

Students Find Trans-Neptunian Object

"Look at our subtraction. Does this look like anything to you?"

Two high school students asked their astronomy teacher about a streak of light they had found in an image from the edge of the solar system. He said no, that the light was probably cosmic rays, but asked them to keep looking. He had seen, below the light, a pair of dots indicating an object.

The students continued studying the image and soon noticed the dots. The teacher, Hughes Pack of Northfield Mount Hermon School (NMH) in Massachusetts, said to himself, "I can't believe it! They've discovered a Kuiper Belt object!" The image the students showed him was one they had produced themselves by combining images provided by the Lawrence Berkeley National Laboratory in California. If the students—Miriam Gustafson of Ambridge, PA, and Heather McCurdy of Killingworth, CT—had not been meticulous with their measurements, their calculations would not have come out well enough to see the very dim Kuiper Belt object.

The Kuiper Belt orbits beyond what is known as the ice line and contains frozen chunks of matter believed to be left over from the formation of the solar system. Objects from this region are known as trans-Neptunian. The piece of ice and rock found by the students measures 100 miles in diameter and was called Paco, Heather's brother's nickname, for the first week after its discovery. It is now registered with the Minor Planet Center in Cambridge and has the official name of 1998 FS144.

While there are 10,000 categorized asteroids, only about 72 objects have been identified in the Kuiper Belt, according to Pack. Asteroids, unlike Kuiper Belt objects, exist in the Main Belt, which orbits between Mars and Jupiter.

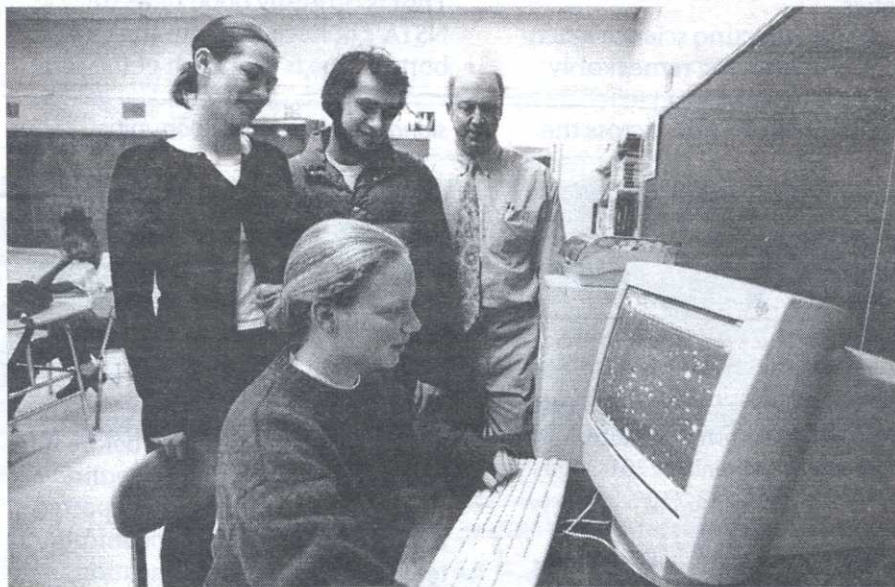
"Within the limits we had, we

did so much," said Heather. "There really are no limitations when you're exploring outer space. It's just free range. With more equipment, we could do a lot more." As a result of this experience, Heather is considering studying astronomy in college. "Mr. Pack is a great teacher. He showed us so much enthusiasm throughout, [that] it gave

us ours," Heather explained. "He's an inspiration."

The students made the discovery on October 30, 1998. They analyzed the data at their computer and performed the calculations. George Peterson of Marshfield, MA, joined the team as an observer.

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—Glenn Minshall

Students in Hughes Pack's astronomy class at Northfield (MA) Mount Hermon School discovered a Kuiper Belt object during their class research. Here Pack (far right) and the students observe a computer image that contains the object.

ESEA Reauthorization Gears Up in Congress

In an expected move, Rep. William Goodling (R-PA), chair of the House Education Committee, introduced—and the committee passed—a change in procedure that will affect the reauthorization of the Elementary and Secondary Education Act (ESEA), the main K-12 education law. The full Education Committee, not the Subcommittee on Early Childhood, Youth, and Families, as anticipat-

ed, will mark up or draft the ESEA. This allows Goodling to have more oversight with ESEA and to move it through Congress quickly—one of his stated goals. Democrats strongly disapproved of this measure.

