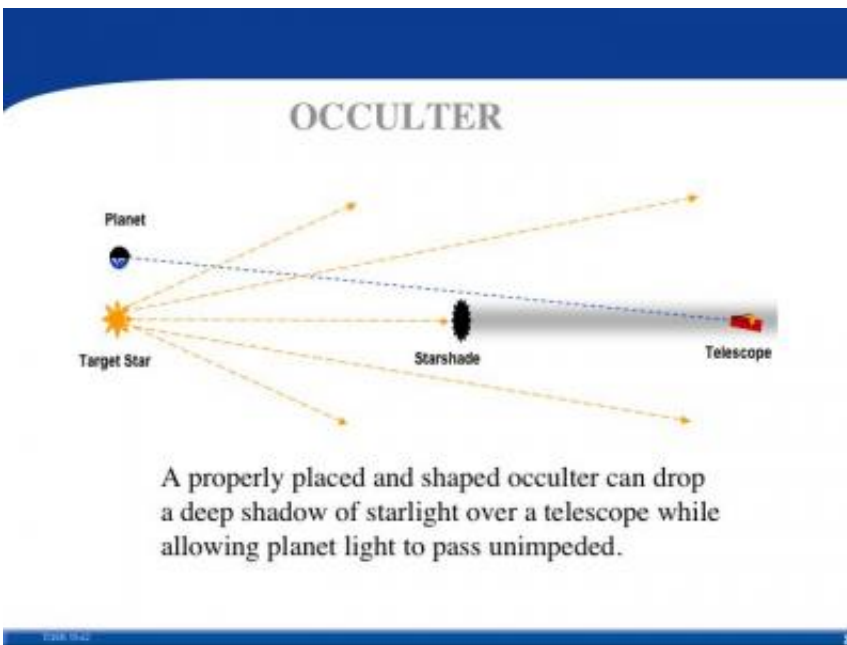


Space shield could help image Earth-like planets

July 5 2006



The daisy-shaped starshade will allow light from distant planets to pass unimpeded into the orbiting space telescope. Credit: CU-Boulder

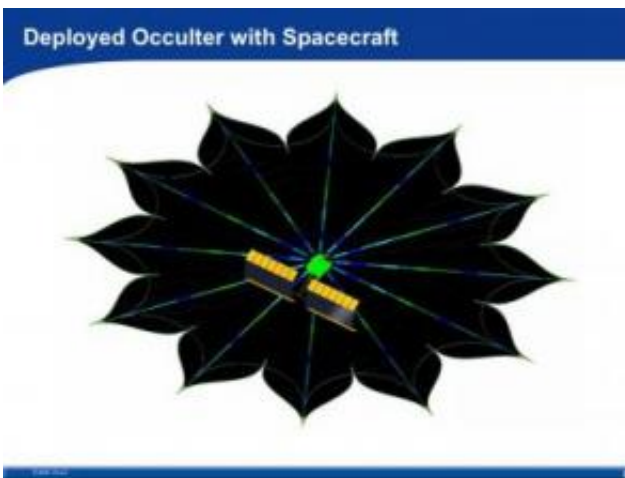
A gigantic, daisy-shaped space shield could be used to block out pesky starlight and allow astronomers using an orbiting telescope to zero in on Earth-like planets in other solar systems, according to a University of Colorado at Boulder study.

The thin plastic "starshade" would allow a telescope trailing thousands of miles behind it to image light from distant planets skimming by the giant

petals without being swamped by light from the parent stars, said CU-Boulder Professor Webster Cash. Researchers could then identify planetary features like oceans, continents, polar caps and cloud banks and even detect biomarkers like methane, oxygen and water if they exist, he said.

"We think this is a compelling concept, particularly because it can be built today with existing technology," said Cash. "We will be able to study Earth-like planets tens of trillions of miles away and chemically analyze their atmospheres for signs of life."

A paper on the subject by Cash is featured on the cover of the July 6 issue of *Nature*. The paper includes mathematical solutions to optical challenges like the bending and scattering of light between the pliable, 50-yard-in-diameter starshade and the space telescope, which would orbit in tandem roughly 15,000 miles apart.



Roughly half the size of a football field, the starshade will be equipped with thrusters to move into the line of sight of distant stars. Credit: CU-Boulder

Scientists would launch the telescope and starshade together into an orbit roughly 1 million miles from Earth, then remotely unfurl the starshade and use small thrusters to move it into lines of sight of nearby stars thought to harbor planets, said Cash. The thrusters would be intermittently turned on to hold the starshade steady during the observations of the planets, which would appear as bright specks.

"Think of an outfielder holding up one hand to block out the sunlight as he tracks a fly ball," said Cash, director of CU-Boulder's Center for Astrophysics and Space Astronomy. "We would use the starshade as a giant hand to suppress the light emanating from a central star by a factor of about 10 billion."

The novel concept could be used to map planetary systems around distant stars and detect planets as small as Earth's moon, said Cash. In recent years, more than 175 planets have been discovered orbiting other stars.

Dubbed the New Worlds Observer, Cash's design was selected for a \$400,000 funding boost last October by NASA's Institute for Advanced Concepts after being selected for initial study in 2004. The team includes researchers from Princeton University, NASA's Goddard Space Flight Center, Ball Aerospace of Boulder, Northrop Grumman Corp. of Los Angeles and the Carnegie Institution in Washington, D.C.

The team also has submitted a \$400 million proposal with NASA's Discovery Program to launch a stand-alone starshade to work in concert with the powerful James Webb Space Telescope. The James Webb Space Telescope is an infrared observatory slated for launch in 2013 and considered the successor to the Hubble Space Telescope.

Alternative proposals for imaging distant planets involve suppressing parent starlight once it has entered the telescope -- a complicated, Rube

Goldberg-like undertaking involving shifting mirrors and active electronics, said Marc Kuchner of NASA's Goddard Space Flight Center's Exoplanets and Stellar Astrophysics Laboratory. "In contrast, this is a very clean and simple optical concept, and may be the most promising idea yet on how to directly image our Earth-like neighbors," said Kuchner, also a member of the New Worlds Observer science team.

"For over a century, science fiction writers have speculated on the existence of Earth-like planets around nearby stars," Cash wrote in *Nature*. "If they actually exist, use of an occulter could find them within the next decade."

An even more advanced version of the New Worlds Imager might involve a ring of telescopes placed on the moon beneath a fleet of orbiting starshades that would allow scientists to actually photograph distant, Earth-like planets, Cash speculated. "There is a bit of Buck Rogers in the New Worlds Imager concept, but seeking and mapping new lands is something that seems to ring deep in the human psyche."

Source: University of Colorado at Boulder

Citation: Space shield could help image Earth-like planets (2006, July 5) retrieved 24 April 2024 from <https://phys.org/news/2006-07-space-shield-image-earth-like-planets.html>

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