Radiation Institute of Science & Engineering: PVAMU's Charged Particle Detector in Space

Q & A Session with Dr. Premkumar Saganti

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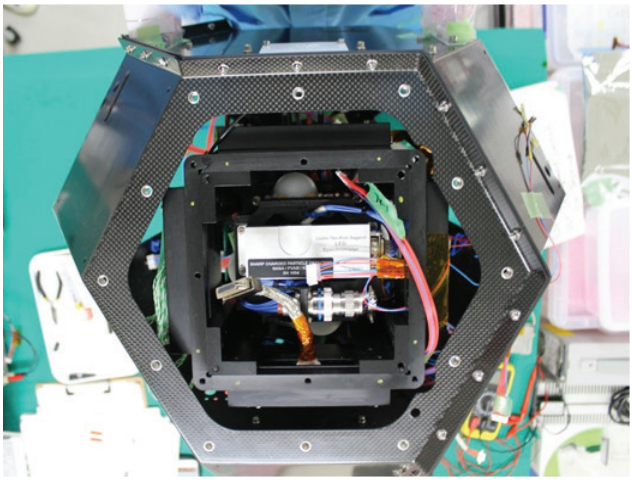
Dr. Premkumar Saganti, TAMUS Regents' Professor in the Department of Chemistry and Physics at PVAMU, is the principal investigator of the Chancellor's Research Initiative (CRI)-supported Radiation Institute of Science & Engineering (RaISE). RaISE was the first such research center established at PVAMU in 2013. As a research scientist at NASA-Johnson Space Center (JSC) for more than a decade, Saganti made significant contributions to projects, such as the International Space Station and Mars Radiation Research for Human Explorations. Saganti joined the Department of Chemistry and Physics in 2003. Since then, Saganti and his team of researchers have made great strides in the field of space radiation biology studies with the goal of assessing risks associated with human space explorations. The RaISE has enjoyed productive collaborations with not only our national labs but also international space research stations in Japan, Bulgaria, and Germany.

Working with the Kyushu Institute of Technology (KIT) - Japan, RaISE and NASA collaboratively developed a Particle Pixel Detector which was launched as a payload aboard the spacecraft, Shinen2, in 2014, which made trips around the Sun between Venus and Mars orbits for the past four years. In 2018, a second and more advanced payload, a Charged Particle Detector (CPD) for Solar Heliospheric Assessment of Radiation Particles was developed by PVAMU / NASA for KIT- Japan and was launched aboard the Ten-Koh spacecraft. It is currently in polar orbit around the earth at an altitude of about 360 miles, passing through PVAMU several times a week.

ORISP recently interacted with Dr. Saganti to learn more about the CPD and the studies it will be used for and the benefits such studies may bring to humanity.



The Charged Particle Detector (CPD) payload on Ten-Koh spacecraft

Launch of Ten-Koh Spacecraft on October 29, 2018

Q: What does the CPD payload aboard Ten-Koh consist of?

A: The payload has a spectrometer that was custom-built by the Bulgarian Academy of Sciences, and a set of six sensors for detecting and quantifying space radiations, including X-rays. These space radiations which include charged particles pose health risks to human space travel.

Q: What is unique about the PVAMU invention?

A: Our payloads are of the lowest weight (less than one kilogram) in its class of mission with the lowest power consumption ever designed for space applications. Our detector system operates at 12 V and consumes less than 3 W power to collect data, while most others require more than 36 V and 10 W power.

Q: How are the data collected by the CPD-SHARP used?

A: We use space radiation data to simulate conditions for ground-based experiments. We subject biological samples, such as neuron cells and other human and mouse cells to radiations of similar kind and intensity and assess and delineate time-dependent, radiation-induced damages at the cellular and sub-cellular levels. Our radiation detectors have an extremely high resolution of two microns. In simple terms, we can assess damages occurring on about one-third of a single human red cell!

Q: What is the ultimate benefit to humanity from your space radiation projects?

A: We aim to characterize charged particles and ionizing radiations in space qualitatively and quantitatively. We use sophisticated and highly sensitive biophysical methods in our ground-based biological studies to characterize chromosomal and DNA damages induced by such radiations. From those studies, we hope to develop novel heavy ion-based radiation protocols to specifically target and destroy cancer cells. Proton and carbon ion based radiations are currently used in cancer treatment.

Q: Who are all working in your lab on the CPD-SHARP project?

A: Two undergraduate students, Patierre Thorpe, and Seth Saganti; two graduate students, Mahmudur Rahman and Sonia Kolluri. These students work with Dr. Gary Erickson, Ramesh Dwivedi, and Brian Cudnik.

Of course, we also work with collaborators from NASA-JSC, Doug Holland and Richard Hagan; from KIT-Japan, Professor Okuyama and his team of students; from Bulgaria, Professor Dachev.

As you can see, we are a large, international team working on the CPD-SHARP project.