

CONTENTS OF PART A

Foreword	xvii
List of Contributors	xviii

1. Superfluidity

Introduction to the Symposium on Superfluids, JOHN BARDEEN	3
Weak Superconductivity and Josephson Tunneling, P. W. ANDERSON	8
Hydrodynamics and Kinetic Theory of Superfluids, PAUL C. MARTIN	9
Vortex Lines in Superconductors, P. G. DE GENNES	19

2. Quantization and Vortices in Superconductors and Liquid Helium

Quantized Magnetic Flux in Superconductors, WILLIAM M. FAIRBANK	33
Quantized Vortices in Superconductors, R. D. PARKS	34
Investigation of Quantized Vortex Rings in Superfluid Helium, F. REIF	46

3. Quantum Liquids

Correlations and Excitations in Quantum Liquids, DAVID PINES	61
Superfluidity of ^3He , V. P. PESHKOV	79
Strong Coupling Cell Theory of Liquid Helium, LYLE B. BORST	84
Energy Fluctuations and the Nature of the Rotons in He II, O. K. RICE ..	88
Inequalities for the Ground State of Liquid ^4He , O. PENROSE	91
Ground-State Energy of a One-Dimensional Bose System, T. R. KOEHLER ...	92
On the Line Width of Cold Neutrons Scattered by He II, S. FRANCHETTI ...	97
A Third Sum Rule for the Density Correlation Function, R. PUFF	101
Virial Expansion for Bose and Fermi Fluids, T. MORITA and T. TANAKA ...	104
Many-Body Effects at Metallic Densities, T. M. RICE	108
On the Quasi-Particle Energy Spectrum in Liquid ^3He , P. M. RICHARDS.....	113
The Attenuation of Sound in Liquid ^3He at Low Temperatures, C. E. GOUGH AND W. F. VINEN	118
The Acoustic Impedance of Liquid ^3He , G. A. BROOKER	121
The Acoustic Impedance of Liquid ^3He Under Pressure, B. E. KEEN AND J. WILKS	125
The Viscosity of Liquid ^3He Above 0.04°K, D. S. BETTS AND J. WILKS	129
The Heat Capacity of Liquid ^3He , B. M. ABRAHAM, M. DURIEUX, C. J. N. VAN DEN MEIJDENBERG, AND D. W. OSBORNE.....	133
Nuclear Susceptibility of Liquid ^3He , B. T. BEAL AND J. HATTON.....	137
Nuclear Magnetic Susceptibility in ^3He Vapor and Liquid, J. E. OPFER, K. LUSZCZYNSKI, AND R. E. NORBERG	143
Diffusion of ^3He in Liquid ^3He - ^4He Mixtures, P. HORVITZ AND H. E. RORSCHACH	147

4. Helium

4.1. Second Sound, Rotation, Vortices, Films

Attenuation of Second Sound in Rotating Liquid Helium at the Passage of the Point of Phase Transition, E. L. ANDRONIKASHVILI, R. A. BABLIDZE, AND J. S. TSAKADZE	155
Relaxation of Onsager-Feynman's Vortices at Heating of Rotating He II Above the Point of the Phase Transition, E. L. ANDRONIKASHVILI, G. V. GUJABIDZE, AND J. S. TSAKADZE	159
Megacycle Frequency Second Sound, H. A. NOTARYS AND J. R. PELLAM ...	164
Wavemode Modification in Liquid Helium with Clamped Normal Fluid, G. L. POLLACK AND J. R. PELLAM	166
Second Sound in Square and Cubical Cavities, P. J. BENDT	170
Mutual Friction Measurements in Liquid He II, R. H. BRUCE	174
A Study of the Laminar and Turbulent Flow of He II in Two Closed Oscillating Geometries, S. KNIGHT AND J. D. REPPY	179
Displacement-Time Curves of an Oscillating Pile of Disks in He II, A. R. CONSTABLE AND C. B. BENSON	184
Angular Momentum of He II in a Rotating Cylinder, G. B. HESS AND W. M. FAIRBANK	188
Rotational Anomaly in Liquid He II, J. R. PELLAM.....	191
A Search for Vortex Lines in Rotating Superfluid Helium by Positron Annihilation, L. O. ROELLIG, T. KELLY, H. H. MADDEN, AND J. McNUTT ...	195
An Attempt to Observe the Creation of a Single Quantized Vortex Ring, W. J. TRELA AND W. M. FAIRBANK	200
The λ Transition in Adsorbed Helium Films at Temperatures Below 1°K, F. D. MANCHESTER	202
The Isothermal Helium Film Below 1°K, C. F. MATE, R. HARRIS-LOWE, AND J. G. DAUNT	206
Enhanced Transfer Rates and Thick He II Films, C. C. MATHESON AND J. TILLEY	210
Oscillations of the He II FILM, F. I. GLICK AND J. H. WERNTZ, JR.	214

