Abstracts

Theory of an FIR Gas Laser, by J. R. Tucker (The Aerospace Corp., Los Angeles, Calif. 90009).

A rate equation model for an optically pumped FIR gas laser is proposed. The gain expression includes saturation effects due to both pump power and FIR intensity. A criterion for positive gain is derived, and the role of velocity cross relaxation examined.

Far Infrared Generation by Noncollinear Difference Frequency Mixing, by R. L. Aggarwal, N. Lee, and B. Lax (Francis Bitter National Magnet Laboratory, Massachusetts Institute of Technology, Cambridge, Mass. 02139).

New developments in far infrared generation by noncollinear mixing of CO_2 lasers in GaAs and CdTe are presented. In particular, new folded crystal geometries which can yield orders of magnitude increase in the output power are discussed.

We have strong reasons to believe that this three orders of magnitude discrepancy between the experimental and theoretical values is primarily due to multimode structure and self-mode-locking of the CO_2 lasers used in this work.

Compact Waveguide Lasers in the Submillimeter and Millimeter Wave Regions, by M. Yamanaka and H. Yoshinaga (Department of Applied Physics, Osaka University, Yamada-Kami, Suita, Osaka 565, Japan).

Performances, for example, dependency on size and gas pressure, of metallic waveguides for far-infrared molecular lasers were studied. Compact highly efficient optically pumped waveguide lasers in the submillimeter and millimeter wave regions have been developed.

Interference Filters for Submillimeter Space Projects, by G. D. Holah (Purdue University, West Lafayette, Ind. 47907).

High quality low-frequency pass and bandpass metallic mesh interference filters are discussed, which cover the range 50–1000 μm. The use of these filters in satellite radiometry (operational) and balloon-borne astronomy is specifically considered.

Pulse Control Unit for Repetitive Slow-Scan Far Infrared Interferometry, by U. Strom, P. C. Taylor, and B. D. McCombe (U.S. Naval Research Laboratory, Washington, D.C. 20375).

An inexpensive electronic interface which controls the flow of a phase-detected signal from a Michelson interferometer to a signal averager is described. This interface is designed to add the advantages of signal averaging techniques to an existing slow-scan interferometer system which employs phase sensitive detection and time constant averaging.

Continuously Tunable Submillimeter Source by Difference Frequency Mixing in InSb of Spin-Flip Raman Lasers, by V.-T. Nguyen and T. J. Bridges (Bell Telephone Laboratories, Inc., Holmdel, N.J. 07733).

As strong resonant nonlinearity due to the conduction spins has been observed when the frequency ($\sim$100 cm^{-1}) of far-infrared (FIR), generated by difference frequency mixing of two orthogonally polarized CO_2 laser beams, is tuned to the spin-resonance frequency in InSb. This effect allows us to take full advantage of the availability of the tunable radiation from the spin-flip Raman laser (SFR) in the generation of tunable FIR. By using a nonresonant superradiant spin-flip Raman laser (NRSSFR) the continuous tuning of FIR was obtained from 90 to 110 cm^{-1}. Results of the attempts to obtain the CW operation of the generation of tunable FIR will also be given.

A Tunable Josephson Junction Far Infrared Source, by R. K. Elsley and A. J. Sievers (Laboratory of Atomic and Solid State Physics, Cornell University, Ithaca, N.Y. 14850).

We have studied radiation emitted by Nb–Nb point contact Josephson junctions at frequencies up to 30 cm^{-1}. Spectroscopic measurements on solids have been made using this source.

Recombination Radiation from Landau States in Impact Ionized GaAs, by J. Waldman and T. S. Chang (Department of Physics, Lowell Technological Institute, Lowell, Mass. 01854).

Recombination radiation from Landau states in impact ionized high-purity GaAs has been observed. The narrow band ($\sim$3-cm^{-1}) emission has been magnetically tuned from 80 to 120 cm^{-1}, and used to observe rotational transitions in water vapor.

Tunable Far Infrared Methyl Fluoride Laser Using Transverse Optical Pumping, by F. Brown, S. Kronheim, and E. Silver (Department of Physics, Williams College, Williamstown, Mass. 01267).

