tem, a "nulling" point on the FGS focal point is determined by calibration. This alignment is implemented by a fine alignment mechanism that is part of the fine guidance camera selection mirror. If the star images meet the modeling assumptions, and the star "centroid" can be driven to that nulling point, the contrast for the coronagraph will be maximized.

This work was done by Paul Brugarolas, James W. Alexander, John T. Trauger, and Dwight C. Moody of Caltech for NASA's Jet Propulsion Laboratory. For more information, contact iaoffice@jpl.nasa.gov. NPO-47067

Single-Antenna Temperature- and Humidity-Sounding Microwave Receiver

This technology has applications in imagers and broadband communications.

NASA's Jet Propulsion Laboratory, Pasadena, California

For humidity and temperature sounding of Earth's atmosphere, a single-antenna/LNA (low-noise amplifier) is needed in place of two separate antennas for the two frequency bands. This results in significant mass and power savings for GeoSTAR that is comprised of hundreds of antennas per frequency channel. Furthermore, spatial anti-aliasing would reduce the number of horns. An anti-aliasing horn antenna will enable focusing the instrument field of view to the "hurricane corridor" by reducing spatial aliasing, and thus reduce the number of required horns by up to 50 percent.

The single antenna/receiver assembly was designed and fabricated by a commercial vendor. The 118–183-GHz horn is based upon a profiled, smooth-wall design, and the OMT (orthomode transducer) on a quad-ridge design. At the input end, the OMT presents four very closely spaced ridges [0.0007 in. (18 μm)]. The fabricated assembly contains a single horn antenna and low-noise broadband receiver front-end assembly for passive remote sensing of both temperature and humidity profiles in the Earth's atmosphere at 118 and 183 GHz. The wideband feed with dual polarization capability is the first broadband low noise MMIC receiver with the 118 to 183 GHz bandwidth.

This technology will significantly reduce PATH/GeoSTAR mass and power while maintaining 90 percent of the measurement capabilities. This is required for a Mission-of-Opportunity on NOAA's GOES-R satellite now being developed, which in turn will make it possible to implement a Decadal-Survey mission for a fraction of the cost and much sooner than would otherwise be possible.

This work was done by Daniel J. Hoppe, David M. Pukala, Bjorn H. Lambrigtsen, Mary M. Soria, Heather R. Owen, Alan B. Tanner, Peter J. Bruneau, Alan K. Johnson, Pekka P. Kangaslahti, and Todd C. Gaier of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1). NPO-47351

Multi-Wavelength, Multi-Beam, and Polarization-Sensitive Laser Transmitter for Surface Mapping

This laser transmitter can be used for precision mapping and remote sensing.

Goddard Space Flight Center, Greenbelt, Maryland

A multi-beam, multi-color, polarized laser transmitter has been developed for mapping applications. It uses commercial off-the-shelf components for a low-cost approach for a ruggedized laser suitable for field deployment.

The laser transmitter design is capable of delivering dual wavelengths, multiple beams on each wavelength with equal (or variable) intensities per beam, and a well-defined state of polarization. This laser transmitter has been flown on several airborne campaigns for the Slope Imaging Multi-Polarization Photon Counting Lidar (SIMPL) instrument, and at the time of this reporting is at a technology readiness level of between 5 and 6.

The laser is a 1,064-nm microchip high-repetition-rate laser emitting energy of about 8 microjoules per pulse. The beam was frequency-doubled to 532 nm using a KTP ($KTiOPO_4$) nonlinear crystal [other nonlinear crystals such as LBO (LiB_3O_5) or periodically poled lithium niobiate can be used as well, depending on the conversion efficiency requirements], and the conversion efficiency was approximately 30 percent. The KTP was under temperature control using a thermoelectric cooler and a feedback monitoring thermistor. The dual-wavelength beams were then spectrally separated and each color went through its own optical path, which consisted of a beam-shaping lens, quarter-wave plate (QWP), and a birefringent crystal (in this case, a calcite crystal, but others such as vanadate can be used).

The QWP and calcite crystal set was used to convert the laser beams from a linearly polarized state to circularly polarized light, which when injected into a calcite crystal, will spatially separate the circularly polarized light into the two linear polarized components. The spatial separation of the two linearly polarized components is determined by the length of the crystal. A second set of QWP and calcite then further separated the two beams into four. Additional sets of QWP and calcite can be used to further split the beams into multiple orders of two.

The spatially separated beams had alternating linearly polarization states; a half-wave plate (HWP) array was then made to rotate the alternating states of