Kim Kolb’s Ph.D. crunch culminated in whirlwind trip to Florence, Italy, that had nothing to do with the Medici, DaVinci or the Arno River. (Well, perhaps, DaVinci.)

Kolb arrived in time for the Scientific Detector Workshop on Oct. 4 to share her findings about a new kind of imaging systemthat could transform future space missions with higher sensitivity and clearer vision.

The devices are imaging arrays of Geiger-mode avalanche photodiodes, or GM-APDS, that count each photon, or unit of light, carried in an “avalanche,” or a big signal of electrons. It was developed at Massachusetts Institute of Technology Lincoln Laboratory and advanced in partnership with RIT’s Center for Detectors in the College of Science with funding from the Gordon and Betty Moore Foundation.

Kolb spent the summer testing and characterizing the device in the RIT Center for Detectors. In September, she and her colleagues irradiated three sensors at Massachusetts General Hospital Francis H. Burr Proton Therapy Center to imitate the effects of space on the instruments.

The posters Kolb presented in Florence, and in the paper published in the conference proceedings, describe her extensive pre- and post-radiation testing that measured the detector’s usability after radiation damage.

“What keeps me going—when the work is repetitive or I have to come in at 1 a.m. to get data or to run a test—is that the results of what I am doing are objectively interesting and valuable to the scientific community, and not just interesting to me,” says Kolb, a graduate student in RIT’s Chester F. Carlson Center for Imaging Science. “I don’t think you earn a Ph.D. without hard work. You are supposed to be the expert and you have to put in the hours.”

Early this fall, she won a fellowship from NASA’s Earth and Space Science program to compare and contrast the new Geiger Mode Avalanche Photodiodes with two other single-photon detectors—linear-mode avalanche photodiodes and electron-multiplying charge-coupled devices.

Most of her original work and contributions will have to do with the GM-APDS. Yet, her first-hand knowledge of how all three kinds of detectors work will give her authority on the strengths and weaknesses of single photon detecting technologies. Her dissertation will recommend the best choice for specific NASA applications, including exoplanet detection (Earth-like planets outside our solar system), high-contrast imaging, adaptive optics and array-based LIDAR.

She initially joined the Center for Detectors, directed by Don Figer, as a senior undergraduate in the microelectronics program. After gaining industry experience, Kolb returned to RIT on a fellowship from the military contractor BAE Systems to pursue a master’s degree from the Center for Imaging Science.

“I feel really lucky,” she says. “There’s a lot of opportunity that I’ve been given that I feel I need to live up to.”

Results from Kolb’s research on the Geiger-mode avalanche photodiodes furthers the Center for Detector’s bid to develop technology suitable for NASA exoplanet and other missions seeking to uncover the physics behind mysterious dark matter and the universe-accelerating force dark energy.

“At the end of the day, all I’m trying to do is to count photons,” Kolb says. “It might seem tedious and small to get so embroiled in tiny details and incremental improvements, but the more photons we can collect, the more we can know. It’s about exploring the universe. It’s about exploring our home on a bigger scale.”

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