Some severe limitations of optically pumped superradiant FIR lasers (700-MHz linewidth, ragged pulse shape) may be overcome using transverse optical pumping (TOP). Strong ($\sim$500-W) lines have been produced in CH_3F with linewidth $<$30 MHz, and cavity tuning has been achieved over a range of 460 MHz at 496 μm.

Evidence for 1.6-mm Wavelength Parametric Amplification in a Josephson Junction Microwave Source, by M. T. Levinsen and B. T. Ulrich (Department of Physics, University of Texas, Austin, Tex. 78712).

A Josephson junction 1.6-mm-wavelength microwave source has been used to demonstrate the parametric amplification by reflection necessary to maintain parametric oscillations at 1.6-mm wavelength. A perturbation calculation based on the resistively and capacitively shunted Josephson junction model gives a negative effective microwave resistance for a junction biased at voltages higher than the voltage for a cavity induced step. The parametric oscillation was observed at voltages consistent with the region in which negative resistance was calculated.

Energy Modulation of an Electron Beam by a Laser, by M. Piestrup, G. Rothbart, R. Fleming, and R. Pantell (Stanford University, Stanford, Calif.).

Energy modulation of an electron beam may be accomplished by the inverse Cerenkov effect, wherein electrons are subjected to an electromagnetic field while passing through a medium at a velocity higher than the velocity of light in the medium. A phase synchronism condition between an electron and the field is maintained by having the correct angle between the two propagation vectors. With a 2-MW Nd:YAG laser, approximately 50-keV modulation has been imposed on a 100-MeV electron beam. This was achieved without using a resonant structure for the light. Energy modulation may be converted to current modulation in a drift space, and thereby provide the basis for submillimeter and optical klystron amplifiers, oscillators, or harmonic generators. Alternatively, laser electron accelerators may be constructed that are much shorter than present linear accelerators. Theoretical and experimental results will be presented.

First Experimental Results of High Precision Interferometry at 337 μm on a Tokamak Plasma, by D. Véron (Centre d'Etudes Nucléaires, Fontenay-aux-Roses, France).

This paper reports the first Tokamak plasma density measurements using a sensitive (10^{-2}-fringe) HCN laser interferometer. The system yields plasma phase shift directly in digital form with a time resolution of 50 μs.

Submillimeter Magnetospectroscopy in n-type InAs Epitaxial Layers: Shallow Hydrogenic Donor Impurity States, by C. W. Litton (Aerospace Research Laboratories, Wright-Patterson Air Force Base, Ohio 45433) and K. J. Button, D. R. Cohn, and H. C. Praddaude (Francis

Bitter National Magnet Laboratory, Massachusetts Institute of Technology, Cambridge, Mass. 02139).

Submillimeter magnetospectroscopic measurements of the shallow donor impurity in InAs epilayer crystals have been made at low temperatures. Several excited state transitions have been observed for the first time, together with various transitions from the ground state.

Development and Application of Optically Pumped Submillimeter Lasers, by H. R. Fetterman (Lincoln Laboratory, Massachusetts Institute of Technology, Lexington, Mass. 02173) and H. R. Schlossberg (Air Force Cambridge Research Laboratories, Air Force Science Center, Bedford, Mass. 01730).

Submillimeter lasers are optically pumped far from molecular absorptions using high power pumping or Stark tuning. Lasing between vibrational levels has been demonstrated with overtone pumping. These lasers have been applied to solid state spectroscopy.

FIR Waveguide Laser Performance in the 40-μm–1-mm Spectral Region, by D. T. Hodges and T. S. Hartwick (Electronics Research Laboratory, the Aerospace Corp., P.O. Box 92957, Los Angeles, Calif. 90009).

The design of a CW compact FIR waveguide laser operating in the 40-μm–1-mm spectral region is described. A metallic waveguide with internal mirrors is essential for efficient operation at wavelengths greater than 500 μm. Performance data are discussed.

Spectroscopy in D_2O Using Resonant Absorption of CO_2 Laser Radiation, by F. Keilmann (Max-Planck-Institut für Festkörperphysik, Stuttgart, Germany) and R. L. Sheffield, J. R. R. Leite, M. S. Feld, and A. Javan (Massachusetts Institute of Technology, Cambridge, Mass. 02139).

