APPENDIX K

University of North Carolina at Charlotte
Request to Establish a Doctoral Program in Optics

Introduction

Following a recommendation from the Graduate Council and from the Senior Vice President for Academic Affairs, the Committee on Educational Planning, Policies, and Programs approved on November 9, 2001 the request from the University of North Carolina at Charlotte to plan a doctoral program in Optics. The University of North Carolina at Charlotte now seeks approval to establish a doctoral program in Optics (CIP: 40.0807) effective January 2003.

Program Description

The proposed degree program is an interdisciplinary program involving six science and engineering departments (Physics and Optical Science, Chemistry, Mathematics, Electrical and Computer Engineering, Mechanical Engineering and Engineering Science, and Computer Science) the Center for Optoelectronics and Optical communications, and the Center for Precision Metrology. The program will be administered through the Department of Physics and Optical Science. The purpose of the program is to educate scientists and engineers who will lead research necessary to develop the next generation of optical technology. The program will emphasize basic and applied interdisciplinary education and research in areas that include (1) active and passive photonic devices and sub-assemblies, (2) fiber-optic devices for telecommunications and sensors, (3) integrated optics and packaging of optical devices, (4) optical materials, (5) optical metrology, (6) optical communication networks, and (7) optical imaging. The program, central to the success of UNC Charlotte's Center for Optoelectronics and Optical Communications and the Charlotte Institute for Technology Innovation, will support the explosive growth of the optics-related industry in the Charlotte region.

Program Review

The review process is designed to surface strengths and weaknesses in proposed new degree programs. Proposals to establish new doctoral programs are reviewed internally and externally. The concerns from the two review processes were summarized in a letter to the Chancellor prior to the presentation to the Graduate Council. That summary follows:

The tenor of this review is very positive but it raises a few concerns. Let me combine those with ones arising from the internal readings. Is the program in the right place in light of the external reviewer's concerns about the impact on the physics department and the concern that so many of theses subjects are typically found in engineering programs? Related to this is the frequent refrain that the program will be producing "scientist/engineers." With the home base in physics, will graduates be able to claim they are engineers? Or will some students take degrees in engineering programs? The

tenor of the proposal suggests all optics doctoral work will be concentrated in this program. The proposal devotes attention to these issues, but the external review raises questions about the arrangement, so apparently it needs some further attention and explanation.

The reviewer raise issues about more directly integrating silicon IC design and the intersections of biology and medicine into the program's curriculum.

The review gave a stamp of approval to the size of the faculty with the proviso that you may need additional faculty if an MS degree is added. I note that UNC-C has now proposed the establishment of a master's in optics as well. In one place or the other the reviewer's concerns need to be addressed.

There is an expectation that faculty research and grant writing will be ratcheted up, if this program is approved. There is not much discussion of a plan to do that, especially in light of the goal of $1 million a year when according to data in the proposal that is the average over the last seven years.

On page 19, the proposal states, "Establishment of the program will afford students in the Department of Chemistry access to a research program in optical materials leading to a Ph.D. I assume this simply means that chemistry students can have access to this new program like any other interested students.

The program identifies 44 post-baccalaureate hours as the minimum for formal course work for the doctoral degree. While the advisory committees may in individual cases require more work, I do wonder if this is a reasonable threshold. This is only 14 hours more than the minimum for a master's degree. I wonder if this has been compared to minimum course requirement in other programs.

Even with some concerns from the readers to this point, I detect a positive reaction internally and externally to this proposal.

Since one of the outside reviewers had not responded by the time of the letter to the Chancellor, but did respond prior to the Graduate Council meeting, that reviewer's comments are summarized as follows:

While noting that the proposed course work for the program is sufficient, the reviewer advises that required course work might be expanded and include more work on geometrical optics and quantum mechanics; location in the Physics department was a concern; the need to have more faculty with optics degree in addition to those from physics and engineering trained in optics; and while recognizing the already existing research programs and infrastructure are strengths for the program, the review expresses the need to expand beyond the emphasis on telecommunications and information technologies.

Graduate Council
The Graduate Council had, as a basis for its consideration, UNCC's proposal to establish the program in optics, copies of the outside reviews of the program, the summary letter to the Chancellor, and a presentation to the Council by representatives of the program. Among the issues to surface during the Council's discussion of the program were the following: (1) number of hours in the program, (2) use of GRE scores, (3) concern about the cost of start-up packages for new faculty for this program, (4) location of the program in a department rather than as a stand alone program, and (5) the difficulties in maintaining interdisciplinary programs.

