

References

- [1] T. G. Blaney, *Infrared and Millimeter Waves* (Academic Press, New York, London, Toronto, Sydney, San Francisco, 1980), "Submillimeter Techniques," vol. 3, chap. 1 - Detection Techniques at Short Millimeter and Submillimeter Wavelengths: An Overview, pp. 2.
- [2] J. W. Fleming, "High-Resolution Submillimeter-Wave Fourier-Transform Spectrometry of Gases," in *IEEE Transactions on Microwave Theory and Techniques*, vol. 22, pp. 1023-1025, 1974.
- [3] D. T. Emerson, "The work of Jagadish Chandra Bose: 100 years of millimeter-wave research," in *IEEE Transactions on Microwave Theory and Techniques*, vol. 45, pp. 2267-2273, Dec. 1997.
- [4] H. Rubens, and R. W. Wood, XXVII. "Focal isolation of long heat-waves," *The London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science*, vol. 21, no. pp. 249-261, 1911.
- [5] E. Hagen, and H. Rubens, XVI. "On some relations between the optical and the electrical qualities of metals," *The London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science*, vol. 7, pp. 157-179, 1904.
- [6] E. Brundermann, H. W. Hubers, and M. F. Kimmitt "Terahertz Techniques," *Springer Series in Optical Sciences, Berlin Heidelberg: Springer-Verlag*, 2012, doi: 10.1007/978-3-642-02592.
- [7] C.H. Cartwright, "Radiation thermopiles for use at liquid-air temperatures," *Review of Scientific Instruments*, vol. 4, 1933.

-
- [8] J. Strong, and S. C. Woo, "Far infrared spectra of gases," *Physical Review Journal*, vol. 42, 1932.
- [9] J. Strong, G.A. Vanasse, "Interferometric spectroscopy in the far infrared," *Journal of Optical Society of America*, vol. 49, pp. 844-850, 1959.
- [10] V. Cleeton, N.H. Williams, Electromagnetic waves of 1.1 cm wave-length and the absorption spectrum of ammonia, *Physical Review Journal*, vol. 45, 1934.
- [11] M. J. E. Golay, "A pneumatic infra-red detector," *Review of Scientific Instruments*, vol. 18, 1947.
- [12] H. A. Zahl, M. J. E. Golay, "Pneumatic heat detector," *Review of Scientific Instruments*, vol. 17, 1946.
- [13] R. Beringer, "The absorption of one-half centimeter electromagnetic waves in oxygen," *Physical Review Journal*, vol. 70, 1946.
- [14] J. A. Klein, J.H.N. Loubser, A.H. Nethercot, C.H. Townes, "Magnetron harmonics at millimeter wavelengths," *Review of Scientific Instruments*, vol. 23, 1952.
- [15] C. A. Burrus, W. Gordy, "Submillimeter wave spectroscopy," *Physics Review Journal*, vol. 93, 1954.
- [16] M. J. E. Golay, "Multi-slit spectrometry," *Journal of the Optical Society of America*, vol. 39, pp. 437-444, 1949.
- [17] P. Fellgett, "On numerical Fourier transformation, with special reference to Lipson-Beevers strips," *Journal of Scientific Instruments*, vol. 35, 1958.

-
- [18] W. S. Boyle, and K. F. Rogers, "Performance characteristics of a new low-temperature bolometer," *Journal of the Optical Society of America*, vol. 49, pp. 66-69, 1959.
- [19] S. J. Fray, and J. F. C. Oliver, "Photoconductive detector of radiation of wavelength greater than $50\ \mu$," *Journal of Scientific Instruments*, vol. 36, 1959.
- [20] P. Guenard, O. Doehler, B. Epsztein, and R. Warnecke, "New UHF tubes with wide electronic tuning range," *Comptes Rendus Academy of Sciences, Paris*, vol. 235, 1952.
- [21] R. Kompfner, N.T. Williams, "Backward-wave tubes," *IEEE Proceeding of the IRE*, vol. 41, pp. 1602-1611, 1953.
- [22] E. H. Putley, "Impurity photoconductivity in n-type InSb," *Journal of Physics and Chemistry of Solids*, vol. 22, pp. 241-247, 1961.
- [23] F. J. Low, "Low temperature germanium bolometer," *Journal of the Optical Society of America*, vol. 51, pp. 1300-1304, 1961.
- [24] M. A. C. S. Brown, and M. Kimmitt, "Far infrared resonant photoconductivity in indium antimonide," *Infrared Physics*, vol. 5, pp. 93-97, 1965.
- [25] W. J. Moore, and H. Shenker, "A high-detectivity gallium-doped germanium detector for the 40–120 μ region," *Infrared Physics*, vol. 5, pp. 99-106, 1965.
- [26] A. G. Kazanskii, P. L. Richards, and E. E. Haller, "Far-infrared photoconductivity of uniaxially stressed germanium," *Applied Physics Letters*, vol. 31, 1977.
- [27] C. C. Grimes, P. L. Richards, and S. Shapiro, "Josephson-effect far-infrared detector," *Journal of Applied Physics*, vol. 39, 1968.

