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NMSU astronomers set their eyes on the sun, hope to gain understanding of space weather

By Audry Olmsted/For the Sun-News

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Astronomers at New Mexico State University's College of Arts & Sciences hope they will soon be able to better understand the depths of the sun and predict space weather with the help of two new grants with NASA and the National Science Foundation.

Space weather is the phenomena that gives rise to interactions between the sun and the Earth. For example, a large magnetic storm that develops on the sun could alter functions on Earth.

"When the sun has a storm on it, it has a mass ejection, and that mass can eventually reach Earth, and when it does, it can cause magnetic storms," said Bernie McNamara, a professor in the Department of Astronomy. "These magnetic storms can interfere with the operation of satellites and can even destroy satellites. They can also interfere with power grids here on Earth as well as the human presence in space."

Jason Jackiewicz, an assistant professor in the Department of Astronomy, estimated nearly half a billion dollars is spent annually repairing equipment damaged by space weather.

The NSF grant (Partnerships in Astronomy and Astrophysics Research and Education) and the NASA Experimental Project to Stimulate Competitive Research, or EPSCoR, grant (New Mexico Solar and Stellar Seismology) team NMSU with the National

Solar Observatory and the Air Force Research Laboratory to develop ties in education and research between the institutions.

With the grants, astronomers can work to use the same principles in space that meteorologists use to predict weather forecasts on Earth.

"The magnetic fields of the sun are really one of the biggest problems in astrophysics," said Jackiewicz. "One of the goals of these projects is to understand how magnetic fields on the sun are generated, how they evolve, how they decay and how they release their energy into our solar system. Magnetic fields do not just affect Earth but all the other planets and beyond."

Astronomers will use helioseismology to look inside the sun. Telescopes and satellites that orbit around the sun 24 hours a day will also aid in the research. Jackiewicz said they will study the sun during "sunquakes," probing its interior to determine the sun's internal properties. From this, the scientists hope to see where a magnetic field is born and how it rises, as well as understand solar eruptions and flares.

McNamara said the goal of the projects is threefold: Develop instrumentation that allows astronomers to obtain high-resolution images of the sun, produce a detailed study of the sun through ground-based and space-based observations, and extend the project to include other stars.

"The sun is one star," McNamara said, "but it's hard to develop a theory based on a single object because you might be looking at something unique or peculiar to that site."

The way scientists try to get around this potential dilemma is by looking at larger samples. McNamara said they hope to look at the seismic properties of

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other stars and then use the results to help them refine and iterate between the model of the sun and other stars.

"That's really not being done at this time," McNamara said. "That really will be very exciting."

If astronomers can start to predict space weather, steps may be taken in advance to prevent damage to Earth, Jackiewicz said. Satellites could be reoriented, instruments that could be sensitive to the effects of magnetic storms could be turned off, or air travel could be diverted or delayed.

The NSF grant totals nearly \$1.6 million and the NASA project is \$1.5 million. These totals include matching funds by NMSU. Both grants are for three years.

The principle investigator on the NSF and NASA projects is Patricia C. Hynes, director of the New Mexico NASA EPSCoR Program and director of the New Mexico Space Grant Consortium. Co-investigators include McNamara and Jackiewicz, as well as Thomas Duvall, NASA Goddard Space Flight Center and Stanford University; Joyce Guzik, with the Department of Energy at Los Alamos National Laboratory; Harjit Ahluwalia with the Physics Astronomy Department at the University of New Mexico; and K. Balasubramaniam and Han Uitenbroek, both with NSO and the AFRL.

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