Where Earth's water comes from, preparing for DART impact and other lessons from space

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Two NAU astronomers presented groundbreaking research at the annual meeting of the Division for Planetary Sciences, a branch of the American Academy of Sciences.

Where does Earth's water come from?

A Northern Arizona University researcher who studies active asteroids, which are rare asteroids with comet-like tails, presented groundbreaking research today at the annual meeting of the Division for Planetary Sciences, a branch of the American Academy of Sciences.

Colin Chandler, a doctoral student in the Department of Astronomy and Planetary Science at Northern Arizona University and recipient of the NSF Graduate Research Fellowship, presented "Recurrent activity from a Main Belt Comet."

Active asteroids hold clues about the origins of water on Earth and where water can be found today in the solar system. Fewer than 30 of these objects have been discovered since 1949. Most recently, asteroid (248370), also known as 2005 QN173, was found to be active on July 7. Chandler began digging into historical astronomical data to learn more about the object's past, and he and co-authors Chad Trujillo of NAU and Henry Hsieh of the Planetary Science Institute discovered an image from July 2016 that showed the object with a long, thin tail.

Because the picture was from a previous orbit from this object, the team concluded the 2021 outburst was probably not the result of a one-off event like a collision with another asteroid.

The team has submitted their discovery to Michael Rudenko at the International Astronomical Union's Minor Planet Center with the goal of (248370) 2005 QN173 be designated a comet; they're hoping for a somewhat more memorable moniker, Chandler said.

"Recurrent activity is often caused by ices sublimating, similar to what dry ice does here on Earth," Chandler said. "This is a very rare discovery; it's only the eighth recurrently active asteroid known to date."

Preparing for DART's impact

Cristina Thomas, an assistant professor in NAU's Department of Astronomy and Planetary Sciences, presented "Lightcurve Observations in Support of the DART Mission: Understanding the Orbit of the Didymos-Dimorphos System."

Thomas leads the DART Observations Working Group; DART is NASA's first planetary defense mission and demonstration of asteroid deflection by kinetic impact. She will discuss the last pre-launch update regarding the orbit of Dimorphos around Didymos. The international working group is preparing for launch, likely in November; the primary goal of the mission is to impact the satellite of the near-Earth asteroid Didymos system and change the orbit of that satellite, Dimorphos, around the primary asteroid. The Observations Working Group has been working for several years to obtain a precise pre-impact orbit of Dimorphos around Didymos.

Using data from 2003, when the satellite was discovered, through early 2021, astronomers have been able to precisely constrain the characteristics of the orbit and the position of Dimorphos in the orbit at the time of impact in fall 2022.

"We do this through observing the light curve of an object—by taking repeated images of the same object we can see dips in brightness when the satellite passes in front of or behind the primary," Thomas said. "We can use the timing of these brightness dips, which we call mutual events, to determine the orbital period of the satellite. This is essentially thinking of the satellite Dimorphos as a clock that will return to its position in front of or behind Didymos at consistent intervals. Our working group will begin observations again in the months prior to the DART impact. We want to have the most complete picture of the current orbit before we change it through impact."

They will continue making observations after impact to determine the change in the orbital period caused by the spacecraft's impact.

You can make a scientific discovery

When Chandler opened his Active Asteroids project to the public, he wasn't sure how long it would take volunteers to review the 10,000 initial images he'd uploaded. These citizen scientists were looking for evidence of active asteroids, which are rare asteroids with comet-like tails.

He got his answer the next day: less than 24 hours. Hundreds of volunteers signed up and scanned images of the sky, and a few flagged some items of interest.

Those findings include an exciting discovery: The team—Chandler, NAU professor Chad Trujillo, Planetary Science Institute Henry Hsieh and NAU alum and current University of Arizona doctoral student Jay Kueny—discovered a new active object, known as a Jupiter Family Comet, called 2015 TC1. The initial discovery was made by a volunteer citizen scientist within weeks of the project's launch at the end of August and demonstrates the potential for success in using citizen science to further our understanding of the solar system.

Marvin Huddleston, a citizen scientist from Mesquite, Texas, has been volunteering to help with citizen science for decades; he's completed a whopping 25,000 dataset classifications for Active Asteroids and another 125,000 observations through Zooniverse. He's long had a love of science and being involved, so this was a good fit for him.

"Your work assists in unlocking the mysteries of our cosmos," Huddleston said. "You assist us in answering questions concerning the formation of our solar system in particular as well as the entire universe."

More information: To see an archived version of the conference, see the AAS Press Office YouTube channel.

Provided by Northern Arizona University