-
- [28] D. T. Young, and J. C. Irvin, "Millimeter frequency conversion using Au-n-type GaAs Schottky barrier epitaxial diodes with a novel contacting technique," *Proceedings of IEEE*, vol. 53, pp. 2130-2131, 1965.
 - [29] A. Crocker, H. A. Gebbie, M. F. Kimmitt, and L.E.S. Mathias, "Stimulated emission in the far infrared," *Nature*, vol. 201, pp. 250-251, 1964.
 - [30] H. A. Gebbie, N. W. B. Stone, and F. D. Findlay, "A stimulated emission source at 0.34-millimetre wave-length," *Nature*, vol. 202, pp. 685, 1964.
 - [31] G. W. Chantry, H. M. Evans, J. W. Fleming, and H. A. Gebbie, "TPX, a new material for optical components in the far infra-red spectral region," *Infrared Physics*, vol. 9, pp. 31-33, 1969.
 - [32] A. M. Nicolson, "Broad-Band Microwave Transmission Characteristics from a Single Measurement of the Transient Response," in *IEEE Transactions on Instrumentation and Measurement*, vol. 17, pp. 395-402, 1968.
 - [33] R. W. Wilson, K. B. Jefferts, and A. A. Penzias, "Carbon monoxide in the Orion nebula," *Astrophysics Journal*, vol. 161, 1970.
 - [34] T. G. Phillips, P. J. Huggins, G. Neugebauer, and M. W. Werner, "Detection of submillimeter (870 μm) CO emission from the Orion molecular cloud," *Astrophysics Journal*, vol. 217, pp. 161-164, 1977.
 - [35] T. S. Hartwick, D. T. Hodges, D. H. Barker, and F. B. Foote "Far infrared imagery," *Applied Optics*, vol. 15, pp. 1919-1922, 1976.
 - [36] W. M. Kelly, and G. T. Wrixon, "Optimization of Schottky-Barrier Diodes for Low-Noise, Low-Conversion Loss Operation at Near-Millimeter Wavelengths," *Infrared and Millimeter Waves*, (Academic Press, New York, London, Toronto,

- Sydney, San Francisco, 1980), *Submillimeter Techniques*, vol. 3, chap. 2, pp. 75–110.
- [37] G. J. Dolan, T. G. Phillips, and D. P. Woody, “Low-noise 115-GHz mixing in superconducting oxide barrier tunnel junctions,” *Applied Physics Letter*, vol. 34, 1979.
- [38] P.L. Richards, T. M. Shen, R. E. Harris, and F. Lloyd, “Quasiparticle heterodyne mixing in SIS tunnel junctions,” *Applied Physics Letters*, vol. 34, 1979.
- [39] S. Komiyama, “Far-infrared emission from population-inverted hot-carrier system in p-Ge,” *Physics Review Letters*, vol. 48, 1982.
- [40] A. A. Andronov, I. Zverev, V. A. Kozlov, Y. N. Nozdrin, S. A. Pavlov, and V. N. Shastin, “Stimulated emission in the long-wavelength IR region from hot holes in Ge in crossed electric and magnetic fields,” *Soviet Journal of Experimental and Theoretical Physics Letters*, vol. 40, pp. 69-71, 1984.
- [41] E. Brundermann, and H.P. Roser, “First operation of a far-infrared p-germanium laser in a standard closed-cycle machine at 15K,” *Infrared Physics and Technology*, vol. 38, pp. 201-203, 1997.
- [42] L.R. Elias, J. Hu, and G. Ramian, “The UCSB electrostatic accelerator free electron laser: First operation,” *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*, vol. 237, pp. 203-206, 1984.
- [43] M. Abo-Bakr, J. Feikes, K. Holldack, G. Wustefeld, and H.-W. Hubers, “Steady-state far-infrared coherent synchrotron radiation detected at BESSY II,” *Physics Review Letters*, vol. 88, Jun. 2002.

-
- [44] D. H. Auston, K. P. Cheung, and P. R. Smith, "Picosecond photoconducting Hertzian dipoles," *Applied Physics Letters*, vol. 45, 1984.
- [45] E. M. Gershenzon, M. E. Gershenzon, G. N. Goltsman, A. M. Lyulkin, A. D. Semenov, and A. V. Sergeev, "On the limiting characteristics of high-speed superconducting bolometers," *Soviet Physics Technical Physics*, vol. 34, 1989.
- [46] D. H. Andrews, W. F. Bruksch, W. T. Zeigler, E. R. Blanchard, "Attenuated superconductors I. For measuring infra-red radiation," *Review of Scientific Instruments*, vol. 13, 1942.
- [47] R. Kohler, A. Tredicucci, F. Beltram, H. E. Beere, E. H. Linfield, A.G. Davies, D. A. Ritchie, R. C. Iotti, and F. Rossi, "Terahertz semiconductor-heterostructure laser," *Nature* vol. 417, pp. 156-159, 2002.
- [48] D. Abbott, and X. C. Zhang, "Scanning the issue: T-ray imaging, sensing, and retection," *Proceedings of IEEE*, vol. 95, 2007.
- [49] K. Fukunaga, Y. Ogawa, S. Hayashi, and I. Hosako, "Terahertz spectroscopy for art conservation," *IEICE Electronics Express*, vol. 4, pp. 258-263, 2007.
- [50] A. S. Muller, I. Birkel, S. Casalbuoni, B. Gasharova, E. Huttel, Y. L. Mathis, D. Moss, N. Smale, P. Wesolowski, E. Brundermann, T. Buckle, and M. Klein, "Characterizing THz coherent synchrotron radiation at the ANKA storage ring," *Proceedings of European Particle Accelerator Conference*, WEPC046, pp. 2091–2093, 2008.
- [51] V. Blackmore, G. Doucas, C. Perry, B. Ottewell, M.F. Kimmitt, M. Woods, S. Molloy, and R. Arnold, "First measurements of the longitudinal bunch profile of

- a 28.5 GeV beam using coherent Smith-Purcell radiation,” *Physical Review Accelerators and Beams*, vol. 12, 2009.
- [52] Y. Neo, H. Shimawaki, T. Matsumoto, H. Mimura, Smith-Purcell “Radiation from ultraviolet to infrared using a Si field emitter,” *Journal of Vacuum Science & Technology B: Microelectronics and Nanometer Structures Processing, Measurement, and Phenomena*, vol. 24, 2006.
- [53] A. Chodos, and J. Ouellette, “This month in physics history,” *American Physical Society*, vol. 12, 2003.
- [54] D. Arnone, C. Ciesla, and M. Pepper, “Terahertz imaging comes into view,” *Physics World*, vol. 13, 2001.
- [55] M. Perenzoni and D. Paul, “Physics and applications of terahertz radiation,” *Springer Series in Optical Sciences*, 2014.
- [56] E. Heniz, D. Born, *et al*, “Progress report on Safe visitor: approaching a practical instrument for terahertz security screening,” *Proceedings of SPIE*, vol. 7670, 2010.
- [57] T. May, G. Zieger, S. Anders, V. Zakosarenko, H.-G. Meyer, M. Schubert, M. Starkloff, M. Rosler, G. Thorwirth, and U. Krause, “Safe visitor: visible, infrared, and terahertz object recognition for security screening application,” *Proceedings of SPIE*, vol. 7309, 2009.
- [58] H. Elayan, O. Amin, R. M. Shubair and M. -S. Alouini, "Terahertz communication: The opportunities of wireless technology beyond 5G," *2018 International Conference on Advanced Communication Technologies and Networking (CommNet)*, pp. 1-5, 2018.

