends. PhysTEC sites are expected to maintain programs post funding; for example, all successful proposals from the 2012 RFP process committed to sustaining major program elements for 3 years or more beyond the funded period.² The commitment of resources to sustain programs should be commensurate with requested funding levels.

¹ Any student who has a physics major, minor or equivalent coursework and who completes a program of teacher education can be counted as a PhysTEC graduate.

² The Arizona State University physics department will sustain a Teacher in Residence (TIR) and Learning Assistants (LA) indefinitely. James Madison University will sustain a TIR for three years with funding from the College of Science and Math and will sustain the LA program with funding from the JMU Learning Center. University of Alabama committed to sustain the TIR and the physics department will fully fund the LA program. At University of Missouri the TIR will be sustained for at least three years with a half-time teaching professor

The project will offer significant financial and intellectual support to selected institutions to achieve project goals. This will include networking with the best programs throughout the country; helping your institution raise other local, state or federal funds; and making available the expertise of dedicated individuals who are working toward similar goals. It should also be kept in mind that PhysTEC funding is limited, and we see a PhysTEC award as support for bootstrapping a nascent physics teacher education program rather than long-term funding of these efforts. Many of our previously funded programs have found funding from other sources during and subsequent to the PhysTEC-funded period. Starting from scratch with PhysTEC is probably not a recipe for a successful program. We expect you have already been thinking about physics teacher preparation and have initiated discussions and activities to make this a successful and sustainable venture at your institution.

The PhysTEC project is focused on pre-service teacher education, which is an often neglected and critical part of teacher education. Proposals that are primarily or exclusively focused on in-service teachers will not be accepted as there are many existing models of in-service programs as well as other funding streams to support teacher professional development.

AWARDS

We will fund approximately three *comprehensive* sites to begin activities in 2015. *Comprehensive* sites can request funding of *up to* \$100,000 per year for three years. Profiles of sites funded from previous solicitations as well as the 2012 solicitation are available on www.PhysTEC.org.

ELIGIBILITY

Eligible organizations

The lead organization must be a university or four-year college that offers a physics degree and teacher certification program, and be located and accredited in the U.S. A consortium of institutions may also include two-year colleges or non-profit entities.

PI eligibility

The principal investigator (PI) must be a tenure-track or tenured faculty member in the physics department. Programs are strongly encouraged to have collaborative arrangements with the School of Education or appropriate unit housing the teacher certification program, which may include a co-PI in Education.

PROPOSALS

Institutions that would like to be considered for PhysTEC funding are required to submit an initial proposal, due 12 May 2014 at 5 p.m. local time. A small number of selected institutions

position jointly appointed in physics and education; the UM physics department will fund the LA program and the UM school of education will fund an adjunct faculty member to co-teach the Physics Teaching Methods course.

will be invited to submit a full proposal, due 8 September 2014 at 5 p.m. local time. Email proposals as an electronic attachment in PDF format to Monica Plisch at plisch@aps.org. Late proposals will not be accepted.

There will be a webinar on the PhysTEC RFP on 22 April 2014 at 3 p.m. EDT. Details will be available on www.PhysTEC.org/solicitation. Project management encourages inquiries and consultation during the proposal writing process. Please contact Monica Plisch (phone: 301-209-3273, email: plisch@aps.org) or Ted Hodapp (phone: 301-209-3263, email: hodapp@aps.org).

Initial proposal

Initial proposals are limited to 3 pages for *comprehensive* sites. Proposals that exceed the page limit will not be read beyond the stated page limit. Text should be single-spaced, written in Times 12-point font or larger, with at least 1 inch margins. While sustainability and institutional support should be addressed in the initial proposal, actual letters of support will not be accepted. Please send a document that includes the following information as appropriate:

- **Institutional context.** Briefly describe the institution, including how teacher education fits with the mission, and whether it is a minority-serving institution. Also, briefly describe the physics department, including major education initiatives.
- **Teacher education.** List existing program(s) to educate physics teachers. Also, describe the need for physics teachers in your region or state.
- **Data table.** Provide a data table with the following: (a) the number of students who received bachelor degrees in physics for each of the last 3 years, and (b) the number of graduates from physics teacher education programs for each of the last 3 years.
- **Project goals.** Give a numerical goal for increasing physics teachers, and define other major project goals.
- **Project activities.** Outline a plan of action for achieving stated goals. It is expected that projects will address the PhysTEC key components listed below, with an emphasis on activities aimed at increasing the number of physics teachers.³
- **Project team.** List key faculty and staff who will implement the project, and briefly describe their experience relevant to physics teacher education.
- **Sustainability.** Provide a brief description of plans for sustaining the project's activities beyond the PhysTEC funding period.
- **Budget.** Provide a budget summary.

