Researcher investigates new developments in laser and sensor technology

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Scientists hope that research being conducted in Binghamton University's Department of Physics, Applied Physics and Astronomy will create lasers that work at wavelengths currently inaccessible.

Funded by a three-year, $300,000 grant from the National Science Foundation as well as a Cottrell College Science Award of $44,244 from the Research Corporation, Oana Malis, assistant professor of physics, is looking for new materials that would allow laser light to be generated in ranges that are not currently accessible. She is particularly interested in how the optical properties of gallium nitride, a compound semiconductor material, could be used.

"These lasers could be used for sensing such as in detecting environmental conditions in a building," said Malis. "There are defense applications as well."

In looking for new materials that would allow her to create lasers in the mid-infrared range, Malis is hoping nitrides are the answer. Their optical and electronic properties are not well understood, in part because they're difficult to make.

The devices in question are incredibly small, less than a millimeter square. The material is like a sandwich of very thin layers, each about a nanometer or two thick. These hundreds or even thousands of layers give nitrides an interesting electronic structure and allow them to emit or absorb light in particular ranges.

“This is an ambitious project,” Malis said. “It’s the first few steps of the process. Getting to the device level, to an actual laser you can hold in your hand, is a little harder.”

She’s especially excited about this project because it will give undergraduate and graduate students experience in applied physics, including materials, advanced techniques such as electron microscopy and making devices and in theoretical modeling.

“I feel it’s important to involve students in applied research,” she said. “Physics students sometimes believe that physics is only about the cosmological level or broad strokes. In the end, physics is an experimental science. It has to do with reality, with the world around us.”

Malis said she tries to encourage her students to think freely and creatively and see that research is more than just following a certain procedure.

“I’m really interested in making things that work,” she said, “in understanding things that will make people’s lives better and will have a technological impact.”

Source: Binghamton University