-
- [59] R. J. Kumud, and G. Singh. “Terahertz planar antennas for next generation communication,” *Springer International Publishing Switzerland*, 2014.
- [60] C. M. Armstrong, “The truth about terahertz,” *IEEE Spectrum*, vol. 49, pp. 36–41, 2012.
- [61] D. T. Leisawitz, W. C. Danchi, M. J. DiPirro, L. D. Feinberg, D. Y. Gezari, M. Hagopian, W. D. Langer, J. C. Mather, S. H. Moseley, M. Shao, R. F. Silverberg, J. G. Staguhn, M. R. Swain, H. W. Yorke, and X. Zhang, “Scientific motivation and technology requirements for the SPIRIT and SPECS far-infrared/submillimeter space interferometers,” *UV, Optical, and IR Space Telescopes and Instruments*, vol. 4013, pp. 36-46, 2000.
- [62] G. J. Fertig, “Evaluation of MOSFETs for Terahertz Detector Arrays,” Master’s thesis, Rochester Institute of Technology, 2014.
- [63] B. Zhu, Y. Chen, K. Deng, W. Hu, and Z. S. Yao. “Terahertz Science and Technology and Applications,” *PIERS Proceedings*, pp. 1166–1170, 2009.
- [64] Jack D. Horowitz, “Characterization of Optimized Si-MOSFETs for Terahertz Detection,” PhD. Thesis, 2017.
- [65] V. P. Wallace, A. J. Fitzgerald, B. Robertson, E. Pickwell, and B. Cole, “Development of a hand-held tpi system for medical applications,” *IEEE MTT-S International Microwave Symposium Digest, 2005*, pp. 636–639, 2005.
- [66] E. P. MacPherson and V. P. Wallace, “Terahertz pulsed imaging-a potential medical imaging modality?” *Photodiagnosis and Photodynamic Therapy*, vol, 6, pp. 128-134, 2009.

-
- [67] B. Karagoz, H. Altan, and K. Kamburoglu, “Terahertz pulsed imaging study of dental caries,” *Medical Laser Applications and Laser-Tissue Interactions VII, Optical Society of America*, 2015.
 - [68] O. Cherkasova, M. Nazarov, and A. Shkurinov. “Non-invasive blood glucose monitoring in the terahertz frequency range,” *Optical and Quantum Electronics*, vol. 48, 217, 2016.
 - [69] H. M. Sherry, “Terahertz Circuits and Systems in CMOS” PhD thesis, University of Wuppertal and University of Lille 1, 2013.
 - [70] R. Wilk, F. Breinfeld, M. Mikulics, and M. Koch, “Continuous wave terahertz spectrometer as a noncontact thickness measuring device,” *Applied Optics*, vol. 47, pp. 3023-3026, 2008.
 - [71] J. B. Jackson, J. Laubaune, R. B. Lesuer, L. D. Alessandro, A. Whyte, J. W. Bowen, M. Menu, and G. Mourou, “Terahertz Pulse Imaging in Archaeology,” *Frontiers of Optoelectronics*, vol. 8, pp. 81-92, 2015.
 - [72] C. Jordens, M. Scheller, B. Breitenstein, D. Selmar, and M. Koch, “Evaluation of the Leaf Water Status by means of the Permittivity at Terahertz Frequencies,” *Journal of Biological Physics*, vol. 35, pp. 255-264, 2008.
 - [73] H. Tataria, M. Shafi, A. F. Molisch, M. Dohler, H. Sjoland, and F. Tufvesson, “6G wireless systems: vision, requirements, challenges, insights, and opportunities,” *Proceedings of IEEE 2021*, vol. 109, pp. 1166–99.
 - [74] Z. R. M. Hajiyat, A. Ismail, A. Sali, M. N. Hamidon, “Antenna in 6G wireless communication system: specifications, challenges, and research directions,” *Optik*, vol. 231, 2021.

-
- [75] D. C. Nguyen, M. Ding, P. N. Pathirana, A. Seneviratne, J. Li, D. Niyato, O. Dobre, and H. V. Poor, "6 G internet of things: a comprehensive survey," *IEEE Internet Things Journal*, vol. 9, pp. 359-383, 2022.
- [76] M. Tonouchi, "Cutting-edge terahertz technology," *nature photonics*, vol. 01, pp. 97-105, 2007.
- [77] S. Nayak, and R. Patgiri, "6G Communication Technology: A Vision on Intelligent Healthcare," *Health Informatics: A Computational Perspective in Healthcare, Studies in Computational Intelligence*, vol 932, pp. 1-18, 2021.
- [78] P. L. Richards, "Bolometers for infrared and millimeter waves," *Journal of Applied Physics*, vol. 76, pp. 1-24, 1994.
- [79] L. Kuzmin, M. Fominsky, A. Kalabukhov, D. Golubey, and M. Tarasov, "Capacitively coupled hot-electron nanobolometer with SIN tunnel junctions," *Proceedings of SPIE 4855, Millimeter and Submillimeter Detectors for Astronomy*, vol. 217, 2003.
- [80] T. R. Stevenson, W. T. Hsieh, R. R. Mitchell, H. D. Isenberg, C. M. Stahle, N. T. Cao, G. Schneider, D. E. Travers, S. H. Moseley, E. J. Wollack, and R. M. Henry, "Silicon hot-electron bolometers with single-electron transistor readout," *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*, vol. 559, pp. 591-593, 2006.
- [81] F. F. Sizov, V. P. Reva, A. G. Golenkov, and V. V. Zabudsky, "Uncooled Detectors Challenges for THz/sub-THz," *Journal of Infrared, Millimeter and Terahertz Waves*, vol. 32, pp. 1192-1206, 2011.