Please keep in mind that while a brief description of existing efforts can be useful to provide context, the emphasis of the initial proposal should be on the types of actions to be undertaken as a result of PhysTEC funding, and how these efforts will result in substantial improvements in physics teacher education.

³ Also, see www.PhysTEC.org for more information on PhysTEC key components.

Full proposal

After the review of the initial proposals, you may be invited to submit a full proposal. The full proposal format is similar to a standard NSF proposal. Review criteria listed below indicate how proposals will be evaluated.

Project description

The project description should be a maximum of 15 pages for *comprehensive* sites. Text should be single-spaced, written in Times 12-point font or larger, with at least 1 inch margins. Also include a one-page project summary suitable for the web, which will not be included in the page count for the project description.

Comprehensive sites must include and clearly identify the following elements in the Project Description section:

- **Project goals.** Give a numerical goal for increasing physics teachers, and define other major project goals during the period of PhysTEC funding and beyond.
- **Institution profile.** Include a brief description of the institution, including how teacher education fits with the mission, and whether it is a minority-serving institution.
- **Physics department profile.** Include a brief description of the physics department, and provide the number of students who received bachelor degrees in physics for at least each of the last 3 years, as well as an overview of the undergraduate program.
- **Physics instruction.** Briefly describe instructional practices in the introductory physics sequence and provide any evidence of effective teaching, such as implementation of research-based curricula/pedagogy or data on student learning gains.
- **Physics teacher education program.** Briefly describe existing program(s) to educate physics teachers and the number of graduates from each program for the last 3 years.
- **Synergistic programs.** Briefly describe existing programs or initiatives that will have significant interaction with the PhysTEC effort. Outline the nature of the interaction.
- **PhysTEC key components.** Describe how you will implement the key components listed below in your local context. It is expected that *comprehensive* sites will implement most but not necessarily all of the PhysTEC key components. If your project will not explicitly implement a key component, provide a rationale or explain how its underlying goals are addressed in other ways. The PhysTEC key components are:⁴
 - **Recruitment.** Describe specific strategies that you will implement to increase the number of physics teachers. This should include discussions of:
 - **Marketing** – Raising awareness about opportunities in physics teaching among students whom you hope to recruit is the first step; this should include considerations of physics majors as well as students in other disciplines that may become physics teachers. Additional considerations include promoting the program outside the university, for example to high school students or potential career changers.

⁴ See www.PhysTEC.org/components for more information on PhysTEC key components.

- **Advising** – Students considering or pursuing physics teaching need encouragement and guidance from someone knowledgeable about the profession and ways to explore pathways leading to a teaching career.
 - **Pathways** – A variety of flexible and streamlined pathways leading to a physics degree and certification is key to attracting a large number of students to physics teaching, as students may develop an interest in teaching at different points in their academic career. Improving existing pathways or establishing new pathways can substantially increase the number of students pursuing physics teaching.
 - **Financial support** – Students who seek certification often take longer to graduate; scholarships, TA support, tuition waivers, or other financial support can make a critical difference in affordability, as can an overall low cost of attendance.
- **Early teaching experiences.** Describe opportunities for prospective teachers to experience teaching early in their college career. Experiences working with pre-college students are especially important for prospective teachers to develop and confirm a passion for teaching (or decide it is not for them).
 - **Learning Assistants.** If your project will include a Learning Assistants (LA) program, describe how this will be implemented at your institution.
 - **Pedagogical content knowledge.** Describe how future teachers will learn knowledge specific to teaching physics (pedagogical content knowledge), as opposed to physics content or general pedagogy. For example, this could include a pedagogy course for Learning Assistants, development of a course on teaching and learning physics, or modification of a science methods course to include physics-specific methods, or other courses designed specifically for future physics teachers.⁵
 - **Induction and mentoring.** Describe how you will support and mentor future teachers and new teachers in their first years of teaching. Provide a plan for tracking PhysTEC graduates and staying in contact with them.
 - **Champion(s).** Name the champion(s) who will lead the project, and describe how they are positioned to have influence in the physics department and with key administrators. In addition, name other faculty and staff on the leadership team, and describe their roles and responsibilities.⁶
 - **Teacher in Residence.** A Teacher in Residence (TIR) is required for a *comprehensive* site, either full time or part time. Describe specific roles and responsibilities of the TIR, also known as a master teacher. The TIR can play a significant role in recruiting, among other roles.
 - **Collaboration.** Describe how the physics department will work collaboratively with the school of education to further project goals, including changes that will

⁵ For specific examples of how supported sites addressed pedagogical content knowledge, see the “Course Reform” section of reports for supported sites available at www.PhysTEC.org/institutions.