Response
The issue of the location in a physics department was discussed, and UNCC's position is that this is a good place from which to launch the new degree program and while they may later decide to have a separate department an interdisciplinary governance structure will work fine and it will be more cost effective not to establish a separate administrative structure. The University has been planning with this location in mind for several years. While there can be differences about the best administrative structure for this program, it does seem to be within the purview of the University to make this judgment in a way that fits their circumstances.

The amount of required course work was a concern expressed several times. From the proposal the minimum appeared to be 44 hours but representatives of the program indicated that the minimum is actually 54 hours of course work plus a minimum of 18 hours of dissertation work. In addition they provided comparisons with other optics programs. The University of Rochester, which has one of the premier optics programs in the country, has a 60 credit hour course work requirement, while the University of Arizona and the University of Central Florida have requirements of 54 hours of course work. UNCC's 54-hour requirement fits more easily into the acceptable range for doctoral coursework.

There was a concern about the breath of the program and whether such areas as IC design, and biological and medical applications would be part of the program. The representatives provided an account of a wide range of current research and application areas that included optical materials, optical metrology, optical imaging with applications in biosensing and medical imaging. As for IC design they have courses in Electronic Think Film Materials and Devices, and Advanced Semiconductor Device Engineering I and II. Research regarding biomedical applications has resulted in theses such as A Technique for Tissue Characterization Using CCD Images and Determination of an Optical Window of Myocardium With a Ti: Sapphire Laser. In addition, they have a spin-off company, Medical Optical Imaging.

UNCC has added 4 additional faculty for the Optics program giving them 10 faculty in the core optics program and 12 faculty from other programs at UNCC who are part of the interdisciplinary faculty of the program giving them a total of 22 faculty who can teach,

and direct research in the doctoral program. They expect to hire at least one additional faculty member and depending on the enrollment in the master's program may add still more faculty. This size faculty should be sufficient for both the doctoral program and the master's program.

Many of the other concerns and recommendations will be of help to the Optics faculty as they implement the program, but they don't require any specific changes in their proposal.

Need for the Program

There is good evidence that there is a strong national pool of candidates for this program, that employment opportunities are good nationally, that this would be the only optics doctoral program in the University of North Carolina, that it builds on major investments UNC Charlotte has made in this area over several years, and that it would contribute significantly to the optoelectronic industry in Charlotte and the surrounding area. One reviewer commented, "The pool of optics students is excellent. [His institution] typically receives 250 applications for its PhD program each year. We typically accept 25 and enroll 12. Our PhD graduates always have easy times finding positions, going to industry, national labs and academia." The other reviewer provided a similar assessment. This program will serve to keep NC students who want to pursue doctoral level work in optics in the state and serve as a magnet to draw outstanding students from elsewhere to North Carolina to help strengthen the optoelectronics industry.

Recommendation by the Graduate Council

After consideration of the issues raised by reviewers and Council members, the Graduate Council voted, without dissent, to recommend approval to establish this doctoral program in optics.

Resources

Space appears to be adequate for the early years of the program and UNCC will have several new facilities becoming available in 2004 funded by the bond program, which should accommodate growth in the program. The new resources for the program are projected to come from three sources: internal reallocation ($174,000), enrollment growth ($205,000) and external grants ($300,000). Prior investment in the infrastructure for optics research has lessened the need for new resources for establishing the program. The University, like all universities in these difficult budget times, must find ways to provide the start up packages for new faculty. The expectation is that with the new level for the program, contract and grant funding from both public and private sources will increase.

Recommendations

While the outside reviewers raised a number of concerns and made a number of suggestions they concluded: (Reviewer 1) "In summary, I think the proposed degree program is a very good idea, and I predict it will be successful in meeting its goals;" (Reviewer 2) "I have mainly expressed critical comments above, but don't want to sound

negative about your plan. Your optics program sounds like a very good idea, with certain benefits locally and to the University. I wholeheartedly support your efforts."

It is recommended that the Board of Governors approve the request from the University of North Carolina at Charlotte to establish a doctoral program in Optics effective January 2003.