Absorbing ν_2 transitions in D_2O, D_2S, and HDS which are in near coincidence to CO_2 laser lines are investigated. Optically pumped laser emission is observed in D_2O, at submillimeter wavelengths, confirming the assignments.

Application of a Far Infrared Grille Spectrometer to the Study of Methyl Cyanide Vapor near 360 cm^{-1}, by G. Gauffre and R. Giraudet (Office National d'Etudes et de Recherches Aérospatiales (ONERA), 92320 Chatillon, France).

A grille spectrometer was specially adapted to the spectral range 20–45 μm. This apparatus, combining the properties of high resolution and large throughput, allowed us to achieve the analysis of the ν_8 vibration–rotation band of methyl cyanide near 360 cm^{-1}. The molecular constants are in good agreement with those provided by microwave measurements.

A Fast Sensitive GaAs Photoconductor System with a Cryogenic Preamplifier, by L. W. Kunz and J. M. J. Madey (Molectron Corp., 177 N. Wolfe Road, Sunnyvale, Calif. 94086).

A sensitive far-infrared (100–400-μm) detector system is described consisting of a liquid-helium cooled GaAs photoconductor, cryogenic preamplifier, and room-temperature post amplifier. The system bandwidth is 1 Hz–30 MHz, ten times greater than for InSb hot electron bolometers.

HCN-Laser Diagnostics, by H. J. Schötzau, B. Adam, and F. Kneubühl (Solid State Physics Laboratory, ETH Zurich, Hönggerberg, CH-8049 Zurich, Switzerland).

Diagnostics of the CW-HCN-laser plasma with field and temperature probe, a mass spectrometer, as well as related experiments prove that H_2 or D_2 molecules are required as collision partners of the HCN molecules. The formation of laser-active HCN molecules on the tube wall influence the radial gain profile. With this effect the excitation or suppression of higher HCN-laser modes can be controlled by the chemical composition of the laser gas.

CW 337-μm HCN Laser Gain Saturation, Emission Line Shape, and Power, by P. Belland, A. I. Ciura, D. Véron, and L. B. Whitbourn (Department de Physique du Plasma et de la Fusion Contrôlée, Centre d'Etudes Nucléaires, Association Euratom-CEA sur la Fusion, Boîte Postal 6, 92260, Fontenay-aux-Roses, France).

The gain saturation of a 337-μm HCN laser is shown to be homogeneous. Dependence of gain and saturation intensity on tube radius and gas temperature leads to the design of a compact clean-running laser.

Construction and Performance of a Transversely Excited 337 Micrometer-HCN Laser, by B. Adam, U. Zimmermann, H. J. Schötzau, and F. Kneubühl (Solid State Physics Laboratory, ETH Zurich, Hönggerberg, CH-8049 Zurich, Switzerland).

The transversely excited 337-μm-HCN laser with an output power near 1 kW is described. Relevant data on the construction, laser gases, and performance are presented.

Plasma Effects in the HCN Laser, by R. Turner (Johns Hopkins University Applied Physics Laboratory, Silver Spring, Md. 20910).

Plasma conditions in the pulsed HCN laser are critical to its performance. The radial electron distribution is such as to produce strong focusing initially. A magnetic field can be used to enhance or reduce or modulate the output.

A Far Infrared Bolometer at 0.10 K, by B. T. Draine and A. J. Sievers (Laboratory of Atomic and Solid State Physics, Cornell University, Ithaca, N.Y. 14850).

The performance of a Ge bolometer cooled to 0.10 K is discussed. A detector responsivity of 1.1×10^7 V/W^{-1} and noise equivalent power of 5×10^{-16} W/Hz$^{-1/2}$ are expected. A single-cycle He dilution refrigerator with no moving parts is also described.

A Microwave Biased Submillimeter GaAs Photodetector, by J. D. Crowley, F. K. Tittel, T. A. Rabson, and W. L. Wilson, Jr. (Department of Electrical Engineering, Rice University, Houston, Tex. 77001).