⁶ Although we do not require the presence of physics education research (PER) faculty, we have often found successful sites have faculty with this expertise. Typically their research emphasis is not specifically in teacher education; however, they can provide a source of knowledge that complements project goals and activities. Consequently, we encourage departments to engage PER faculty whenever possible to help inform the project.

take place in education (as well as physics) to improve physics teacher education. In addition, describe how you will work with local schools to improve the physics teacher education program. Some sites establish a Teacher Advisory Group (TAG) with expert teachers as advisors, cooperating teachers, or in other roles.

- **Institutional commitment.** Describe how program activities will be sustained by the institution and program changes will become standard practice after PhysTEC funding ends. Also, provide a plan for keeping your local administration informed about the project.
- **Assessment.** Describe how your institution will measure success with respect to stated goals, including data you will gather and evaluation metrics. Explain how results will be used as feedback to improve the teacher education program.
- **Elementary teachers (optional).** If your project will improve physics education for elementary teachers, describe your plans to implement research-based curriculum materials and methods.⁷ A small amount of additional funding is available to further these goals.

Additional proposal sections

There is no page limit for the additional sections listed below, and none of the sections will count toward the page limit for the project description.

- **References.** References should be included in a separate section from the project description.
- **Biographical sketches.** Provide an NSF-style, two-page CV for senior members of your project team listed in the project description.
- **Personal statement.** The PI should write a short personal statement (no more than one page) addressing motivations for taking leadership in physics teacher education.
- **Current and pending support.** If the proposed budget includes stipends or salary offsets for faculty, provide a NSF-style document listing current and pending support for each faculty member who will receive a partial salary from the PhysTEC grant.
- **Letters of support.** Institutions are expected to provide significant matching funds to the funds provided by the PhysTEC project. The institution must commit, in writing, to provide resources to sustain the physics teacher education program beyond PhysTEC funding. Letters of support should include specific commitments of resources or other contributions. Letters that offer only endorsement rather than actual support are discouraged.

Budget

A NSF-style budget and budget justification is required with the full proposal. Include a budget for each project year and a summary budget for the entire project. The budget justification should include a description of each budget item. Funds must be spent on efforts primarily focused on improving the education of future physics teachers. Activities that, for example, benefit primarily science teachers in other disciplines or benefit physics majors at large without a special emphasis on teachers will likely not be allowed. No support for scholarships is allowed, although we encourage this type of in-kind support as a component of cost sharing.

⁷ For recommended curricula, see www.PhysTEC.org/keycomponents/elementary.cfm

- **Fringe benefits.** The fringe benefit rate on salaries is limited to the institutional fringe rate or 33%, whichever is smaller.
- **Travel.** Include travel for the PI to two project meetings each year (the PhysTEC annual conference and the summer AAPT meeting), as well as travel for the Teacher in Residence (TIR) to the summer AAPT meeting before and after their academic year of TIR service. We also encourage the PI to bring colleagues to these meetings, and encourage in-kind travel support to meetings as a component of cost sharing.
- **Indirect cost limitations.** No indirect costs are allowed on the TIR salary or participant support including stipends for Learning Assistants, if applicable. Indirect costs are limited to 24.73% on other budgetary items.
- **Cost sharing.** Although a specific level of cost sharing is not required, successful proposals typically have provided significant matching funds and in-kind contributions. Reviewers typically interpret these resources as demonstrating commitment by the institution to a sustainable program.

PROPOSAL REVIEW

All applications will go through an NSF-style review process. A panel composed of external reviewers and the PhysTEC project management team will evaluate proposals. Anonymous comments from individual reviewers and the panel discussion will be sent to all Principal Investigators. Project management will visit top candidate *comprehensive* sites in Fall 2014. New sites will be announced in November 2014 after the entire process is completed. Funding will begin 1 August 2015 to allow for a planning period and find a TIR.

Review criteria

Panels will use the following criteria during review of initial letters and full proposals.

- Potential to increase the number of physics teacher graduates – *What is the potential to substantially increase the number of well qualified physics teachers? How large is the pool of potential physics teachers including physics majors and others? How well conceived is the plan to recruit future teachers, and retain them to successful graduation?*
- Potential to successfully implement PhysTEC key components – *How will key components be successfully implemented in the local context? What existing programs and efforts will support implementation of key components?*
- Potential to develop a national model – *What is the potential to build a highly successful program that can be promoted nationally to advance physics teacher education? Are there unique features that distinguish the program from other efforts and add to the PhysTEC model? Is there a well-conceived plan to evaluate and document successes?*
- Qualifications of team to carry out project – *Is the team well positioned to implement proposed changes in the physics department and school of education? What is the knowledge and experience of the team in physics education? How is the project informed by contemporary educational research?*
- Evidence of institutional support – *What matching funds and other support will the*

institution provide? What resources will the institution commit to sustaining the project after PhysTEC funding? How will the administration stay informed about and connected to the project? What is the nature of communication between the site leaders and administration members with budgetary responsibilities?

