

TABLE OF CONTENTS

	Personnel	vi
	Publications and Reports	ix
I.	Physical Electronics	1
	Electron Emission Problems	1
	Magnetic Velocity Analyzer Investigation of Thermionic Emission from Tungsten	1
	Photoelectric Study of Surface States on Insulators	1
	A Redetermination of the Crystallographic Variation of Electron Field Emission from Tungsten	2
	Conduction Mechanism in Oxide-Coated Cathodes	2
	Physical Electronics of the Solid State	4
	Studies of Thermoelectric Power and Conductivity of Ionic Conductors	4
	Experimental Techniques	5
	Ionization Gauge Studies	5
	Infrared Radiation Pyrometer for Temperature Measurements on Oxide-Coated Cathodes	5
II.	Microwave Gaseous Discharges	6
	Characteristics of Maintaining Fields in Microwave Gas Discharges	6
	Electron-Ion Recombination in Hydrogen	6
	Oscillations in DC Discharges	8
	Breakdown in Hydrogen at 100 Mc/sec	10
III.	Solid State Physics	12
	The Quantum Mechanical Foundation of the Theory of Solids	12
	Soft X-ray Vacuum Spectrograph	13
	Microwave Study of Semiconductors	13
	Electrical Properties of Germanium at Microwave Frequencies	13
IV.	Low Temperature Physics	15
	Magnetic Dipole Interactions in Crystals	15
	Determination of the Thermodynamic Temperature Scale at Very Low Temperatures by a Magnetic Method	16
	Growth of Large Crystals of Paramagnetic Alum	17
	The Resistance Minimum in Metals	17
	Specific Heat of Magnesium	19
	Thermal Conductivity of Magnesium	20
	Thermoelectric Forces	20
	Thermal Properties of Metals Measured by a Pulse Technique	23

	Pressure Dependence of Second-Sound Velocity in the Demagnetization Region	23
	Second-Sound Pulse Amplitudes in Liquid Helium II	24
	Thermomechanical Effect	25
	Temperature and Pressure Dependence of the Viscosity of Liquid Helium	26
V.	Microwave Spectroscopy	27
	Zeeman Effect	27
	Paramagnetic Resonance	28
	The Microwave Spectrum of Methyl Alcohol	30
VI.	Molecular Beam Research	32
	Precision Measurement of the HFS of RB^{87}	32
	Detection Techniques	32
	Surface Ionization of the Halogens	32
	The Spin Gyromagnetic Ratio of the Electron	33
VII.	Magnet Laboratory Research	35
	Nuclear Magnetic Resonances	35
	Nuclear Resonances in Gases	35
	The Deuteron-Proton Moment Ratio	35
	Double Resonance Experiments	35
	Hyperfine Structure of the $3\text{P}_{3/2}$ State of Sodium	35
	Magnetic Properties of Solids	36
	Ferromagnetic Materials	36
	Diamagnetism of Metals in Weak Fields	36
VIII.	Tube Research and Development	37
	Magnetron Development	37
	Testing and Design of High Power 10.7-Cm Magnetrons	37
	Microwave Tubes	39
	Noise and Space-Charge Waves	39
	Effect of drifting on noise in beams with velocity spread	39
	Experimental study of noise in electron beams	43
	Traveling-Wave Amplifiers	48
	10-cm pulsed traveling-wave amplifier	48
	Interleaved-fin slow-wave structure	49
	1-Mev Pulsed Electron Source	51
IX.	Communication Research	53
	Multipath Transmission	53
	Speech and Music. Transatlantic Tests	53
	Television	55
	Simplified FM Receiver	55
	Statistical Theory of Communication	58

Multichannel Analog Electronic Correlator	58
Pulse Code Magnetic Recorder	58
Information Theory	60
Transmission of information through channels in cascade	60
Vocoder	61
Human Communication Systems	62
Technical Report	62
Experiment on the Effect of Change in Communication Network	62
Experimental Apparatus	63
IBM Analysis of Data	64
Replacement of Visual Sense in Task of Obstacle Avoidance	65
Communications Biophysics	68
Interaction of Cortical Activity and Evoked Potentials	68
Variability of Cortical Responses to Acoustic Clicks	68
Instrumentation	68
Neurophysiology	69
Mechanical Translation	71
A New Method of Syntactical Description	74
Semantic Information and its Measures	75
Parallel Chain Amplifier	78
Correlation Functions of Amplitude Distorted Noise	79
Transient Problems	80
Basic Existence Theorems	80
Conformal Mapping of Physically Realizable Passive Networks	90
X. Analog Computer Research	91
The Operation of Present Computers	91
The Macnee Differential Analyzer	91
The Use of Computing Elements in Nonlinear Time Domain Filters	91
Integral Equation Computer	92