Studies were made of two different GaAs submillimeter detection systems. DC biased and microwave biased GaAs photoconductive detectors were compared and evaluated. The microwave biased detector exhibited a significantly wider bandwidth over that of the dc device.

Surface Channel Detection of Millimeter Waves in InSb, by J. Stannard (Naval Research Laboratory, Washington, D.C. 20375).

A new detector in the millimeter wave region of the spectrum has been developed using heavily doped but closely compensated InSb. Conduction in this detector is along a surface channel and detectors have been constructed with responsivities at peak of 500 V/W and a noise equivalent power at peak of 10^{-10} W/cm^2·Hz$^{1/2}$.

Photoconductive Far Infrared Detection in Silicon, by P. Norton (Department of Physics, Syracuse University, Syracuse, N.Y. 13210), W. J. Moore (Naval Research Laboratory, Washington, D.C. 20390), and F. DeRosa (Bell Telephone Laboratories, Murray Hill, N.J. 07974).

A new type of far infrared detector is described with a useful long wavelength limit of about 400 μm. Fast response times of several microseconds (source limited) have been demonstrated with pulsed far infrared molecular laser detection.

Experiments on Josephson Mixers for Heterodyne Reception at 0.3-mm Wavelength, by T. G. Blaney and D. J. E. Knight (National Physical Laboratory, Teddington, England).

A point contact Josephson junction has been investigated as a heterodyne mixer at 337 μm. The conversion efficiency reached about −32 dB using a laser local oscillator and about −42 dB using nineth or twelfth harmonic mixing with a klystron.

Josephson Junction Bolometer, by J. Clarke, G. I. Hoffer, and P. L. Richards (Department of Physics, University of California and Inorganic Materials Research Division, Lawrence Berkeley Laboratory, Berkeley, Calif. 94720).

A bolometer for use in the submillimeter and far infrared is de-

scribed. The temperature sensitive element is an SNS Josephson junction. The electrical noise equivalent power is 5×10^{-15} W/Hz$^{1/2}$ and the detectivity D^* is 10^{14} cm·Hz$^{1/2}$/W^{-1}.

Group Theory of Submillimeter-Wave-Frequency Angular Correlation Functions Related to the Rotation of Molecules in Liquids, by B. Keller and F. Kneubühl (Solid State Physics Laboratory, ETH Zurich, Hönggerberg, CH-8049 Zurich, Switzerland).

The group theory of submillimeter-wave-frequency angular autocorrelation functions of almost-rigid polyatomic molecules in liquids is presented and illustrated by functions determined from vibration–rotation spectra.

The Influence of the Coriolis Coupling on Submillimeter-Wave-Frequency Angular Correlation Functions Related to the Rotation of Molecules in Liquids and Gases, by K. Müller, P. Etique, and F. Kneubühl (Solid State Physics Laboratory, ETH Zurich, Hönggerberg, CH-8049 Zurich, Switzerland).

The influence of Coriolis coupling on submillimeter-wave-frequency angular autocorrelation functions describing the random rotation of spherical or symmetric molecules is calculated. Theoretical and experimental correlation functions of molecules with Coriolis effects are compared.

Rate Equations for an Optically Pumped FIR Laser, by J. O. Henningsen and H. G. Jensen, (University of Copenhagen, Copenhagen, Denmark).

The threshold pump power and conversion efficiency have been measured as function of gas pressure for some lines of a CO_2 pumped CH_3OH laser, and lasing has been observed down to a pump power level of 30 mW. Rate equations are set up which describe the experimental results and make it possible to identify the dominant loss mechanism in the laser.

Submillimeter Wave Generation and Amplification Using Optical Pumping, by R. K. Arora (Tata Institute of Fundamental Research, Homi Bhabha Road, Bombay 400 005, India) and V. P. Kodali (Department of Electronics, Government of India, New Delhi, 110011, India).

