PROJECT DESCRIPTION

1. Broader Impact and Connections between Outreach and Research

The PI has worked hard throughout her career to encourage the participation all students — especially women and minority students — in mathematics and science. This has included:

- participating in the Women in Science and Engineering (WiSE) student group at Brown University and the WiSE faculty group at the University of Southern California (USC);
- participating in the Women in Mathematics groups at Brown and at USC;
- becoming an active member of the Hawai‘i–Pacific chapter of Graduate Women in Science as well as sponsoring memberships for her graduate students;
- attending the first Women in Numbers (WIN) conference, and organizing the upcoming WIN 2 conference at the Banff International Research Station; and
- co-organizing community events like “A Beautiful Afternoon of Mathematics for Girls and Their Families” and the “Moloka‘i Math Day.”

The proposed project will allow the PI to build on her demonstrated success working with students at all levels, with a focus on gender equity issues and on outreach in K–12 education.

Mentoring Women in Mathematics at the University of Hawai‘i. The mathematics department at UH has just two women out of 23 full-time tenured or tenure-track faculty. The ranks of women graduate students and undergraduate majors are swelling each year, but there is a perception in the Department that many of the female graduate students are among the weakest in the program. Few of them are on track to earn Ph.D.’s, and are likely instead to leave the program with a master’s degree.

To date, the Department has not provided targeted support for these young women, despite recognizing the fact that they are struggling and not as engaged as the male students. The PI benefitted greatly from the camaraderie and support she found in both WiSE and a mathematics graduate student affinity group.

Therefore, the PI plans to recruit female graduate students and any new faculty to join the new and growing Hawai‘i–Pacific chapter of the national organization Graduate Women in Science (GWIS). Activities for the group include regular meetings, social activities, mentoring and support from faculty and senior graduate students, panels on career choices, and outreach activities in the community. Already, both women faculty and four of our graduate students are members of the organization, and these four students have collaborated with students from the Zoology department in writing a small grant to run “Be a Scientist Tonight” events at local schools.
The PI’s goals in for GWIS are:

- to foster a sense of community among the women faculty and students in our Department and collaboration with other departments;
- to provide a place for women graduate students to vent, complain, and express fear, as well as a place where they find understanding, support, and mentorship;
- to encourage the women graduate students to support each other, to work hard at science and mathematics, and to take chances; and
- to improve the success of our women graduate students in classes, on exams, in earning degrees, and in achieving their career goals.

In addition to this more informal mentoring, the PI began directing the research of undergraduate and graduate students in the past six months. She has found that rather than being a drain on her time (as she expected), the graduate students bring energy and ideas to every meeting, and the PI’s own research has benefitted tremendously from these interactions. Support for these graduate students — including financial support — is essential in getting them through to Ph.D.

**Math Teachers’ Circle Hawai‘i.** The PI has been concerned with how to continue serving partner teachers from our GK–12 project after the STEM Fellows complete their one-year placement. A fundamental goal of that project was to establish ongoing relationships between the UH Department of Mathematics and local schools. We have successfully built those relationships, and now we must find ways to continue supporting local teachers. This is especially necessary as Hawai‘i adopts the rigorous “Common Core Standards,” and more will be asked of our teachers than ever before. The PI is uniquely qualified for this work, thanks to eight years’ experience working in the popular and ongoing “PROMYS for Teachers” summer and school-year programs.

In June 2010, the PI organized a team from Hawai‘i — one Graduate STEM Fellow, a staff member of CRDG, and two middle school math teachers — to attend the “How to Run a Math Teachers’ Circle” workshop at the American Institute for Mathematics (AIM) in Palo Alto, CA. The team returned home with a firm belief that Hawai‘i would benefit tremendously from a Math Teachers’ Circle, and with a plan in place to get one off the ground based on the model developed at AIM.

Math Teachers’ Circle Hawai‘i (MaTCH) will be a collaborative group of teachers, mathematicians, and middle school educators who meet regularly to do mathematics. Our fundamental beliefs are that when teachers engage in mathematical problem solving activities, they further their own mathematical knowledge as well as develop pedagogical content knowledge, and that raising mathematical content knowledge is a critical component of teacher professional development.

Plans are underway for a summer kickoff retreat in June, 2011 (see the flyer attached to this proposal). Twenty-five teachers will be in residence for four days and three nights at the East-West center at UH. During the day, UH faculty and Graduate STEM Fellows will lead teachers in mathematics problem-solving activities. Time will be set aside each afternoon to discuss pedagogical issues, the new Common Core Standards,
and other issues of concern to the teachers. In the evening, SUPER-M Fellows will staff the on-site “Math Lab,” where participants can continue explorations from earlier in the day, ask questions, and deepen their understanding. We also plan for six MaTCH Saturday morning workshops each school year. The Saturday workshops will follow a structure similar to a half-day at the retreat: mathematics activities led by a local expert, followed by pedagogical discussion facilitated by colleagues from CRDG.

The goal is for MaTCH to become self-sustaining. We hope to find local sponsors or other methods for providing food and space for the workshops. We believe the Mathematics Department will adopt this outreach project, with faculty and graduate students taking turns running the Saturday workshops, and we will also reach out to other departments and to local industry to find presenters. In addition, we have plans to collaborate with mathematicians from other campuses, bringing their expertise and ideas to the teachers. (See attached letters of support.) Our hope is to have Math Teachers’ Circles on each of the main Hawai‘i islands in a few years. We know that positive word-of-mouth will go a long way, once MaTCH is underway.

However, to get MaTCH off the ground will require funding. Teachers’ time is precious, and they should be compensated for spending a week doing mathematics and furthering their professional growth. We also hope to give stipends to our founding cohort of teachers for the first few years of the program, to encourage regular attendance so that we achieve a critical mass, essential to the success of the program.

We are lucky to be able to leverage the existing SUPER-M project to help establish and run MaTCH. The PIs and graduate Fellows of SUPER-M will organize and run the summer retreat and six school-year sessions as part of their project work. Our initial cohort of participants will include current and former partner teachers in the SUPER-M program, including two teachers from Maui, two from Moloka‘i, and four from the Big Island of Hawai‘i. We hope that at least five of these teachers will choose to participate for the first several years of the project, and then will become leaders in establishing MaTCH chapters on their own islands. We therefore request travel funds for these teachers, both for the summer retreat and the school-year sessions.

The connection between the PI’s proposed research and MaTCH may not be obvious at first. But the PI has spent a great part of her career working on making mathematics research — both the ideas and the methods — accessible to a wide audience. It is unreasonable to expect middle school teachers to work at the frontiers of mathematics, especially in a single afternoon once a month. However, teachers can be exposed to ideas from higher mathematics. One of the great joys of working in number theory is that, though the problems can be quite difficult to solve, they are often easy to describe, even for non-experts.