**Public Abstract**

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**NRT-IGE: Enhancing Learning and Retention in Graduate Physics**

In recent years, education research has revolutionized undergraduate STEM education and physics education in particular. However, many of the positive changes to instructional practices and metrics for success have not been implemented at the graduate level. With a national economy increasingly dependent on highly-trained specialists in technical fields, this is a nationally-relevant problem. Similarly widespread are the problems of high attrition rates in physics graduate programs (on the order of 50%, nationally) and persistent underrepresentation of women, African Americans, Hispanics and other groups in Physics and STEM. These chronic shortcomings in diversity and in retention highlight the need for improved strategies in STEM education for graduate students. One of the significant barriers is the traditional approach to graduate core physics courses. This National Science Foundation Research Traineeship (NRT) award in the Innovations of Graduate Education (IGE) Track to The Ohio State University will develop, adopt, and assess innovative, research-based instructional best practices in graduate-level core physics courses, especially focusing on factors affecting retention and diversity. In particular, the project is aimed at ensuring that the developed methods and materials are widely-applicable and adoptable by engaging multiple sites in the development process (initially four large Midwestern research universities), and collecting data on effectiveness at each site.

This project will directly engage the physics graduate instructors of participating institutions in the development of a new approach to core graduate training in physics. The approach applies and adapts a successful model for establishing and maintaining faculty learning communities to facilitate the professional development of instructors and the adoption of research-based instructional materials and methods. The project will engage the department graduate-studies committees to facilitate positive change in policies and practices to ensure systemic and lasting change. In a bottom-up process emerging from the needs of the faculty learning communities, instructional materials will be developed via a research-based iterative model including the identification of student difficulties and construction of materials to engage students in addressing those difficulties in an inclusive and welcoming environment. The approach includes feedback to the instructors and the project researchers via student performance on exams, course assignments, in-class performance, student surveys (e.g., attitude, belonging, motivation) and student and faculty surveys and interviews. This program will advance our knowledge of topic-specific instructional materials and methods to improve student learning at the graduate level and will generate novel instructional materials that are currently unavailable. Our program can serve as a model for other graduate programs in physics.