-
- [82] C. Corsi, F. Sizov, "THz And Security Applications: Detectors, Sources, and Associated Electronics for THz Applications," in *NATO Advanced Research Workshop on THz and Security Applications- Detectors, Sources and Associated Electronics for THz Applications*, Kiev, 2013.
- [83] A. Rogalski, F. Sizov, "Terahertz detectors and focal plane arrays," *Opto-Electronics Review*, vol. 19, pp. 346-404, 2011.
- [84] D. B. Veksler, "Plasma Wave Electronics Devices for THz Detection," PhD Thesis, Rensselaer Polytechnic Institute, August 2007. UMI: 3286347.
- [85] L. O. Fernandes, P. Kaufmann, R. Marcon, A. S. Kudaka, A. Marun, R. Godoy, E. C. Bortolucci, M. B. Zakia, and J. A. Diniz, "Photometry of THz radiation using Golay cell detector," *IEEE XXXth URSI General Assembly and Scientific Symposium*, pp. 1-4, 2011.
- [86] H. Rashid, V. Desmaris and V. Belitsky, "Design and simulations of a micromachined Golay-cell based THz sensors for room temperature imaging applications," *35th International Conference on Infrared, Millimeter, and Terahertz Waves*, pp. 1-2, 2010.
- [87] D. Dooley, "Sensitivity of broadband pyroelectric terahertz detectors continues to improve," *Laser Focus World*, May, 2010.
- [88] P. Chahal, F. Morris and G. Frazier, "Zero bias resonant tunnel Schottky contact diode for wide-band direct detection," in *IEEE Electron Device Letters*, vol. 26, pp. 894-896, 2005.

-
- [89] R. Tauk, F. Teppe, S. Boubanga, D. Coquillat, and W. Knap, "Plasma wave detection of terahertz radiation by silicon field effects transistors: responsivity and noise equivalent power," *Applied Physics Letters*, vol. 89, 2006.
- [90] S. Boppel, A. Lisauskas, M. Mundt, D. Seliuta, L. Minkevicius, I. Kasalynas, G. Valusis, *M. Mittendorff, S. Winnerl, V. Krozer, and H. G. Roskos*, "CMOS Integrated Antenna-Coupled Field-Effect Transistors for the Detection of Radiation From 0.2 to 4.3 THz," in *IEEE Transactions on Microwave Theory and Techniques*, vol. 60, pp. 3834-3843, 2012.
- [91] J. D. Sun, Y. F. Sun, D. M. Wu, Y. Cai, H. Qin, and B. S. Zhang, "High-responsivity, low noise, room-temperature, self-mixing terahertz detector realized using floating antennas on a GaN based field-effect transistor," *Applied Physics Letters*, vol. 100, 2012.
- [92] R. A. Lewis, "A review of terahertz detectors," *Journal of Physics D: Applied Physics*, vol. 52, 2019.
- [93] A. J. M. Kreisler, "Submillimeter Wave Applications of Submicron Schottky Diodes", *Proceedings of SPIE 0666, Far-Infrared Science and Technology*, Quebec, Canada pp. 51-63, 1986.
- [94] S. Cibella, R. Casini, A. Di Gaspare, and M. Ortolani, "Air bridge improves terahertz detector response time", *Laser Focus World*, vol. 47, pp. 51-55, 2011.
- [95] F. Friederich, W. Von Spiegel, M. Bauer, F. Meng, M. D. Thomson, S. Boppel, A. Lisauskas, B. Hils, V. Krozer, and A. Keil, "THz Active Imaging Systems With Real-Time Capabilities," *IEEE Transactions on Terahertz Science and Technology*, vol. 1, no. 1, pp. 183-200, Sept. 2011.

-
- [96] F. H. L. Koppens, T. Mueller, Ph. Avouris, A.C. Ferrari, M. S. Vitiello, and M. Polini, “Photodetectors based on graphene, other two-dimensional materials and hybrid systems,” *Nature Nanotechnology*, vol. 9, pp. 780–93, 2014.
 - [97] T. Low and P. Avouris, “Graphene plasmonic for terahertz to mid-infrared applications,” *ACS Nano*, vol. 8, pp. 1086–1101, 2014.
 - [98] V. Ryzhii, M. Ryzhii, V. Mitin, and T. Otsuji, “Terahertz and *infrared* photodetection using p-i-n multiple-graphene-layer structures,” *Journal of Applied Physics*, vol. 107, pp. 1-7, 2010.
 - [99] V. Ryzhii, N. Ryabova, M. Ryzhii, N.V. Baryshnikov, V.R. Karasik, V. Mitin, and T. Otsuji, “Terahertz and infrared photodetectors based on multiple graphene layer and nanoribbon structures,” *Opto-Electronics Review*, vol. 20, pp. 15–25, 2012.
 - [100] X. Cai, A. B. Sushkov, R. J. Suess, M. M. Jadidi, G. S. Jenkins, L. O. Nyakiti, R. L. Myers-Ward, J. Yan, D. K. Gaskill, T. E. Murphy, H. D. Drew¹, M. S. Fuhrer, “Sensitive room-temperature terahertz detection via the photothermoelectric effect in graphene,” *Nature Nanotechnology*, vol. 9, pp. 814-20, 2013.
 - [101] L. Vicarelli, M.S. Vitiello, D. Coquillat, A. Lombardo, A.C. Ferrari, W. Knap, M. Polini, V. Pellegrini, and A. Tredicucci, “Graphene effect as room-temperature terahertz detectors,” *Nature Materials*, vol. 11, pp. 865-871, 2012.
 - [102] D. Spirito, D. Coquillat, S.L. De Bonis, A. Lombardo, M. Bruna, A.C. Ferrari, V. Pellegrini, A. Tredicucci, W. Knap, and M.S. Vitiello, “High performance bilayer-graphene terahertz detectors,” *Applied Physics Letters*, vol. 104, pp. 1-5, 2014.

