

cations include automotive radar (both transmitters and receivers), communication links, radar systems for collision avoidance, production monitors, ground-penetrating sensors, and wireless personal networks.

This work was done by Pekka P. Kangaslahti, Todd C. Gaier, Joelle T. Cooperrider, Lorene A. Samoska, Mary M. Soria, Ian J. O'Dwyer, Sander Weinreb, Brian Custodero, and Heather Owen of Caltech; Keith Grainge of Cambridge University; Judy M. Lau and

Sarah Church of Stanford University; and Richard Lai and Xiaobing Mei of Northrop Grumman Corp. for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1). NPO-46522

Waveguide Transition for Submillimeter-Wave MMICs

NASA's Jet Propulsion Laboratory, Pasadena, California

An integrated waveguide-to-MMIC (monolithic microwave integrated circuit) chip operating in the 300-GHz range is designed to operate well on high-permittivity semiconductor substrates typical for an MMIC amplifier, and allows a wider MMIC substrate to be used, enabling integration with larger MMICs (power amplifiers). The waveguide-to-CBCPW (conductor-backed coplanar waveguide) transition topology is based on an integrated dipole placed in the E-plane of the waveguide module. It demonstrates low loss and good impedance matching. Measurement and simu-

lation demonstrate that the loss of the transition and waveguide loss is less than 1-dB over a 340-to-380-GHz bandwidth.

A transition is inserted along the propagation direction of the waveguide. This transition uses a planar dipole aligned with the maximum E-field of the TE₁₀ waveguide mode as an interface between the waveguide and the MMIC. Mode conversion between the coplanar striplines (CPS) that feed the dipole and the CBCPW transmission line is accomplished using a simple air-bridge structure. The bottom side ground plane is truncated at the same reference as the

top-side ground plane, leaving the end of the MMIC suspended in air.

This work was done by Kevin M. Leong, William R. Deal, Vesna Radisic, Xiaobing Mei, Jansen Uyeda, and Richard Lai of Northrop Grumman Corporation, and Lorene A. Samoska, King Man Fung, and Todd C. Gaier of Caltech for NASA's Jet Propulsion Laboratory. The work was sponsored under the DARPA SWIFT program and the contributors would like to acknowledge the support of Dr. Mark Rosker (DARPA) and Dr. H. Alfred Hung (Army Research Laboratory). Further information is contained in a TSP (see page 1). NPO-46237

Magnetic-Field-Tunable Superconducting Rectifier

This device would be useful in superconducting circuit applications.

Goddard Space Flight Center, Greenbelt, Maryland

Superconducting electronic components have been developed that provide current rectification that is tunable by design and with an externally applied magnetic field to the circuit component. The superconducting material used in the device is relatively free of pinning sites with its critical current determined by a geometric energy barrier to vortex entry. The ability of the vortices to move freely inside the device means this innovation does not suffer from magnetic hysteresis effects changing the state of the superconductor.

The invention requires a superconductor geometry with opposite edges along the direction of current flow. In order for the critical current asymmetry effect to

occur, the device must have different vortex nucleation conditions at opposite edges. Alternative embodiments producing the necessary conditions include edges being held at different temperatures, at different local magnetic fields, with different current-injection geometries, and structural differences between opposite edges causing changes in the size of the geometric energy barrier. An edge fabricated with indentations of the order of the coherence length will significantly lower the geometric energy barrier to vortex entry, meaning vortex passage across the device at lower currents causing resistive dissipation.

The existing prototype is a two-terminal device consisting of a thin-film su-

perconducting strip operating at a temperature below its superconducting transition temperature (T_c). Opposite ends of the strip are connected to electrical leads made of a higher T_c superconductor. The thin-film lithographic process provides an easy means to alter edge-structures, current-injection geometries, and magnetic-field conditions at the edges. The edge-field conditions can be altered by using local field(s) generated from dedicated higher T_c leads or even using the device's own higher T_c superconducting leads.

This work was done by John E. Sadleir of Goddard Space Flight Center. Further information is contained in a TSP (see page 1). GSC-15643-1