It is known that a quantum paramagnetic amplifier (QPA), when pumped by a source at optical frequencies, is capable of providing large gain-bandwidth and low noise operation. The treatment available for analyzing the operation of an amplifier/generator of this type is applicable at microwave and millimeter wave frequencies only because of the assumptions made in the analysis. However the technique itself is useful for frequencies extending beyond the submillimeter wave region. The purpose of this paper is to provide an analysis of the operation of a QPA/QPG in the submillimeter wave region. While our present method of approach is generally similar to that given for operation at lower frequencies, no simplifying assumptions which restrict its applicability will be made.

Criteria for the Observation of Dicke Superradiance in the Submillimeter Wavelength Region, by C. M. Bowden (Quantum Physics, Physical Sciences Directorate, Redstone Arsenal, Ala. 35809).

The phenomena of Dicke superradiance is discussed from the standpoint of the Fokker–Planck differential equation representation derived from the master equation in the atomic coherent states. Results calculated from the solution of this equation together with a self-consistency argument first put forth by Arecchi and Courtens are used to present characteristics of and criteria for its detection.

Submillimetric Spectrometry Using a Polarizing Interferometer, by D. H. Martin and E. Puplett (Department of Physics, Queen Mary College, University of London, Mile End Road, London, E1 4NS, England).

Two-beam interferometric spectrometry, in which a spectrum is obtained by taking the Fourier transform of an interferogram, is now the preferred technique for most applications in the submillimeter spectrum, say 5–200 cm^{-1}. The method most commonly in use is based on the Michelson or Twyman–Green configuration with a stretched dielectric film as beam divider. The results obtained in practice using this method fall well short of what should be possible ideally. We have previously reported briefly on a new method of interferometry involving a polarizing beam divider. This has brought performances closer to the ideal. Examples of performance and a fuller discussion of the method are given in this paper.

Antiferromagnetic Resonance in NiO:Co^{2+} and NiO:Fe^{2+}, by C. R. Becker, R. Geick, and V. Wagner (Physikalisches Institut der Universität Würzburg, Würzburg, Germany).

The antiferromagnetic resonance (AFMR) of NiO doped with Fe^{2+} and Co^{2+} was studied at 4.2 K in the far infrared spectral region by means of Fourier transform spectroscopy. For the Co^{2+} doped crystals, a strong shift of the AFMR line was observed. In case of the Fe^{2+} doped crystal, this shift was much smaller. In addition, a second absorption line was found for larger concentrations of Co^{2+} (5–7 percent). All these effects are attributed to the single ion anisotropies of the Fe^{2+} and Co^{2+} ions, and the experimental results are interpreted by means of a simple model calculation.

A Submillimeter Michelson Interferometer with Frustrated-Total-Internal-Reflection Beamsplitter, by M. Daehler (Naval Research Laboratory, Washington, D. C. 20390).

An efficient beamsplitter for a Michelson interferometer can be made from a pair of 90° prisms, using the process of frustrated total internal reflection. The design, laboratory tests, and astronomical applications of such an interferometer are discussed.

Submillimeter and Millimeter Antiferromagnetic Resonance in Polycrystalline Nickel Oxide, by C.-H. Chen, E. A. DeMeo, and G. S. Heller (Materials Research Laboratory, Brown University, Providence, R.I.).

The temperature dependence of the effective internal fields of NiO has been determined from antiferromagnetic resonance experiments at submillimeter frequencies using Fourier transform spectroscopy and at millimeter wavelengths with the usual spectroscopic techniques.

Submillimeter EPR Spectrum of FE^{3+} in Hemoglobin, by J. Tuchendler, Y. Couder, Y. Alpert, and H. Thomé (Laboratoire de Physique des Solides de l'Ecole Normale Supérieure, 24 rue Lhomond 75231 Paris, 05, France).

The zero field splitting of the high spin ferric ion in a frozen solution of methemoglobin is obtained from the frequency dependence of the g value determined by EPR experiments performed in the wavelength range: 4–0.7 mm. The submillimeter EPR spectrometer and the results are described.

Measurement of the Emission from Tokamak Plasma near the Electron Cyclotron Frequency, by A. E. Costley, J. Chamberlain, K. Muraoka, and D. D. Burgess (Division of Electrical Science, National Physical Laboratory, Teddington, Middlesex TW11 OLW, England).

