FAR-INFRARED MICROBOLOMETER DETECTORS

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Dedicated to D.J., for helping to launch it; and to Julie, for helping to keep it on course.

FAR-INFRARED MICROBOLOMETER DETECTORS

by

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DISSERTATION

Presented to the Faculty of the Graduate School of

The University of Texas at Austin

in Partial Fulfillment

of the Requirements

for the Degree of

DOCTOR OF PHILOSOPHY

THE UNIVERSITY OF TEXAS AT AUSTIN

May 1990

ACKNOWLEDGEMENTS

The premise of the movie Its a Wonderful Life is that every man's life is important because it touches on so many others. Likewise, many other lives have touched my own. And many other people have contributed to make this dissertation possible.

First, thanks to all members, every generation, of club MED (the Microelectromagnetic Devices group, alias Team Neikirk). This group has almost always been a lot of fun, and has almost always been supportive of my efforts. Within this group I must extend special thanks to Bob Rogers, Phil Cheung, and Doug Miller, for years of assistance, advice, and argument. Thanks also to John Heston and Jason Lewis, for their assistance and collaboration. And to the founding father and Grand Poohbar of club MED, my advisor Dean Neikirk, I can only say thanks for everything; for taking me in, for giving me timely advice (in digestable quantities), for giving me the freedom to experiment, and for letting me work on some great projects.

Bountiful thanks go to Terry Mattord, who has as much to do with my equipment working as anyone, and who greases a good O-ring. Thanks also, Terry, for Grendel and her ilk. My appreciation to Chris Maziar, for the professional advice she has given me. And thanks to Bernice Wootton, for always making the bureaucracy manageable. To Gus and the boys, thanks for helping to make my stay in Austin enjoyable.

Finally, with one hand over my heart and the other raised in a 'hookem', I proudly recite the club MED motto: "if it's broke, don't fix it!"

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Publication No. ____________

Stuart Martin Wentworth, Ph.D.
The University of Texas at Austin, 1990

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Receivers and imaging systems for the far-infrared (FIR) spectral region (wavelengths between 100 μm and 3 mm) are desired for applications in astronomy, radar, and fusion research. Microbolometer detectors integrated with planar antennas are broad-band devices which work well in the FIR and which can be assembled into arrays for imaging. Radiation captured by the antenna heats the microbolometer detector, causing its temperature to change. With a good microbolometer material, this temperature change will result in a significant change in resistance, which can be measured. Also, a microbolometer has a small thermal mass, which means it can respond rapidly to a modulated FIR signal.

This study addresses the theory and operation of microbolometer detectors, and demonstrates the performance of conventional microbolometers using the elements bismuth and tellurium. The application of a bismuth microbolometer as the detector for a twin slot antenna structure is presented. The conventional microbolometer structure is constrained in that the resistance of the detector must match reasonably well with the impedance of the antenna. A composite microbolometer structure is demonstrated which removes this constraint. Finally, the sharp change in resistance at the transition temperature of a superconductor could be utilized to make a very responsive microbolometer. Preliminary results of such a <u>tr</u>ansition <u>e</u>dge <u>m</u>icro<u>bol</u>ometer (TREMBOL) are presented using a conventional superconductor (lead) chilled to 7 K.

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