-
- [103] F. Bianco, D. Perenzoni, D. Convertino, S.L. De Bonis, D. Spirito, M. Perenzoni, C. Coletti, M.S. Vitiello, and A. Tredicucci, "Terahertz detection by epitaxial-graphene field effect-transistors on silicon carbide," *Applied Physics Letters*, vol. 107, pp. 1-5, 2015.
- [104] J. Yan, M.-H. Kim, J.A. Elle, A.B. Sushkov, G.S. Jenkins, H.M. Milchberg, M.S. Fuhrer, and H.D. Drew, "Dual-gated bilayer graphene hot electron bolometer," *Nature Nanotechnology*, vol. 7, pp. 472-478, 2012.
- [105] R. S. Allgaier, "History of narrow-gap semiconductors and semimetals, 1945-1965," *Semiconductor Science and Technology*, vol. 5, pp. 326-333, 1990.
- [106] G. L. Hansen, J. L. Schmit, and T. N. Casselman, "Energy gap versus alloy composition and temperature in $Hg_{1-x}Cd_xTe$," *Journal of Applied Physics*, vol. 53, 1982.
- [107] A. Rogalski, K. Adamiec, and J. Rutkowski, "Narrow-Gap Semiconductor Photodiodes," SPIE Press, 2000.
- [108] A. Rogalski, "Infrared Photon Detectors," *SPIE*, 1995.
- [109] P. Capper and J. W. Garland, "Mercury Cadmium Telluride Growth, Properties and Applications," *Wiley*, 2010, doi: 10.1002/9780470669464.
- [110] J. Wenus, J. Rutkowski and A. Rogalski, "Two-dimensional analysis of double-layer heterojunction $HgCdTe$ photodiodes," *IEEE Transactions on Electron Devices*, vol. 48, pp. 1326-1332, 2001.
- [111] M. H. Weiler, "Magneto-optical properties of $Hg_{1-x}Cd_xTe$ alloys," *Semiconductors and Semimetals*, vol. 16, pp 119-191.

-
- [112] J. P. Rosbeck, R. E. Star, S. L. Price, and K. J. Riley, “Background and temperature dependent current–voltage characteristics of $Hg_{1-x}Cd_xTe$ photodiodes,” *Journal of Applied Physics*, vol. 53, pp. 6430-6440, 1982.
 - [113] J. Chu, B. Li, K. Liu, and D. Tang, “Empirical rule of intrinsic absorption spectroscopy in $Hg_{1-x}Cd_xTe$,” *Journal of Applied Physics*, vol. 75, pp. 1234-1235, 1994.
 - [114] R. Dornhaus, G. Nimtz, and B. Schlicht, “Narrow-Gap Semiconductors,” *Berlin: Springer*, 1983.
 - [115] P.K. Saxena, “Modeling and simulation of HgCdTe based $p^+ - n - n^+$ LWIR photodetector,” *Infrared Physics and Technology*, vol. 54, pp. 25–33, 2011.
 - [116] A. D. D. Dwivedi, “Analytical Modeling and Numerical simulation of $P^+-Hg_{0.69}Cd_{0.31}Te/n-Hg_{0.78}Cd_{0.22}Te/CdZnTe$ heterojunction photodetector for a long-wavelength infrared free space optical communication system,” *Journal of Applied Physics*, vol. 110, Aug. 2011.
 - [117] F. Sizov, V. Dobrovolski, Z. Tsybrii, V. Zabudsky, S. Dvoretiskii, and N. Mikhailov, “Narrow-gap MCT as THz detector,” *21st International Conference on Microwave, Radar and Wireless Communications, MIKON 2016*, pp. 8-10, 2016.
 - [118] F. Sizov, V. Zabudsky, S. Dvoretiskii, V. Petryakov, A. Golenkov, K. Andreyeva, and Z. Tsybrii, “Two-color detector: Mercury-cadmium-telluride as a terahertz and infrared detector,” *Applied Physics Letters*, vol. 106, 2015.
 - [119] A.Y. Pawar, D.D. Sonawane, K.B. Erande, and D. V. Derle, “Terahertz technology and its applications,” *Drug Invent Today*, vol. 5, pp. 157-163, 2013.

-
- [120] M. Shur, "Terahertz technology: devices and applications," *Proceedings of ESSCIRC 2005 31st European Solid-State Circuits Conference*, pp. 13–21, 2005.
- [121] A. D. D. Dwivedi, and P. Chakrabarti, "Modeling and ATLAS simulation of HgCdTe based MWIR photodetector for free Space optical communication," *International Conference of Recent Advances in Microwave Theory and Applications, MICROWAVE 2008*, pp. 412-415, 2008.
- [122] A. D. D. Dwivedi, and P. Chakrabarti, "Analytical Modeling and Numerical Simulation of $\text{Hg}_{1-x}\text{Cd}_x\text{Te}$ Based $\text{N}^+\text{n}^0\text{p}^+$ Photodetector for MWIR Free Space Optical Communication," *International Journal of Advanced Applied Physics Research*, vol. 2, pp. 20-27, 2015.
- [123] A. D. D. Dwivedi, A. Pranav, G. Gupta, and P. Chakrabarti "Numerical Simulation of HgCdTe Based Simultaneous MWIR/LWIR Photodetector for Free Space Optical Communication," *International Journal of Advanced Applied Physics Research*, vol. 2, pp. 37-45, 2015.
- [124] P. Migliorato, and A. M. White, "Common anion heterojunctions: CdTe-CdHgTe," *Solid State Electronics*, vol. 26, pp. 65-69, 1983.
- [125] J. R. Lowney, D. G. Seiler, C. L. Littler, and I. T. Yoon, "Intrinsic carrier concentration of narrow-gap mercury cadmium telluride based on the nonlinear temperature dependence of the band gap" *Journal of Applied Physics*, vol. 71, pp. 1253-1258, 1992.
- [126] P. N. J. Dennis, C. T. Elliott, and C. L. Jones, "A method for routine characterisation of the hole concentration in p-type cadmium mercury telluride", *Infrared Physics*, vol. 22, pp. 167-169, 1982.

