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DSU's Optics Program Goes to Mars

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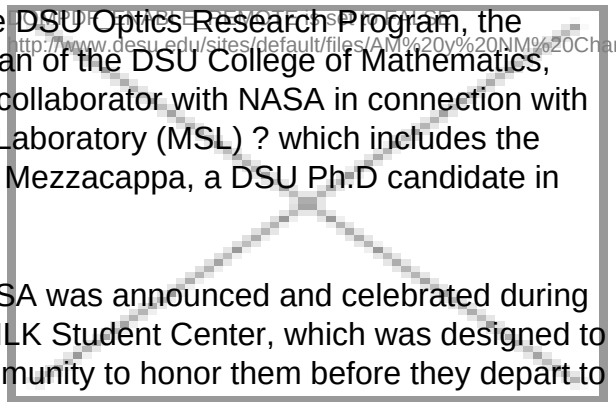
Delaware State University is making its mark on the Universe ? literally ? through its involvement in a space mission to the planet Mars.

Dr. Noureddine Melikechi, who is the founder of the DSU Optics Research Program, the University?s vice president of research, and the dean of the DSU College of Mathematics, Natural Sciences and Technology, is working as a collaborator with NASA in connection with the upcoming Nov. 26 launch of the Mars Science Laboratory (MSL) ? which includes the Curiosity land rover. He is being assisted by Alissa Mezzacappa, a DSU Ph.D candidate in optics and a graduate research assistant.



Alissa Mezzacappa (left) and Dr. Noureddine Melikechi adjust a Mars Chamber that they used to test the laser in the reduced-pressure environment of the Red Planet. Ms. Mezzacappa built the Chamber.

Dr. Melikechi and Ms. Mezzacappa's work with NASA was announced and celebrated during a Nov. 18 press briefing and sendoff event in the MLK Student Center, which was designed to inform the media and also allow the University community to honor them before they depart to attend the Nov. 26 launch at Cape Canaveral, Fla.

According to the NASA website, the Curiosity rover has a ChemCam instrument that utilizes a Laser-induced Breakdown Spectroscopy technique, which is an area of Dr. Melikechi?s optics expertise. After the MSL arrives at the planet Mars in August 2012, the Curiosity rover will land on the Mars terrain in an area called the Gale Crater, where it will conduct a laser analysis of the rock forms.

The laser will clear the rock of dust and get past the weathering layer, and then shoots a laser blast of a certain depth into the targeted rock. The laser blast will form plasma that emits light, the wavelength of which will be read by spectrometers inside the rover. That data will then be sent back to earth and yield information on the elemental compositions of the rock. It will be the first time that the Laser-induced Breakdown Spectroscopy technique has been used on Mars.

Dr. Melikechi, accompanied by Ms. Mezzacappa, has assisted NASA at the Los Alamos National Laboratory in New Mexico in testing the technique in a Mars Chamber built there. Additionally, a Mars Chamber was built in the Mishoe Science Center on campus where additional tests were conducted.

The Mars Chamber allows the laser to be operated in a reduced-pressure Mars environment, and also allows the evaluation of the data that is yielded from that environment.

When the Curiosity Rover sends actual data back from Mars in 2012, Dr. Melikechi and Ms. Mezzacappa will also assist NASA with the analysis of it.

?Our role has been to do some measurements and analysis, to try and understand a lot of the physics that takes place under Mars conditions,? Dr. Melikechi said. ?When the data actually starts to come (from Mars), we will have an idea how to analyze it from those extreme conditions.?

In her Ph.D. journey, Ms. Mezzacappa is using this experience as the subject of her doctoral dissertation ? a study of how the temperature of the plasma is impacted by the planet?s pressure. She said to be a collaborator on a multi-national rover mission to Mars as a graduate student has been an excellent opportunity and will be an impressive part of her curriculum vitae.

Ph.D candidate Alissa Mezzacappa (r) shares with the media how the experience has enhanced her life's work.

?The experience of working with so many great scientists from all around the world is invaluable, and it has matured me as a scientist and as a person,? said Ms. Mezzacappa, 24, of Holmdel, N.J. ?I have gained a lot of perspective on how these missions actually work. It has definitely inspired me to continue in this vein in my future career.?

Both Dr. Melikechi and Ms. Mezzacappa will travel to Cape Canaveral, Fla., to witness the Nov. 25 launch of the MSL. While that is exciting, Dr. Melikechi said he looks forward to analyzing the data that comes back from Mars.

?It would be exciting if we uncover something that none of us at this moment can think of, something that no one is expecting,? Dr. Melikechi said. ?It is possible, and that would be absolutely amazing. That would be wonderful for mankind.?

Although Gov. Jack Markell could not attend the Nov. 18 press briefing and sendoff, he sent an official tribute that named Dr. Melikechi as the state's "Ambassador to Mars." In addition to the humor, Gov. Markell also sent a letter that recognized Dr. Melikechi's accomplishments.

"The hard work you are doing right here in Delaware is having a dramatic impact," Gov. Markell said in the letter. "We appreciate your commitment to scientific excellence, your significant contributions to our state's reputation as a cradle of innovation, and the esteem your work is bringing to the First State."

(L-r) Dr. Noureddine Melikechi and DSU President Harry L. Williams share a laugh as Board of Trustees Chairman Claibourne Smith reads a tribute from Gov. Jack Markell that names the optics scientist Delaware's Ambassador to Mars.

The involvement of DSU in the Mars mission is the latest accomplishment of the University?s prolific Optics Program, which Dr. Melikechi founded in 1998 with the establishment of the Applied Optics Center of Delaware at DSU. With a focused vision, Dr. Melikechi methodically worked over the next decade to maximize every new opportunity and each research success.

The Optics Program later received two $5 million research grants from the National Science Foundation (2006) and from NASA (2009), creating two separate optics centers under Dr. Melikechi?s direction. Respectively, those grants resulted in the establishment of a Center for Research in Education and Optical Sciences and its Applications, and the Center for Applied Optics in Space Sciences. The expansion of the Optics Program research infrastructure led to the creation of an Applied Optics Master of Science and Optics Ph.D. programs at DSU in 2008.

In January, Dr. Melikechi announced that the program?s research had produced the University?s first-ever intellectual property that a company is currently developing into a laser-

based diagnostic device to be used in hospitals and medical laboratories.

Delaware Gov. Jack Markell announced in May 2011 the inclusion of $10 million in his fiscal 2012 budget to go toward the construction of an Optics Research Facility at DSU.

Article and photos by Carlos Holmes.

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