An experiment is described in which the emission from a Tokamak plasma in the region of the electron cyclotron frequency and its low harmonics (up to the sixth) is measured. The results are compared with the predictions of the theory of cyclotron emission.

Airborne Solar and Stratospheric Submillimeter Spectroscopy, by W. G. Mankin (National Center for Atmospheric Research, Boulder, Colo. 80303).

A high resolution Michelson interferometer has been used to obtain solar spectra from a jet aircraft in the low stratosphere. The spectra are absolutely calibrated in intensity, enabling the solar brightness temperature to be specified from 200 to 700 μm. Concentrations of trace gases in the stratosphere are determined from intensity of absorption lines.

Submillimeter-Wave Solar Brightness Temperature Measured with a Balloon-Borne Lamellar-Grating Interferometer, by P. Stettler,

J. Rast, and F. Kneubühl (Solid State Physics Laboratory, ETH Zurich, Hönggerberg, CH-8049 Zurich, Switzerland) and E. A. Müller (Observatory of Geneva, CH-1290 Sauverny, Switzerland).

The solar brightness temperature was measured in the spectral region between 180- and 500-μm wavelength with a balloon-borne lamellar-grating interferometer. The result is in good agreement with the HSRA model.

Attenuation of Submillimeter Radiation by Clouds and Rain, by D. Deirmendjian (The Rand Corp., Santa Monica, Calif.).

The scattering and extinction properties of cloud and rain elements for far-infrared and submillimeter radiation have been estimated on the basis of recently determined optical constants, by means of polydisperse Mie scattering theory and realistic drop-size distributions.

Fourier Spectroscopy of Water Vapor in a Long Path Absorption Cell for the Range 5–20 cm^{-1} (150–600 GHz), by H. A. Gebbie, R. J. Emery, and D. L. Jones (Appleton Laboratory, Ditton Park, Slough, Bucks., SL3 9JX, England).

Measurements in this range made over a horizontal path at sea level show features which cannot be attributed to monomeric water molecules or oxygen. Related laboratory work will be described and tentative explanations for the existence of such features will be given.

The Current Role and Future Prospects of Pyroelectric Coherent Radiation Detectors, by A. C. Baynham, C. T. Elliott, N. Shaw, and D. J. Wilson (Royal Radar Establishment, Malvern, Worcs., England).

Theoretical estimates are presented of the limiting performance which might be achieved in the heterodyne mode with currently available pyroelectric materials over a range of intermediate frequencies.

Experimental measurements on triglycine sulphate detectors have yielded a noise equivalent power at 10.6 μm of 2×10^{-15} W/Hz^{-1}, at 337 μm of 1×10^{-12} W/Hz, and at 3 cm of 8×10^{-13} W/Hz^{-1} with intermediate frequencies of 20 kHz, 800 Hz, and 1 kHz, respectively.

Far Infrared Voltage-Tunable Spectrometer Detector, by H. S. Goldberg and R. G. Wheeler (Department of Engineering and Applied Science, Yale University, New Haven, Conn.).

An n-channel MOSFET at low temperatures exhibits a photoresistive response when illuminated by far-infrared radiation due to electron transitions defined by the potential at the Si–SiO_2 interface. Gate voltage variations lead to continuous tuning between 8 and 35 meV.

Far Infrared Cyclotron Resonance in Metals, by J. Peech (Gordon McKay Laboratory, Harvard University, Cambridge, Mass.) and S. J. Allen (Bell Telephone Laboratories, Murray Hill, N.J.).

Azbel'Kaner cyclotron resonance measurements at a wavelength of 220 m are compared with 4-mm measurements. A submillimeter reflection cavity spectrometer and a calorimetric spectrometer are described and compared. These experiments are difficult because a sufficiently stable high-power submillimeter source is not yet available.

Cyclotron Resonance at High Frequency in Metals, by P. Goy and B. Castaing (Groupe de Physique des Solides de l'Ecole Normale Supérieure, 24 rue Lhomond, 75231 Paris Cédex 05, France).

An original spectrometer permits the observation of cyclotron resonance in metals in the 2–0.6-mm wavelength band. Physical results concern the electron–phonon interaction in lead and indium, and the Fermi surface of a ferromagnetic metal, nickel.