In a letter, Goodling says he anticipates dividing ESEA issues between the two education subcom-

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The three students are all members of the Class of 1999.

The team sent their data to fellow students at Oil City Area High School in Pennsylvania for verification. Angel Birchard and Stacey Hinds—along with their teacher, Tim Spuck, who co-founded the asteroid search project with Pack—verified that the data was correct. The NMH team then forwarded their discovery to astrophysicist Carl Pennypacker at the Berkeley lab. Pennypacker, founder of the Hands-On Universe (HOU) Project, of which the students' project is a part, said that when he realized high school students had discovered a Kuiper Belt object, "It was one of the great moments in my research and educational career."

Astronomer Tom Gehrels of the Lunar and Planetary Lab and Spacewatch Project at the University of Arizona visited the Astronomy 411 class on November 16 to look at their work. He said that everything was excellent, that they knew what they were doing, and that it was not a lucky shot. "Before this

discovery, only professional astronomers have found such objects," he observed. He told the students about his early experiences with scientists Oort and Kuiper, who hypothesized the existence of the Kuiper Belt and Oort Cloud, from which comets originate.

In December, Pack received a fax from Belfast University in Ireland saying that the object had been sighted again from a 2.5-meter telescope in the Canary Islands. Several astronomers have called to confirm the orbit. 1998 FS144 probably won't be lost, now that its orbit has been confirmed several times.

"The students found at least 20 Main Belt asteroids—every team in the class found them," said Pack. Based on their coordinates in space, these asteroids were ones that had never been documented, he explained.

In Pack's class, there were six Asteroid Search Teams. The images they studied were taken by a Blanco 4-meter telescope at the Cerro Tololo Inter-American Observatory in Chile, which subsequently sent them to the Berkeley lab. "Professional astronomers don't spend a lot of time searching for asteroids.... So amateurs are the

ones who look for them, but they don't generally have the powerful telescopes," Pack said. With the images from the very large Chilean telescope, these students were apparently finding unnamed asteroids, but they did not have enough successive images to document them. "There is no reason why, if we have the proper facilities, high school students cannot map the solar system," Pack said. "If we had the telescopes, we could do it."

Pack has visited Sweden and Japan to present HOU asteroid search materials to groups of teachers from Russia, Sweden, Germany, and Japan. Currently, he is working on a student exchange with Sweden. "We're trying to teach that science is a work of collaboration. We want to have cultural exchanges and have kids get to know kids from other cultures."

Five hundred U.S. teachers and several hundred teachers around the world now use HOU in their classrooms. This is the first school year that the HOU Asteroid Search project has been in full use. More than 4,000 teachers are said to be eager to join, and project staff hope this will be made possible through the Internet. "I think this is an incredibly effective way to teach."

emphasized Pack. "The students are much more focused, much more excited, than they ever were in the past."

Many teachers have reported success with HOU. "My students began using Hands-On Universe this fall and really like it!" commented Nancy Alexander, an astronomy teacher at Spotswood High School in Rockingham County, VA. "Two of my students went to a workshop last weekend in Chicago with me—they learned how to do an asteroid search as well as other HOU activities."

Tom Morin, an astronomy teacher in Belmont, NH, has been involved with HOU since 1993. "I have students repairing telescopes, photographing the evening skies, and searching for asteroids," he said. "I have been able to work with John Goegel, a math teacher, to design and develop an integrated astronomy and math program for our school. Recently, as GTE GIFT Fellows (1996), we were able to not only integrate the two programs but to purchase our own telescope to help develop more programs and encourage our students in their interest in astronomy."

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HOU is supported by the National Science Foundation, the Department of Defense, and the Department of Energy. "The HOU program has become very popular because it takes real astronomical images and, through the use of the special software, allows students to carry out actual scientific investigations," said NSF program director Joe Stewart. "These are 'real' investigations, not 'programmed' investigations, in the sense that the students can discover things not previously known."

NMH, founded by D.L. Moody in 1978, is an independent, college-preparatory boarding school with students from all over the United States and 40 other countries. Students take two major classes per term for in-depth study, and astronomy is taught at all grade levels.

For pictures of the Kuiper Belt object, see <http://astronomy.geecs.org>, the HOU website run by a group of students led by Chris Micali. Many students have used HOU to explore astronomical data. For examples of their work, see <http://hou.lbl.gov/research>. For more information on HOU, see <http://hou.lbl.gov>. ●