A multilayer dielectric device has been fabricated as a prototype of a low-loss, low-distortion, transmissive optical phase modulator that would provide as much as a full cycle of phase change for all frequency components of a transmitted optical pulse over a frequency band as wide as 6.3 THz. Arrays of devices like this one could be an alternative to the arrays of mechanically actuated phase-control optics (adaptive optics) that have heretofore been used to correct for wave-front distortions in highly precise optical systems. Potential applications for these high-speed wave-front-control arrays of devices include agile beam steering, optical communications, optical metrology, optical tracking and targeting, directional optical ranging, and interferometric astronomy.

The device concept is based on the same principle as that of band-pass interference filters made of multiple dielectric layers with fractional-wavelength thicknesses, except that here there is an additional focus on obtaining the desired spectral phase profile in addition to the device’s spectral transmission profile. The device includes a GaAs substrate, on which there is deposited a stack of GaAs layers alternating with AlAs layers, amounting to a total of 91 layers. The design thicknesses of the layers range from 10 nm to >1 µm. The number of layers and the thickness of each layer were chosen in a computational optimization process in which the wavelength dependences of the indices of refraction of GaAs and AlAs were taken into account as the design was iterated to maximize the transmission and minimize the group-velocity dispersion for a wavelength band wide enough to include all significant spectral components of the pulsed optical signal to be phase modulated.

The figure depicts the normal-incidence power transmission and relative transmitted phase spectrum computed for the optimized design. The band-pass re-
A report discusses an early phase in the development of the MISR-2 C, a second, improved version of the Multi-angle Imaging Spectroradiometer (MISR), which has been in orbit around the Earth aboard NASA’s Terra spacecraft since 1999. Like the MISR, the MISR-2 would contain a “pushbroom” array of nine charge-coupled-device (CCD) cameras — one aimed at the nadir and the others aimed at different angles sideways from the nadir. The major improvements embodied in the MISR-2 would be the following:

- A new folded-reflective-optics design would render the MISR-2 only a third as massive as the MISR.
- Smaller filters and electronic circuits would enable a reduction in volume to a sixth of that of the MISR.
- The MISR-2 would generate images in two infrared spectral bands in addition to the blue, green, red, and near-infrared spectral bands of the MISR.
- Miniature polarization filters would be incorporated to add a polarization-sensing capability.
- Calibration would be performed non-intrusively by use of a gimbaled tenth camera.

The main accomplishment thus far has been the construction of an extremely compact all-reflective-optics CCD camera to demonstrate feasibility.

This work was done by Steven Macenka, Larry Hovland, Daniel Preston, Brian Zellers, and Kevin Downing of Caltech for NASA’s Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1). NPO-35097