-
- [127] J. H. Chu, Z. Y. Mi, and D. Y. Tang, "Band-to-band optical absorption in narrow-gap $Hg_{1-x}Cd_xTe$ semiconductors," *Journal of Applied Physics*, vol. 71, pp. 3955-3961, 1992.
- [128] V. C. Lopes, A. J. Syllaos, and M. C. Chen, "Minority carrier lifetime in mercury cadmium telluride," *Semiconductor Science and Technology*, vol. 8, pp. 824-841, 1993.
- [129] A. D. D. Dwivedi, and P. Chakrabarti, "Analytical modeling and ATLAS simulation of $N^+-Hg_{0.69}Cd_{0.31}Te/n^0-Hg_{0.78}Cd_{0.22}Te/p^+-Hg_{0.78}Cd_{0.22}Te$ photodetector for long wavelength free space optical communication," *Optoelectronics and Advanced Materials- Rapid Communications*, vol. 4, pp. 480-497, 2010.
- [130] W.R. Tribe, D.A. Newnham, P.F. Taday, and M.C. Kemp, "Hidden object detection: security applications of terahertz technology," *Terahertz Gigahertz Electron. Photonics III*, 2004 doi: 10.1117/12.543049.
- [131] A. Jozwikowska, K. Jozwikowski, and O. Markowska, "Numerical Estimation of lattice strain, bending and generation of misfit dislocations in CdHgTe heterostructures grown on GaAs substrates," *Optical and Quantum Electronics*, vol. 52, pp. 1-14, 2020.
- [132] P. Chakrabarti, S.M. Ieee, A. Krier, and A.F. Morgan, "Analysis and Simulation of a Mid-Infrared $P^+ - InAs_{0.55}Sb_{0.15}P_{0.30} / n^0 - InAs_{0.89}Sb_{0.11} / N^+ - InAs_{0.55}Sb_{0.15}P_{0.30}$ Double Heterojunction Photodetector Grown by LPE," *IEEE Transactions on Electron Devices*, vol. 50, pp. 2049-2058, 2003.

-
- [133] R. K. Lal, M. Jain, S. Gupta, and, P. Chakrabarti, “An analytical model of double heterostructure mid-infrared photodetector,” *Infrared Physics and Technology*, vol. 44, pp. 125-132, 2003.
- [134] V. Devarakonda, A.D.D. Dwivedi, A. Pandey, and P. Chakrabarti, “Performance analysis of $N^+ - CdTe / n^0 - Hg_{0.824675}Cd_{0.175325}Te / p^+ - Hg_{0.824675}Cd_{0.175325}Te$ n-i-p photodetector operating at 30 μm wavelength for terahertz applications,” *Optical and Quantum Electronics*, vol. 52, pp. 1–19, 2020.
- [135] Y. Tian, B. Zhang, T. Zhou, H. Jiang, and Y. Jin, “Theoretical analysis of the detectivity in N-p and P-n GaSb/GaInAsSb infrared photodetectors,” *IEEE Transactions on Electron Devices*, vol. 47, pp. 544-552, March 2000.
- [136] Y. Tian, B. Zhang, T. Zhou, H. Jiang, and Y. Jin, “Numerical analysis of the Detectivity in $n^+ - n - p$ and $P^+ - p - n$ GaInAsSb Infrared Photodetectors,” *Solid State Electronics*, vol. 43, pp. 1723-1735, 1999.
- [137] F. Xia, T. Mueller, Y. M. Lin, A. V. Garcia, and P. Avouris, “Ultrafast graphene photodetector,” *Nature Nanotechnology*, vol. 4, pp. 839-843, 2009.
- [138] B. Y. Zhang, T. Liu, B. Meng, X. Li, G. Liang, X. Hu, and Q. J. Wang, “Broadband high photoresponse from pure monolayer graphene photodetector,” *Nature communications*, vol. 4, pp. 1-11, 2013.
- [139] T. Mueller, F. Xia, and P. Avouris, “Graphene photodetectors for high-speed optical communications,” *Nature Photonics*, vol. 4, pp. 297-301, 2010.

-
- [140] C. H. Liu, Y. C. Chang, T. B. Norris, and Z. Zhong, “Graphene photodetectors with ultra-broadband and high responsivity at room temperature,” *Nature Nanotechnology*, vol. 9, pp. 273-278, 2014.
- [141] A. Urich, K. Unterrainer, and T. Mueller, “Intrinsic response time of graphene photodetectors,” *Nano Letters*, vol. 11, pp. 2804-2808.
- [142] F. Luo, M. Zhu, Y. Tan, H. Sun, W. Luo, G. Peng, Z. Zhu, X. A. Zhang, and S. Qin, “High responsivity graphene photodetectors from visible to near-infrared by photogating effect,” *AIP Advances*, vol. 8, 2018.
- [143] F. Withers F, T. H. Bointon, M. F. Craciun, and S. Russo, “All-graphene photodetectors,” *ACS Nano*, vol. 7, pp. 5052-5057, 2013.
- [144] P. Tassin, T. Koschny, and C. M. Soukoulis, “Graphene for terahertz applications,” *Applied Physics, Science*, vol. 341, pp. 620-621, 2013.
- [145] C. J. Docherty, M. B. Johnston, “Terahertz properties of graphene,” *Journal of Infrared, Millimeter, and Terahertz Waves*, vol. 33, pp. 797-815, 2012.
- [146] J. Tong, M. Muthee, S. Y. Chen, S. K. Yngvesson, and J. Yan, “Antenna enhanced graphene THz emitter and detector,” *Nano Letters*, vol. 15, pp. 5295-5301, 2015.
- [147] M. Alattas, and U. Schwingenschlogl, “Band Gap Control in Bilayer Graphene by Co-Doping with B-N Pairs,” *Scientific Reports*, vol. 8, 2018.
- [148] J. Li, L. Niu, Z. Zheng, and F. Yan, “Photosensitive graphene transistors,” *Advanced Materials*, vol. 26, pp. 5239-5273, 2014.
- [149] M. Jung, P. Rickhaus, S. Zihlmann, P. Makk, and C. Schonenberger, “Microwave photodetection in an ultraclean suspended bilayer graphene p–n junction,” *Nano Letters*, vol. 16, pp. 6988-6993, 2016.

