quency passive isolation platform to filter spacecraft vibrations with voice coil actuators for active tip-tilt correction below the resonant frequency.

The canonical deep-space optical communications transceiver makes synergistic use of innovative technologies to reduce size, weight, power, and cost. This optical transceiver can be used to retire risks associated with deep-space optical communications on a planetary pathfinder mission and is complementary to ongoing lunar and access link developments.

This work was done by Gerard G. Ortiz, William H. Farr, and Jeffrey R. Charles of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1). ***NPO-46073***

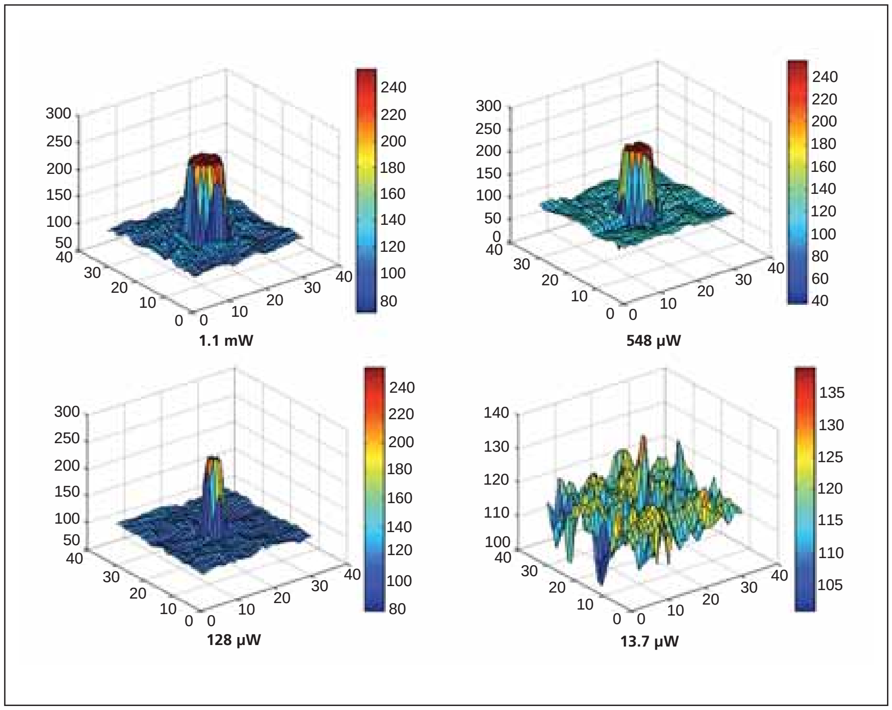
Two-Photon-Absorption Scheme for Optical Beam Tracking

This approach reduces cost for free-space optical communication receivers.

NASA's Jet Propulsion Laboratory, Pasadena, California

A new optical beam tracking approach for free-space optical communication links using two-photon absorption (TPA) in a high-bandgap detector material was demonstrated. This tracking scheme is part of the canonical architecture described in the preceding article. TPA is used to track a long-wavelength transmit laser while direct absorption on the same sensor simultaneously tracks a shorter-wavelength beacon. The TPA responsivity was measured for silicon using a PIN photodiode at a laser beacon wavelength of 1,550 nm. As expected, the responsivity shows a linear dependence with incident power level. The responsivity slope is 4.5 $\times$ 10^{-7} A/W^2. Also, optical beam spots from the 1,550-nm laser beacon were characterized on commercial charge-coupled device (CCD) and complementary metal-oxide semiconductor (CMOS) imagers with as little as 13.7 µW of optical power (see figure). This new tracker technology offers an innovative solution to reduce system complexity, improve transmit/receive isolation, improve optical efficiency, improve signal-to-noise ratio (SNR), and reduce cost for free-space optical communications transceivers.

This work was done by Gerardo G. Ortiz and William H. Farr of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1). ***NPO-46063***



Two-Photon Absorption generated signal levels caused by a 1,550 nm laser focused spot on a silicon CMOS focal plane array detector at various power levels. Note that the spot is distinguishable even with incident power levels in the 10's of microwatts.

High-Sensitivity, Broad-Range Vacuum Gauge Using Nanotubes for Micromachined Cavities

NASA's Jet Propulsion Laboratory, Pasadena, California

A broad-range vacuum gauge has been created by suspending a single-walled carbon nanotube (SWNT) (metallic or semiconducting) in a Schottky diode format or in a bridge conductor format, between two electrically charged mesas. SWNTs are highly sensitive to molecular collisions because of their extremely small diameters in the range of 1 to 3 nanometers. The measurement parameter will be the change in conductivity of SWNT due to decreasing rate of molecular collisions as the pressure inside a chamber decreases.

The rate of heat removal approaches a saturation limit as the mean free path (m.f.p.) lengths of molecules increase due to decreasing pressure. Only those sensing elements that have a long relaxation time can produce a measureable response when m.f.p. of molecules increases (or time between two consecutive collisions increases). A suspended SWNT offers such a capability because