Alfven Wave Transmission Study of Bismuth in the Far Infrared, by H. R. Verdun and H. D. Drew (Department of Physics, University of Maryland, College Park, Md.).

Absorption spectra of transmitted Alfven waves in bismuth in Faraday configuration and H directed at and near the bisectrix axis have been studied using the 311- and 337-μm radiation from a HCN laser and magnetic fields up to 100 kG.

Measurements of the Cosmic Background in the 7–10-cm^{-1} Atmospheric Window, by G. Dall'Oglio, S. Fonti, B. Melchiorri, F. Melchiorri, and V. Natale (TESRE-CNR, Florence, Italy), P. Lombardini and P. Trivero (Laboratory Cosmogeofisica, Torino, Italy), and S. Sivertsen (Auroral Observatory of Tromsoe, Tromsoe, Norway).

We have measured the sky temperature through the 7–10-cm^{-1} atmospheric window from the Alpine station of Testa Grigia (3500 m above sea level). An upper limit of 2.7 K has been found.

Far Infrared Optical Properties of Selenium and Cadmium Telluride, by E. J. Danielewicz and P. D. Coleman (Department of Electrical Engineering, Electro-Physics Laboratory, University of Illinois, Urbana, Ill. 61801).

The submillimeter region is an area of the spectrum where a limited knowledge of the linear optical properties of useful materials exists. Trigonal (class 32) Se and cubic (class 43-m) CdTe have important linear and nonlinear optical properties in the near infrared for laser optics. To extend their usefulness, the optical constants (index of refraction n and power absorption $\alpha = 4\pi\kappa/\lambda$) of Se and CdTe have been measured in the 10–100-cm^{-1} range. Fourier transform spectroscopy, combined with the channeled spectrum technique, provided a convenient method of obtaining accurate far-IR optical data. These data have been combined with the available data from the literature to obtain a new and improved oscillator fit and to obtain more accurate values for the fundamental lattice vibrations.

Submillimeter-Wave Spectral Thermal Emission of Small Crystals and Thin Films of Alkalihalides, by R. Kälin and F. Kneubühl (Solid State Physics Laboratory, ETH Zurich, Hönggerberg, CH-8049 Zurich, Switzerland).

The submillimeter-wave spectral emission of small crystals and thin films of alkalihalides was measured for different angles of emission and polarization. The resulting spectra are interpreted as virtual modes.

Far Infrared Reflectivity and Electron Scattering in GaAs, by S. Perkowitz and J. Breecher (Physics Department, Emory University, Atlanta, Ga. 30322).

The reflectivity of n-GaAs has been measured between 16 and 230 cm^{-1} by Fourier transform spectroscopy. The reflectivity is shown to be relatively independent of the electron scattering model and useful for determining carrier concentration and mobility.

A Cooled Interferometric Modulator to Measure the Cosmic Background Spectrum, by E. I. Robson, J. E. Beckman, P. E. Clegg, D. G. Vickers, and J. S. Huizinga (Department of Physics, Queen Mary College, University of London, London, E1 4NS, England).

The experiment is designed to determine the spectrum of the cosmic background radiation in the wavelength range 3 mm–300 μm, using a balloon-borne liquid-helium-cooled polarizing interferometer with two indium antimonide detectors.

A Calibrated Experimental 20-μm Photometer, by J. J. Wijnbergen and H. Olthof (Kapteyn Astronomical Institute, Department of Space Research, University of Groningen, Groningen, The Netherlands).

A photometer has been built, calibrated, and tested for photometry in the 20-μm atmospheric window. The spectral band is selected by means of four successive reflections at Irtran-1 crystal material, fitted in a helium dewar together with a germanium bolometer.

A reflective near-focal-plane chopper modulates the beam in a square wave mode. The laboratory calibration showed a sensitivity of 3.5×10^4 V_{eff}/W corresponding with an efficiency of the photometer of 13 percent. Coupled to the 60-cm $f/15$ telescope in Roden a detection limit of 2.10^{-24} W/m^2·Hz could be established.