-
- [150] A. M. Itsuno, J. D. Phillips, and S. Velicu, “Mid-Wave Infrared HgCdTe nBn Photodetector,” *Applied Physics Letters*, vol. 100, pp. 161102-1–161102-3, 2012.
- [151] T. Deng, Z. Zhang, Y. Liu, Y. Wang, F. Su, S. Li, Y. Zhang, H. Li, H. Chen, Z. Zhao, and Y. Li, “Three-dimensional graphene field-effect transistors as high-performance photodetectors,” *Nano Letters*, vol. 19, pp. 1494-1503, 2019.
- [152] O. Koybasi, I. Childres, I. Jovanovic, and Y. P. Chen, “Graphene field effect transistor as a radiation and photodetector,” *Micro-and Nanotechnology Sensors, Systems, and Applications, SPIE*, vol. 8373, pp. 117-124, 2012.
- [153] K. E. Chang, T. J. Yoo, C. Kim, Y. J. Kim, S. K. Lee, S. Y. Kim, S. Heo, M. G. Kwon, and B. H. Lee, “Gate-Controlled graphene–silicon Schottky junction photodetector,” *Small, Wiley*, vol. 14, 2018.
- [154] A. V. Klekachev, A. Nourbakhsh, I. Asselberghs, A. L. Stesmans, M. M. Heyns, and S. De Gendt, “Graphene transistors and photodetectors,” *The Electrochemical Society Interface*, vol. 22, pp. 63-68, 2013.
- [155] Q. Qiu, and Z. Huang, “Photodetectors of 2D Materials from Ultraviolet to Terahertz Waves,” *Advanced Materials*, vol. 33, 2021.
- [156] A. Sood, J. Zeller, P. Ghuman, S. Babu, and N. Dhar, “Development of high-performance graphene-HgCdTe technology for Mid-wave Infrared Applications,” *Proc. SPIE 12091, Image Sensing Technologies: Materials, Devices, Systems, and Applications IX*, vol. 12091, pp. 59-75, 2022.
- [157] S. Bansal, K. Sharma, P. Jain, N. Sardana, S. Kumar, N. Gupta, and A. K. Singh, “Bilayer graphene/HgCdTe based very long infrared photodetector with superior

- external quantum efficiency, responsivity, and detectivity,” *Royal Society of Chemistry Advances*, vol. 8, pp. 39579-39592, 2018.
- [158] S. Bansal, A. Das, P. Jain, K. Prakash, K. Sharma, N. Kumar, and N. Sardana, N. Gupta, S. Kumar, and A. K. Singh, “Enhanced Optoelectronic Properties of Bilayer Graphene/HgCdTe-Based Single-and Dual-Junction Photodetectors in Long Infrared Regime,” *IEEE Transactions on Nanotechnology*, vol. 18, pp. 781-789, 2019.
- [159] C. You, W. Deng, M. Liu, P. Zhou, B. An, B. Wang, S. Yu, and Y. Zhang, “Design and Performance Study of Hybrid Graphene/HgCdTe Mid-Infrared Photodetector,” *IEEE Sensors Journal*, vol. 21, pp. 26708-26715, Dec. 2021.
- [160] A. Rogalski, “Graphene-Based Materials in the Infrared and Terahertz Detector Families: A Tutorial,” *Advances in Optics and Photonics*, vol. 11, pp. 314-379, 2019.
- [161] R. Yan, Q. Zhang, W. Li, I. Calizo, T. Shen, C. A. Richter, A. R. Hight-Walker, X. Liang, A. Seabaugh, D. Jena, and H. G. Xing, “Determination of graphene work function and graphene-insulator-semiconductor band alignment by internal photoemission spectroscopy,” *Applied Physics Letters*, vol. 101, 2012.
- [162] K. Tsakmakidi, “Coherent absorption in graphene,” *Nature Materials*, vol. 12, pp. 688-688, 2013.
- [163] G. Pirruccio, L. M. Moreno, G. Lozano, and J. G. Rivas, “Coherent and broadband enhanced optical absorption in graphene,” *ACS Nano*, vol. 7, pp. 4810-4817, 2013.

-
- [164] N. Kakenov, O. Balci, T. Takan, V. A. Ozkan, H. Altan, and C. Kocabas, "Observation of gate-tunable coherent perfect absorption of terahertz radiation in graphene," *ACS Photonics*, vol. 3, pp. 1531-1535, 2016.
- [165] Y. Fan, F. Zhang, Q. Zhao, Z. Wei, and H. Li, "Tunable terahertz coherent perfect absorption in a monolayer graphene," *Optics Letters*, vol. 39, pp. 6269-6272, 2014.
- [166] X. Hu, and J. Wang, "High-speed gate-tunable terahertz coherent perfect absorption using a split-ring graphene," *Optics Letters*, vol. 40, pp. 5538-5541, 2015.
- [167] Y. Wang, S. Yang, A. Ballesio, M. Parmeggiani, A. Verna, M. Cocuzza, C. F. Pirri, and S. L. Marasso, "The fabrication of Schottky photodiode by monolayer graphene direct-transfer-on-silicon," *Journal of Applied Physics*, vol. 128, 2020.
- [168] X. Li, M. Zhu, M. Du, Z. Lv, L. Zhang, Y. Li, Y. Yang, T. Yang, X. Li, K. Wang, H. Zhu, and Y. Fang, "High Detectivity Graphene-Silicon Heterojunction Photodetector," *Small, Wiley*, vol. 12, pp. 595-601, 2016.
- [169] S. Riazimehr, D. Schneider, C. Yim, S. Kataria, V. Passi, A. Bablich, G. S. Duesberg, and M. C. Lemme, "Spectral sensitivity of a graphene/silicon pn-junction photodetector," *EUROSOI-ULIS 2015:2015 Joint International EUROSOI Workshop and International Conference on Ultimate Integration on Silicon*, pp. 77-80, 2015.
- [170] X. An, F. Liu, Y. J. Jung, and S. Kar, "Tunable graphene-silicon heterojunctions for ultrasensitive photodetection," *Nano letters*, vol. 13, pp. 909-916, 2013.