- *Extent to which the institution adds diversity – What is the potential of the project to increase diversity of PhysTEC graduates? How does the type of institution and geographic location extend the portfolio of PhysTEC Supported Sites, and provide further examples of successful teacher education programs?*

AWARD ADMINISTRATION

Comprehensive sites will be expected to participate in project activities described below. While significant effort is required on the part of supported sites, the level of project support is commensurate. Such support includes a national profile for sites, advocacy by project leadership, ideas and models from national leaders in physics education, and assistance with fundraising by project management.

Communication

Each site will be asked to designate one person as the primary point of contact, and the management team will communicate with this person on all project matters. In addition, communication will be facilitated by a listserv, monthly videoconference, and project wiki.

Memorandum of Understanding

The project will negotiate an institution-specific Memorandum of Understanding (MOU) with each *comprehensive* site for every project year. The MOU will include a detailed list of activities to be carried out by faculty and staff during the project year (August 1 to July 31). The MOU will also include a budget for the project year.

Site visits

The PhysTEC project management will conduct site visits once a year for *comprehensive* sites. The visit will last about one day and will include discussions with faculty, students, administrators and staff. The project management will write up a synopsis of the visit that will be sent to the site but will not be published, and is intended to provide feedback to the site on project activities and suggestions for synergistic activities. The site will be given an opportunity to comment on the validity and accuracy of the report before it is finalized. Site visits often include members from other PhysTEC sites or from the larger coalition of PhysTEC Member Institutions committed to teacher preparation (see www.PhysTEC.org). Individuals from your institution may also be invited to take part in site visits to other institutions where there seems to be a mutual benefit to such a visit.

Leadership Council

The Principal Investigator from each site is expected to participate in the PhysTEC Leadership Council. The Leadership Council will meet monthly via videoconference during the academic year and in person twice each year (once at the annual PhysTEC conference, and once at the summer AAPT meeting). The purpose of this Council is to ensure smooth operation of the

project, provide input on project policies, share ideas, and help spread knowledge of excellent teacher preparation activities. New awardees should also plan to attend the PhysTEC conference in February 2015 in Seattle, WA, and will receive travel support.

Publications

We expect each site to author a significant publication based on their activities. This could, for example, be directed at the American Journal of Physics, Physical Review Special Topics – Physics Education Research, The Physics Teacher, The Forum on Education Newsletter or other similar venues. Sites should consider how they structure data gathering and documentation efforts in such a way as to make this a significant project outcome.

Annual reports

We ask each site to compile an annual report that we will place on the PhysTEC website to inform the broader community of its progress and activities. We have constructed a template for this report and will assist each site in making reports web-compatible. Examples of these reports can be found at www.PhysTEC.org/institutions

Assessment

We collect data from every site annually to help with local assessment of progress and to characterize project success as a whole. The project will expect the following from each *comprehensive* site:⁸

- Data and a clear description of methods used to count teachers for each year of the project as well as the three years prior to PhysTEC funding (to provide a baseline). These numbers will be used, in part, to measure your success. This should include separate categories for the number who graduate from your physics teacher education program and the number who are in the pipeline as future physics teachers.
- Number of teachers mentored by your Teacher in Residence (this includes teachers that have graduated from your physics teacher education program, other teachers in schools where your TIR is available to provide mentoring, and future teachers still in classes).
- Names of faculty and staff involved from both physics and education departments (to help measure faculty buy-in to project goals).
- Course enrollment data for courses that were significantly transformed by the project.
- Conceptual surveys to measure student learning in introductory physics courses, such as the Force Concept Inventory (FCI), and the Conceptual Survey of Electricity and Magnetism (CSEM).
- Updated contact information for all program graduates. We send a brief survey to all PhysTEC graduates each year to ask about employment outcomes. We ask each site to maintain contact with *all* graduates during the project and for a period of five years following funding, to assist with gathering employment and retention data.
- Data and evaluation metrics as outlined in your proposal to measure success toward stated goals.

⁸ For more information on assessment tools and strategies employed by the PhysTEC project, visit <http://www.phystec.org/components/assessment>

- We will also ask, from time to time, for short descriptions of project successes or activities. These feature innovative programs set up at your institution, or significant successes in your work toward the goal of improving teacher preparation.

ABOUT PHYSTEC

The PhysTEC project has support from the National Science Foundation and through individual and corporate gifts to the American Physical Society's (APS) Campaign for the 21st Century. The project is led by APS in partnership with the American Association of Physics Teachers. More information about PhysTEC is available at www.PhysTEC.org