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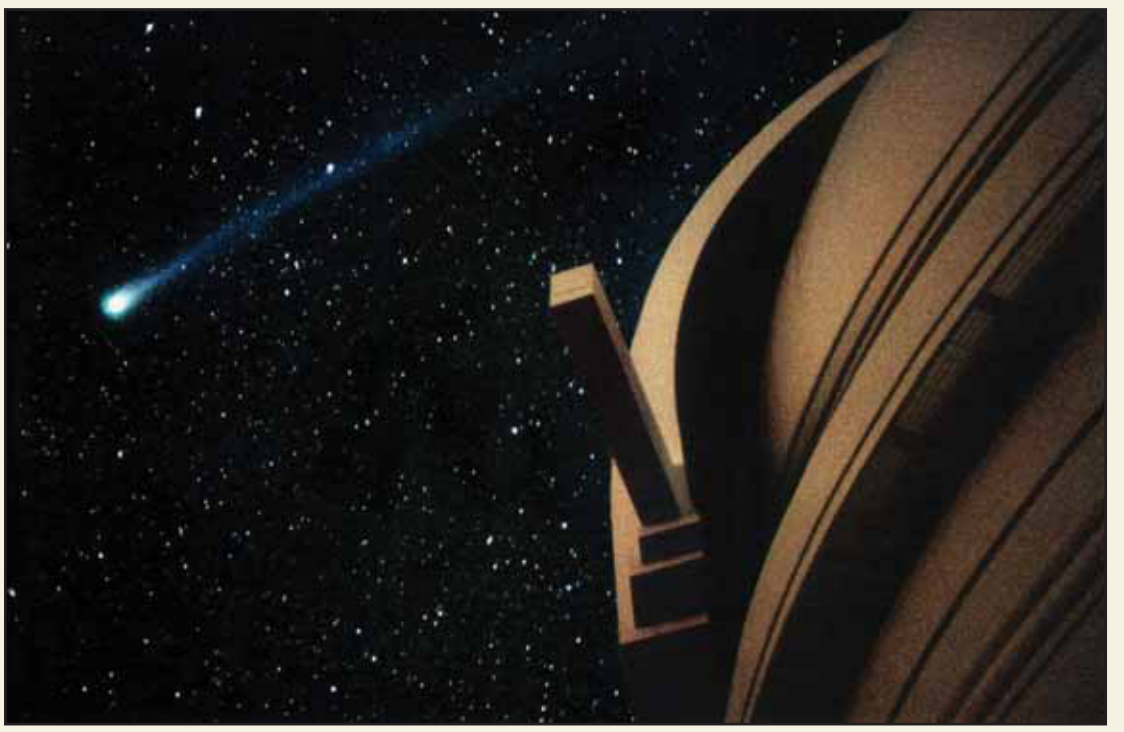
EDI to assist search for planets



DON BARTLETTI

Comet Hyakutake shoots past the Mt. Palomar dome earlier this year.

By Anne M. Stark
NEWSLINE STAFF WRITER

David Erskine might just be on his way to finding the Holy Grail; of Earth-like planets, that is.

With the help of the externally dispersed interferometer (EDI) that he developed more than seven years ago, Erskine and colleagues from UC Berkeley and Cornell University will use the instrument on the Mount Palomar 200-inch telescope to hunt for Earth-size planets in the infrared.

This would be the first precision Doppler planet search in the infrared, which is optimized to measure low mass stars that tend to be cool.

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The motion of a planet around a star causes the star to wobble, which in turn causes a changing Doppler shift in the wavelength of the star light. Light passing through the periodic fringes of an interferometer (and then into a spectrograph) creates a moire pattern. The moire pattern shifts proportional to the Doppler velocity. Conventional spectrograph distortions can prevent their precise measurement of the Doppler shift, but by using the EDI, the small Doppler shifts of low mass stars can be measured.

And that's where the Holy Grail comes in. For years, astronomers have identified new planets, but typically they are giant planets, close to the size of Jupiter or Saturn.

"The holy grail is to find an Earth-like planet,î Erskine said. ìUsing EDI, we have a fighting chance to find one."

An Earth-like planet could help astronomers understand how Earth formed and how planets form in a habitable zone where water is not boiling or freezing.

Using EDI in conjunction with a spectrograph at Mt. Palomar, Erskine said the team can expect to measure cool stars such as brown dwarfs with a velocity sensitivity 10 times better than with the spectrograph alone.

"There are all these red (new) stars that are not being looked at to see if there are planets around them because they are too feeble in the visible light," he said. "To date, no one has had an infrared instrument this sensitive and precise. We're like the new kids on the block."

The idea behind EDI started out as a 1998 Laboratory Directed Research and Development pilot project put together by Erskine of the Physics and Advanced Technologies Directorate using white light velocity interferometer techniques from H-Divisionís two-stage gas guns and combining it with astronomical spectroscopy.

In September 2005, the LLNL/UCB/Cornell team received a $1 million grant over three years from the National Science Foundation to conduct experiments at Mt. Palomar. This also would be the largest telescope application of the Doppler interferometer technique invented and developed at LLNL. Cornell is building the spectrograph and UC Berkeley / LLNL the interferometer.

"Stars less massive have cool atmospheres that are faint in visible light," said James Lloyd, a collaborator from Cornell. "Low mass stars and brown dwarfs are therefore largely unexplored for planets by the visible radial velocity methods that have been used so far. To explore the population of planets around the lowest mass stars and brown dwarfs, we are combining EDI with a spectrograph on the Palomar 200-inch telescope."

In addition, the group recently received $500,000 to conduct a design study for a Doppler planet search instrument based on Erskineís EDI at the Gemini Observatory.

Other outside collaborators on the project include Jerry Edelstein of the Space Sciences Lab at UC Berkeley and Terry Herter of Cornell University.

In September, the Keck Foundation awarded funding to the University of Florida to use a modified LLNL interferometer technique to study hundreds of stars simultaneously at the Sloan 2.5 m telescope. The Florida group is led by Jian Ge, who learned the technique while a postdoc at the Laboratory for the 1998 LDRD project. LLNL will license the technology. A known exoplanet was measured using EDI by this group at the Kitt Peak Observatory in Arizona.