

DEPARTMENT OF MATHEMATICS

VIGRE Funding Report**(due 30 days after semester of support)**

Semester/Summer and Year:

Spring 2008

Name: Robert Jenkins

List the graduate courses you have taken this semester (including independent studies), your grades, and the instructors:

Course	Title	Grade	Instructor
Math 920	Dissertation	K	McLaughlin
Math 529	Topics in Modern Analysis	A	McLaughlin

List the title, date and location of any talks you have given, either here or elsewhere:

If you are working on your dissertation, include a one paragraph description of your research progress. If you have not yet begun dissertation research, describe your progress toward finding a dissertation topic and advisor and beginning that research.

This semester began wondering when I would finish and ended knowing I would be done soon. I was able to crack the major technical difficulty that was keeping my research from progressing this semester. There are still details to be worked out, but we have a very clear idea of how things will develop. I will quite easily be ready to defend my thesis in the coming academic year.

List publications, if any.

Check all activities you completed during the funded period:

Academics:

- Independent Study
- Oral Comprehensive Exam
- Commence Thesis Research
- Conference attendance
- Conference participation
- Complete PhD

Professional development and outreach:

- AP Calculus Visit
- High School Workshops
- Undergraduate Research Project
- Undergraduate Research Seminar
- Super TA
- Mentoring junior graduate students for the qualifying exams
- RTG (help organize)
- Research Seminar (help organize)

Other (please specify)

I was a mentor for a group of students in the Mathematical Modeling course Math 485

Attach a brief statment about your academic progress and professional development during the period of support.

Robert Jenkins

Report for VIGRE support 1/08-5/08

June 13, 2008

During the Spring 2008 semester I received VIGRE support from the Program in Applied Mathematics. My goal during the period of support was to get as close as possible to completing my thesis research. I am thrilled to report that during this past semester that my advisor, Dr. Ken McLaughlin, and I have "cracked" the problem; there are a few details left to work out, but the difficult portion of my thesis was completed this semester.

As was outlined in my grant proposal, my research focuses on using asymptotic methods to solve the small dispersion limit of the focusing nonlinear schrödinger equation (NLS),

$$i\epsilon q_t + \frac{\epsilon^2}{2}q_{xx} + q|q|^2 = 0, \quad q(x, t = 0) = q_0(x),$$

given compactly supported initial data. At the semester's outset, we had successfully solved the associated RHP at the initial time, and had an inkling of how to deform this solution to allow a genus zero solution for t positive, but there were several issues that would have to be resolved before we had a proof. In particular, for positive times, a new local problem emerged that required us to build a local parametrix unlike those in the literature. The bulk of this semesters work revolved around finding a solution to this local problem. It took several months to get it exactly right, but happily we eventually found the right solution to this problem. In addition, we found a curve in space time along which the solution transitions from genus zero to genus two and were able to describe the solution in this region as well. It took an incredible amount of time to work all the details out. I'm sure that with a regular teaching load I would still be at the board working out details. VIGRE support was an enormous help this semester.

As part of my VIGRE agreement, I volunteered to be a undergraduate mentor for the Mathematical Modeling course. In this course, groups of 3-5 students are tasked with reviewing real research articles, reproducing the data in their article, and are asked to analyze the modeling choices made in the articles and even to try to generalize these models to produce new data. As a mentor I met with my group each week to help them understand the papers they were reading and to help them learn how to effectively run numerical simulations of the models they were examining. Mentoring students is a chance to teach, in a informal way, at a high level. Graduate students rarely get a chance to teach anything more sophisticated than calculus.