



As an undergraduate student at Moravian College and an up-and-coming researcher at Lehigh, **Laurie Sibbach** has led a prosperous dual life in the last two years. Last year, Sibbach won a Barry M. Goldwater Scholarship, the premier national award for undergraduate students of math, science and engineering.



The past two summers, Sibbach has done research at Lehigh through the Research Experience for Undergraduates (REU) program, which is funded by the National Science Foundation and by Lehigh's physics department.

Next fall, funded by a dean's fellowship from the College of Arts and Sciences, she will begin studying towards a Ph.D. in physics at Lehigh.

Sibbach's REU experiments, verifying theoretical models of two states of the sodium potassium molecule (NaK), formed the basis of a paper published last year in the *Journal of Chemical Physics*. She was a co-author of the paper, which was written in collaboration with her adviser, **John Huennekens**, professor of physics at Lehigh.

At a conference of the Division of Atomic, Molecular and Optical Physics in Connecticut last year, Sibbach co-presented a poster on her work at Lehigh.

"It was really a thrill to get to experience conference life before graduate school," she says. "Who would have thought, two years ago, that I could have a paper published by the time I started graduate school?"

Sibbach has a record of doing things ahead of schedule. The REU program, which has attracted students from across the U.S. to Lehigh for more than a decade, is designed for rising seniors, but Sibbach was accepted into it the summer after her sophomore year at Moravian.

Her REU research into the atom-atom interactions of the $1^3\Delta$ and $3^3\Pi$ (one triplet delta and three triplet pi) states of the sodium potassium molecule requires a good understanding of quantum mechanics, the branch of physics dealing with atomic and subatomic systems and their interaction with radiation. Sibbach had not yet studied quantum mechanics before joining the REU program, but she was able to learn what she needed to know on her own with help from Huennekens.

In the lab, Sibbach heats a mixture of sodium and potassium to approximately 380 degrees Celsius inside a cross-shaped heatpipe. Into the north arm of the heatpipe, she directs the beam from the titanium-sapphire laser, while the beam from the dye laser is directed into the south arm. The two counter-propagating lasers strike the NaK molecules created in the heatpipe. The dye laser excites the NaK molecules to an intermediate state, from which the Titanium Sapphire laser further excites them to the level of interest – the $1^3\Delta$ and $3^3\Pi$ states. Fluorescence is monitored from the east-west arms of the heatpipe using a photomultiplier tube (PMT). The intensity of this fluorescence is then seen on a computer screen in the lab.

Through the use of several computer programs, Sibbach and her colleagues can compare the results of their physical experiments with calculations from theoretical models that other researchers have developed. The goal of the project, she says, is to learn more about the basic physical interactions of molecules and atoms.

Sibbach, who also majors in math at Moravian, conducted the research into NaK for a year-long

honors project which she did at Lehigh under Huennekens' supervision in order to graduate with honors from Moravian. The work contained in her thesis is an extension of her REU research. The REU program, she says, helped her see more clearly what she wanted to do.

"I wasn't sure before the first REU program what I wanted to do – statistics, mechanical engineering or physics. While I was here [at Lehigh], I saw presentations on other areas of physics, and decided that I really enjoyed molecular physics.

"The idea of research has enticed me the last two years. Now I'm excited at the prospect of getting to do my own research project as a Ph.D. student."