

the *Hubble*? That would be like looking for a spot on an elephant with a straw," says Green. "You want to see the whole elephant; then you zero in on that spot and watch it move."

European efforts

Complementing NASA's efforts, ESA's 1-m Optical Ground Station telescope at Tenerife's Teide Observatory performs follow-up observations to discern NEO orbits. The ESA-funded Near Earth Objects Dynamic Site (<http://newton.dm.unipi.it/neodys/>), located in Pisa, Italy, is one of two centers worldwide devoted to calculating the orbits and risks to Earth of known NEOs; the other is at NASA's Jet Propulsion Laboratory.

ESA recently secured funding for a 1-m ground telescope optimized to

search for asteroids and having a very wide field of view, says Drolshagen. Ultimately, the agency would like to have four such instruments to survey the complete sky every night.

Help may come from the private sector. Planetary Resources is one of two US companies planning to mine near-Earth asteroids for water and minerals in the years ahead. In July the company launched its first spacecraft from the International Space Station on a flight to test the computers, control and power systems, radios, and other components that will be needed for prospecting. Its second satellite, scheduled for launch later this year, will put a telescope into orbit.

"We are going out in Earth orbit and doing something you can't do even with

the largest telescope on the largest mountain on the planet: To look at asteroids on the sunlit side of the Earth," says Planetary Resources president Chris Lewicki.

"Statistically, we should have discovered 1000 or so Atira asteroids [those whose orbits lie entirely within Earth's], when you compare them to other categories. In reality, the number is now 14 or 15," Lewicki says. The Chelyabinsk meteor, he notes, arrived on Earth's daytime side, "and there is no system in place that could have seen that coming."

Through its two-year-old "grand challenge" program, NASA is enlisting help from and offering prizes to citizen-scientists from around the world. One programmer received a prize of \$55 000 for improving the performance of an

Physics whiz kids converge in India

For a week in July, 382 high school students from 83 countries competed in this year's International Physics Olympiad (IPhO). The event took place in Mumbai, India.

The top scorer was Taehyoung Kim of South Korea, who also had the best marks on the theoretical part of the competition; the best experimental score was earned by his teammate Sol Kim. A total of 38 gold medals were awarded to competitors from 16 countries (lower photo). The only country for which all five team members won golds was China. The teams from Russia, South Korea, Taiwan, and the US each took home four golds and a silver.

Earning gold medals on the US team (top photo) were Zachary Bogorad (front left) of Solon, Ohio; Adam Busis (front right) of Silver Spring, Maryland; Kevin Li (second from left) of Princeton Junction, New Jersey; and Saranesh Prembabu (center) of San Ramon, California. Jason Lu (second from right) of Lincolnshire, Illinois, garnered a silver. The American Association of Physics Teachers and the American Institute of Physics are the main sponsors of the US team. Ahead of the olympiad, the US competitors flew to Bangkok for five days of training with the team from Thailand. They were invited by Thailand's Institute for the Promotion of Teaching Science and Technology.

This year the theoretical calculations involved photons and

neutrinos from the Sun, the extremum principle in classical and quantum mechanics, and the design of a nuclear reactor. In the experimental part of the competition, students used diffraction to determine geometrical parameters of a helical spring and to calculate the surface tension and viscosity of water. (The problems, solutions, and more about IPhO are at <http://www.ipho2015.in/>.)



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When not busy with exams, students visited a research institute and a car and truck manufacturing plant, went on a walking tour of South Mumbai, and saw other local sights.

The olympiad in India "was one of the best, if not the best, we have ever had," says IPhO president Hans Jordens. "The problems were interesting and challenging," he says, and "neither cost nor effort were spared to have the competition run well."

Paul Stanley of Beloit College, a coach for the US team, says the team's "strong performance" and the training in Thailand were highlights for the students. "But the real value is meeting peers from around the world. Sometimes the competitors stay in touch for years."

The 2016 International Physics Olympiad will be jointly hosted by Switzerland and Liechtenstein and held in Zürich.

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