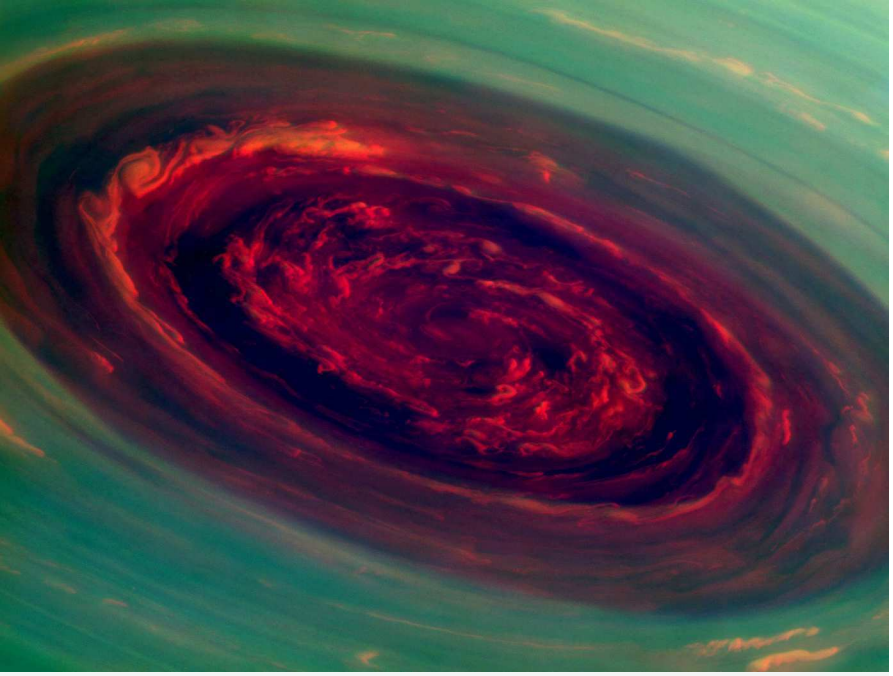

National Aeronautics and
Space Administration

Optics

Nanostructure secondary mirror apodization mask

A novel method for transmitter signal suppression in a duplex telescope.

NASA Goddard Space Flight Center has developed an innovative secondary mirror apodization mask for duplex telescopes that (1) uses a superior material (carbon nanotubes grown on silicon) for the absorption of on-axis radiation from the transmitted beam, and (2) applies this material in a way that smoothly tapers or "apodizes" the absorption to minimize diffraction. The shape of the mask provides a smooth transition to the clear aperture of the secondary mirror. This reduces stray light by many orders of magnitude compared to optical systems that do not incorporate a central mask.

BENEFITS

- Significantly improves suppression of stray light

technology solution

THE TECHNOLOGY

Telescopes that both receive and send source beams to each other are said to operate in duplex mode. In such a system, scattered light from the transmitted beam striking the center of the telescope secondary mirror can be a significant issue, since it can be many orders of magnitude stronger than the received beam. To address this issue, a black mask is applied to the center of the secondary mirror in the region of central obscuration, where no received light is lost. This mask is designed to absorb transmitted light that could be reflected back into the receiver. The mask is composed of carbon nanotubes, an extremely black material over all angles. This material suppresses stray light approximately 3 to 10 time more efficiently than Z306, a standard aerospace paint currently used for stray light control. By carefully shaping this mask into a smooth apodized taper, stray light can be very significantly reduced in the telescope.

APPLICATIONS

The technology has several potential applications:

- Space science
- Terrestrial telescopes
- Other optical systems (especially duplex) where stray light is an issue

PUBLICATIONS

Patent No: 8963068

More Information

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