NMSU graduate student looks for indications of life on Mars in possible trace methane gas

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An astronomy graduate student at New Mexico State University is looking for possible signs of life on Mars by studying the possible detection of methane gas on the planet.

Malynda Chizek is working on computer simulations using the NASA/Ames Mars Atmospheric General Circulation Model to replicate trace gases in the Martian atmosphere. She is using these simulations to predict the amount of methane that might be seen by the Mars Science Laboratory.

"There is an instrument onboard the Curiosity Rover – which landed on Mars in August – capable of measuring methane, but the scientists operating that instrument haven't made any public announcements of their results yet," said Chizek. "There have been several claims of methane detection in the past decade, but it is controversial whether or not there is really methane on Mars, because we do not understand how it would get there and scientists' observations suggest that it's varying in abundance on a very quick time scale, which is unexpected."

The significance of detecting methane on Mars is exciting, Chizek said, because it could lead to evidence of life. Approximately 95 percent of the methane in Earth's atmosphere is a product of biology.

To help people understand the volume and significance of methane on Mars, Chizek uses a very Earthly creature that produces the gas – cows.

"In a couple of my presentations, I show how many cows would be required to equal the amount of methane that astronomers have observed on Mars," she said. "Depending on which observations I am looking at, that number is close to five million cows, or roughly 200,000 tons of methane production per year."

Researchers are using telescopes on Earth and spacecraft in orbit around Mars to observe methane on Mars.

The Earth-based observations are considered controversial because Earth's atmosphere has a significant amount of methane, a factor of 100 to 1,000 times higher than what the published Martian methane detections have stated, which may interfere with detection of the Martian methane signal. The instruments on spacecraft orbiting Mars used for methane detections have a lower methane detection capability than do the Earth-based instruments. Some scientists consider the orbiting instruments to be inadequate for detecting Martian methane, Chizek said.

Chizek said she is using her model to try and trace back the detected methane to its source location to see if it is coming from something like a volcanic source, water surface chemistry interaction or bacteria living on or near the surface.

"Mars is thought to be a geologically dead planet," she said. "If the methane detections are confirmed, and we do not find any signs of bacterial life, this means there are likely some interesting geological processes happening on Mars that we don't yet know about."

Jim Murphy, Chizek's adviser, said some of the recent observations of Mars' atmosphere, which suggest that methane might be present there, also suggest that there are substantial seasonal variations in the quantity of methane.

"These variations are unexpected since methane is expected to persist for hundreds of years within the atmosphere if it is introduced in to the atmosphere, and since the variations would imply substantial sources being currently active, such as life or a chemistry of some sort," he said.

Even if there are not any currently active sources of methane on Mars, and even if the "too rapid loss" of methane suggested by the recent observations is incorrect, Curiosity could still possibly detect methane being present in very small amounts.

In such a situation, Chizek's computer simulation results still suggest that Curiosity should see some seasonal variations in its local methane abundance since gases like methane become concentrated within the high latitudes of the winter hemisphere as the main atmospheric gas, carbon dioxide, "freezes out" of the atmosphere and forms a winter polar ice cap.

Chizek is now finishing simulations of her observations and is completing a paper on the topic co-authored by Murphy, an associate professor of astronomy, and former NMSU student Melinda Kahre. Kahre now works at the NASA Ames Research Center.

Chizek's work is funded by a previously awarded $15,000 NASA Space Grant fellowship. Chizek, who plans to complete her doctorate in 2013, is using her Mars research for her dissertation.

"I am now providing predictions on what Mars Science Laboratory scientists might see, based on the other past observations," she said. "More confirmation will come from MSL itself when it eventually announces whether or not it has observed methane and what sort of variations it might or might not have seen."

"This research is important to NMSU by virtue of it being the work of a

graduate student, as well as placing NMSU in the position to provide substantial value to ongoing U.S. Mars-exploration efforts," said Murphy. "We want our students and faculty to be involved in leading-edge science studies, and this effort of Malynda is one such effort. Conducting investigations to aid in the interpretation of data/measurements is a cornerstone of science, and this research is a very good example of the work required to understand what available data are trying to tell us."

Provided by New Mexico State University