Explained: Near-miss asteroids (w/ Video)

June 29 2012, by Jennifer Chu, MIT News Office

On May 29, an asteroid the size of a bus came whizzing past Earth at 10 times the speed of a fired bullet. The near-miss asteroid, named 2012 KT42 — or "KT42" for short — streaked across the orbits of weather and television satellites, 22,000 miles above Earth's surface, making it the sixth-closest asteroid approach on record. While the object had little chance of colliding with Earth, its approach gave scientists an opportunity to run a rapid-response program — or as MIT's Richard Binzel calls it, an asteroid-tracking "fire drill" — to gain as much information as possible from the incoming space rock.

"This thing missed, but chances are, at this size, we will one day find an object headed for an impact," says Binzel, a professor of planetary sciences in MIT's Department of Earth, Atmospheric and Planetary Sciences. "Depending on where it's falling, you might need to know whether it's going to survive passage through the atmosphere, and how many fragments [will make impact]. We'd like to have the capability to deliver those kinds of answers, if we need to."

Binzel is part of an international team of astronomers who monitor the skies for approaching asteroids. The scientists receive data from the Minor Planet Center (MPC), a clearinghouse for asteroid discoveries at the Smithsonian Astrophysical Observatory. Researchers at the MPC collect observational data from telescopes and satellites around the world, then calculate the orbits of asteroids and comets. Each day, the MPC sends out circulars to astronomers around the world, highlighting new objects discovered in space.

When an object's orbit appears poised to bring it close to Earth, scientists like Binzel take particular notice. Binzel's research group routinely reserves time at NASA's Infrared Telescope Facility (IRTF) on Mauna Kea in Hawaii, operating the telescope remotely from MIT to observe objects of interest. When Binzel receives an MPC circular, he scans the data for objects that may come close to Earth, and that are observable using the NASA scope.

In the case of KT42, the incoming asteroid fit both categories, but the scientists had to act fast: The asteroid was moving at high speed, and would streak past Earth within 24 hours, a small window for scientists to request observing time on the IRTF. Typically, researchers reserve telescope time months in advance, to observe distant planets and stars. In the event of an incoming asteroid, scientists may put in a last-minute proposal to interrupt a previously scheduled project, though these requests are not always guaranteed.

Tracking an asteroid

On Memorial Day, May 28, 18 hours before the asteroid's closest approach to Earth, Binzel sent an alert to IRTF, along with a formal request to interrupt the telescope's program. Several hours later, the facility approved the request, granting a small window of time to observe and track the asteroid: just after sunset in Hawaii, and just past midnight in Boston. At such a late hour, Binzel opted to observe the asteroid not from his MIT offices, but from an elaborate computer setup at his home.

"I have the capability of doing it from my attic," Binzel says. "Once everything was set, I just waited until after midnight, then went upstairs."

At the appointed time, Binzel fired up an array of computer screens, showing Skype sessions with the telescope's operator, along with a support astronomer and technician in Hilo, Hawaii. Two more screens displayed images from the telescope's camera, tracking the asteroid in real time, as well as light-intensity data. Over three hours, the researchers took measurements and tracked the asteroid's incoming path.

"These readiness drills are important, because there's a process to go through, and we want to make sure it works," Binzel says. "In the event that we really need to work on short order, we'll have confidence that we'll be successful."

In this case, the team quickly analyzed the data and calculated that the asteroid was about 23 feet wide, and likely made from a crumbly carbon material — a combination unlikely to penetrate Earth's atmosphere intact. Binzel says in order for an asteroid to make impact, it would have to be much larger, and made from a hardier material, such as silica or iron. He speculates that an object 30 to 60 feet wide might make it through the atmosphere, breaking up into small meteorites before hitting the ground, while an asteroid 150 to 200 feet wide might hit the surface completely intact.

Far-flung objects

But what brings asteroids close to Earth in the first place? Most of them are located in the asteroid belt, a vast, cluttered region of the solar system that inhabits an orbit between Mars and Jupiter. These asteroids are leftover chunks of a planet that failed to fully form billions of years ago.

For the most part, these chunks of rock stay within the asteroid belt. But every so often, asteroids escape and travel as far as Earth's orbit. For 200 years, why this happens remained a mystery.

In the 1980s, Jack Wisdom, a professor of planetary science at MIT, came up with a solution: He discovered that Jupiter's gravitational field occasionally forces an asteroid out of its orbit, tugging at the asteroid repeatedly and stretching its orbit until, like an overstretched rubber band, the orbit snaps, flinging the asteroid into space.

“Once in a while, Jupiter will nudge things out and send them our way, for better or worse,” Binzel says. “The dinosaurs probably wish it hadn’t.”

Binzel is now looking for ways to improve the asteroid rapid-response program. The May 29 incident, he says, demonstrated a new level of readiness: Scientists were able to quickly gain access to the telescope facility, and the asteroid was the fastest object ever tracked by the telescope. The astronomers were also able to characterize the asteroid’s size and composition in a limited amount of time — observations that would be essential in the event of an actual impact.

In the future, Binzel hopes to improve the telescope’s tracking ability, to observe even faster-approaching objects. The speed of KT42, he says, was at the upper limit of what the telescope could reliably track.

“This one was so close and so fast, it demonstrated a new level of capability of the telescope,” Binzel says. “Now we’re finding ways to improve for the next one.”

This story is republished courtesy of MIT News (web.mit.edu/newsoffice/), a popular site that covers news about MIT research, innovation and teaching.

Provided by Massachusetts Institute of Technology

Citation: Explained: Near-miss asteroids (w/ Video) (2012, June 29) retrieved 27 April 2024 from https://phys.org/news/2012-06-near-miss-asteroids-video.html