Scientists Working to Deflect Asteroids Threatening Earth

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A team of scientists and engineers at The University of Alabama in Huntsville (UAH) are conducting research that could one day save humanity from asteroids threatening Earth.

UAH Laser Science and Engineering Group, headed by Dr. Richard Fork, is conducting research into characterizing and deflecting asteroids that may endanger Earth.

It sounds like science fiction, but Fork, who has a doctorate from Massachusetts Institute of Technology and more than 40 years of experience working with lasers, said someday it could be possible to locate a laser in space or on the moon to look at the properties of asteroids and perhaps alter their trajectories away from Earth.

The research has students excited about using lasers for space-related applications. Graduate student Blake Anderton wrote his master's thesis on "Application of Mode-locked lasers to asteroid characterization and mitigation."

Undergraduate Gordon Aiken won a prize at a recent student conference for his poster and presentation "Space positioned LIDAR system for characterization and mitigation of Near Earth Objects." And members of the group are building a laser system "that is the grandfather of the laser that will push the asteroids," Fork said.

Anderton said his thesis discusses "a way to look at asteroids at

maximum range, which means early detection." According to his calculations, an asteroid could be characterized up to 1 AU away (1.5 x 10 to the 11 meters).

Arecibo and other radar observatories can only detect objects up to 0.1 AU away, so in theory a laser would represent a vast improvement over radar.

Anderton is an engineer at Raytheon Corp. in Huntsville, Ala. He said the project was a good one for him at this point in his career because of his interests in optical and laser physics. At Raytheon he's involved in radar work for the National Missile Defense radar systems, but he's poised to move into optical and laser physics work, so the masters degree in electrical and computer engineering with an emphasis on optics helped him prepare for his next job assignment.

The thesis was a stepping stone that “opened doors” for him at his job, he said. But Anderton added he has a personal interest in the asteroid mitigation problem.

"We only have one Earth and you don't want to lose it."

Anderton shared a LSEG office with undergraduate Gordon Aiken. The two students talked about their interests. The result of their collaboration is a sharing of knowledge in their academic research pursuits.

Aiken started out in mechanical engineering, then transferred to optical engineering when he discovered that UAH is one of just a few colleges in the U.S. with an undergraduate program in optical engineering.

When Fork spoke of his research to one of Aiken's engineering classes, Aiken expressed interest and landed a REU grant (Research Experience for Undergraduates) for the summer of 2006.

At the end of the REU, Aiken made a presentation on what he'd learned, and Dr. Vernhard Vogler, of UAH's Chemistry Department, suggested Aiken submit his poster to a new annual UAH student research conference, held last year.

Aiken won the prize for best undergraduate poster and presentation.

"I really like optics. I wanted to get into the field of working with lasers," said the sophomore, who served as a medic in the Army before coming to UAH.

"The school has been amazing for me ... If you show interest, they're going to find something for you to do. This has all fallen into place for me."

Putting graduate students together with undergraduates is a great idea, he noted.

"It's a good mixture of talent."

Fork said the current research relates back to work he performed in the mid-1980s, when he and other researchers at AT&T Bell Laboratories developed the first femtosecond lasers. They used one of the lasers to ablate material by ultra-intense laser pulses with femtosecond time resolution ("Femtosecond imaging of melting and evaporation at a photo excited silicon surface," M. C. Downer, R.L. Fork and C.V. Shank, *Journal of the Optical Society of America* B2,595-599 (1985)).

"The laser we are developing now is also being developed to ablate materials," Fork said, but the device would be "a substantial distance" from the target. The system includes an argon laser, a mode-locked Ti-sapphire oscillator, a regenerative Ti-sapphire amplifier, a doubled neodymium-yag pulsed laser and helium-neon line-up lasers, according

to Dr. Fork.

The short-term goal of the work is "to amplify femtosecond pulses to high peak power at high average power for remote sensing," using unique features associated with the high pulse intensity, Fork said. The work is funded by the U.S. Army and involves a local company that employs several of Fork's former students. The research does not concern characterizing or deflecting asteroids, but Fork sees a connection.

"My vision is that this system is the progenitor of the laser that could characterize and deflect asteroids," he said.

Source: University of Alabama Huntsville