-
- [171] D. Xiang, C. Han, Z. Hu, B. Lei, Y. Liu, L. Wang, W. P. Hu, and W. Chen, "Surface Transfer Doping-Induced, High-Performance Graphene/Silicon Schottky Junction-Based, Self-Powered Photodetector," *Small, Wiley*, vol. 11, pp. 4829-36, 2015.
 - [172] L. Yang, X. Yu, M. Xu, H. Chen, and D. Yang, "Interface engineering for efficient and stable chemical-doping-free graphene-on-silicon solar cells by introducing a graphene oxide interlayer," *Journal of Materials Chemistry A*, vol. 2, pp. 16877-83, 2014.
 - [173] T. Feng, D. Xie, Y. Lin, H. Zhao, Y. Chen, H. Tian, T. Ren, X. Li, Z. Li, K. Wang, and D. Wu, "Efficiency enhancement of graphene/silicon-pillar-array solar cells by HNO₃ and PEDOT-PSS," *Nanoscale (RCS)*, vol. 4, pp. 2130-2133, 2012.
 - [174] X. Miao, S. Tongay, M. K. Petterson, K. Berke, A. G. Rinzler, B. R. Appleton, and A. F. Hebard, "High efficiency graphene solar cells by chemical doping," *Nano letters*, vol. 12, pp. 2745-2750, 2012.
 - [175] H. Aydin, S. B. Kalkan, C. Varlikli, and C. Çelebi, "P3HT-graphene bilayer electrode for Schottky junction photodetectors," *Nanotechnology*, vol. 29, 2018.
 - [176] A. D. Bartolomeo, G. Luongo, L. Iemmo, F. Urban, and F. Giubileo, "Graphene-Silicon Schottky Diodes for Photodetection," in *IEEE Transactions on Nanotechnology*, vol. 17, pp. 1133-1137, 2018.
 - [177] S. Cakmakyapan, and M. Jarrahi, "High responsivity and bias-free graphene photodetector with nano-grating contact electrodes," *Conference on Lasers and Electro-Optics, Optical Society of America*, pp. 1-2, 2018.

-
- [178] L. H. Zeng, M. Z. Wang, H. Hu, B. Nie, Y. Q. Yu, C. Y. Wu, L. Wang, J. G. Hu, C. Xie, F. X. Liang, and L. B. Luo, "Monolayer graphene/germanium Schottky junction as high-performance self-driven infrared light photodetector," *ACS applied materials & interfaces*, vol. 5, pp. 9362-9366, 2013.
- [179] V. Devarakonda, A. Pandey, and P. Chakrabarti, "Enhanced optoelectronic properties of a mercury cadmium telluride based double heterojunction photodetector for terahertz applications," *Optik*, vol. 247, 2021.
- [180] P. Chakrabarti, A. Gupta, and N. A. Khan. "An Analytical Model of GaAs OPFET," *Solid-State Electronics*, vol. 39, pp. 1481-1490, 1996.
- [181] M. S. Shur, "Analytical model of GaAs MESFET's," in *IEEE Transactions on Electron Devices*, vol. 25, pp. 612-618, 1978.
- [182] P. Chakrabarti, S. K. Shrestha, A. Srivastava and D. Saxena, "Switching characteristics of an optically controlled GaAs-MESFET," in *IEEE Transactions on Microwave Theory and Techniques*, vol. 42, pp. 365-375, 1994.
- [183] P. Chakrabarti, N. L. Shrestha, S. Srivastava and V. Khemka, "An improved model of ion-implanted GaAs OPFET," in *IEEE Transactions on Electron Devices*, vol. 39, pp. 2050-2059, 1992.
- [184] P. Chakrabarti, M. Madheswaran, A. Gupta and N. A. Khan, "Numerical simulation of an ion-implanted GaAs OPFET," in *IEEE Transactions on Microwave Theory and Techniques*, vol. 46, pp. 1360-1366, 1998.
- [185] B. B. Pal, S. N. Chattopadhyay, S. Mishra, S. Singh and R. U. Khan, "Time dependent analysis of an ion-implanted GaAs OPFET," in *IEEE Transactions on Electron Devices*, vol. 41, pp. 491-498, 1994.

-
- [186] A. A. A. De Salles, "Optical Control of GaAs MESFET's," in *IEEE Transactions on Microwave Theory and Techniques*, vol. 31, pp. 812-820, 1983.
- [187] V. K. Singh, S. N. Chattopadhyay, and B.B. Pal, "Optically Controlled Characteristics In An Ion-Implanted Silicon MESFET," *Journal of Semiconductor Technology and Science*, vol. 29, pp. 707-711, 1986.
- [188] Shih-Hsien Lo, and Chien-Ping Lee, "Numerical analysis of the photoeffects in GaAs MESFET's," in *IEEE Transactions on Electron Devices*, vol. 39, pp. 1564-1570, 1992.
- [189] Y. Zebda, and S. A. Helweh, "AC characteristics of optically controlled MESFET (OPFET)," in *Journal of Lightwave Technology*, vol. 15, pp. 1205-1212, 1997.

AUTHOR'S RELEVANT PUBLICATIONS

Journals:

1. V. Devarakonda, A.D.D. Dwivedi, A. Pandey, and P. Chakrabarti, "Performance analysis of $N^+ - CdTe / n^0 - Hg_{0.824675}Cd_{0.175325}Te / p^+ - Hg_{0.824675}Cd_{0.175325}Te$ n-i-p photodetector operating at 30 μm wavelength for terahertz applications," *Optical and Quantum Electronics*, vol. 52, no. 7, Jul. 2020, doi: 10.1007/s11082-020-02450-1.

2. V. Devarakonda, A. Pandey, and P. Chakrabarti, "Enhanced optoelectronic properties of a mercury cadmium telluride based double heterojunction photodetector for terahertz applications," *Optik*, vol. 247, Dec. 2021, doi: 10.1016/j.ijleo.2021.167947.

3. V. Devarakonda, A. Pandey, and P. Chakrabarti, "A Proposed Graphene-Gated Semiconductor Terahertz Detector" submitted in *Optik*. (Under Review)