4.2. Solid Helium Including Isotopic Mixtures

The Exchange Interaction and Related Relaxation Process in Solid ^3He , M. G. RICHARDS, J. HATTON, AND R. P. GIFFARD.....	219
Spin-Lattice Relaxation in Solid ^3He , E. D. ADAMS, R. A. SCRIBNER, M. F. PANCYZK, A. SAMEC, AND E. A. GARBATY	226
Properties of the bcc-hcp Phase Transition of ^3He and ^4He , A. F. SCHUCH AND W. C. OVERTON, JR.	229
Solidification of ^3He - ^4He Mixtures, C. LE PAIR, K. W. TACONIS, R. DE BRUYN OUBOTER, E. DE JONG, AND J. PIT	234
The Melting Curve Slope of ^4He and ^3He - ^4He Mixtures, G. O. ZIMMERMAN.....	240
The Specific Heat of ^3He - ^4He Solid Mixtures, G. O. ZIMMERMAN.....	244
On the Phase Diagram of ^3He - ^4He Mixtures, P. M. TEDROW AND D. M. LEE...	248
Evidence for a Quadruple Point in ^3He - ^4He Mixtures, F. P. LIPSCHULTZ, P. M. TEDROW, AND D. M. LEE	254
Specific Heat of ^4He Under Pressure Below 1°K, J. WIEBES AND H. C. KRAMERS	258

The Thermal Conductivity of bcc ^4He and of Isotopic Mixtures, R. BERMAN AND S. J. ROGERS	262
Thermal Conductivity of Isotopic Mixtures of Solid Helium, B. BERTMAN, C. W. WHITE, AND HENRY A. FAIRBANK.....	266
Isotopic Solutions of Solid Helium, P. G. KLEMENS, R. DE BRUYN OUBOTER, AND C. LE PAIR	270
^4He Melting Curve Minimum, S. G. SYDORIAK AND R. L. MILLS	273
Calculations of the Ground-State Energies of Crystals of the Light Elements, L. H. NOSANOW	277

4.3. Superfluid Flow, Critical Velocities, Turbulence

Momentum of Liquid Helium and Critical Velocity Calculations, YU. G. MAMALADZE.....	281
Turbulent Effects in Liquid Helium Flow, T. M. WIARD, G. VAN DER HEYDEN, AND H. C. KRAMERS	284
The Flow of He II at Moderate Reynolds Numbers, J. T. TOUGH, W. D. McCORMICK, AND J. G. DASH	287
Thermohydrodynamic Flow Similarity of He II in Wide Channels at Super- critical Velocities, T. H. K. FREDERKING AND J. D. SCHWEIKLE	291
Helium Superflow Through Saran Charcoal, M. H. EDWARDS, A. S. MCKIRDY, AND W. C. WOODBURY	295
Vorticity in He II in Narrow Channels, P. A. DZIWORNOOH, E. S. R. GOPAL, K. MENDELSSOHN, AND S. M. A. TIRMIZI	299
The Superflow of He II in Very Narrow Channels, J. F. ALLEN AND D. J. WATMOUGH	304
Isothermal Flow of Liquid He II in Narrow Channels, W. E. KELLER AND E. F. HAMMEL	307
Critical Velocities in the Isothermal Flow of Superfluid Helium, G. CARERI, M. CERDONIO, AND F. DUPRE	311
Heat Transport by He II Through Small Capillaries, H. H. MADDEN, R. H. HAMMERLE, AND H. V. BOHM	312
Heat Transport by He II at Low Temperatures, P. L. J. CORNELISSEN AND H. C. KRAMERS	316
Superfluid Vorticity and Critical Velocities in Heat Currents in He II, D. J. GRIFFITHS, D. V. OSBORNE, AND J. F. ALLEN.....	320
Superfluid Flow in Liquid Helium, W. M. VAN ALPHEN, W. VERMEER, K. W. TACONIS, AND R. DE BRUYN OUBOTER	323
Stability of Superfluid Flow Near the λ -Point, JAMES CLOW, JAMES C. WEAVER, DAVID DEPATIE, AND JOHN D. REPPY	328
Gravitational Flow of Superfluid Helium at 0.45°K , J. N. KIDDER AND H. A. BLACKSTEAD	331

4.4. Ions in Liquid Helium

Hot Ions in Liquid He II, G. CARERI, S. CUNSOLO, P. MAZZOLDI, AND M. SANTINI.....	335
Ions in He II in a Magnetic Field, LOTHAR MEYER	338
Change of the Mobility of Positive Ions in Rotating He II, I. MODENA, A. SAVOIA, AND F. SCARAMUZZI.....	342

Ions in Rotating He II: Some Exploratory Experiments, D. J. TANNER, B. E. SPRINGETT, AND R. J. DONNELLY	346
Dependence of Ionic Mobilities in Liquid ^3He on Temperature and Density, P. DE MAGISTRIS, I. MODENA, AND F. SCARAMUZZI	349
Ion Mobility Discontinuities in Liquid Helium, J. A. COPE AND P. W. F. GRIBBON	353
Localized Excitations in Condensed Neon, Argon, Krypton, and Xenon, J. JORTNER, L. MEYER, S. A. RICE, AND E. G. WILSON	356
Anomalous Scintillation Effects in He II, F. E. MOSS AND F. L. HEREFORD.....	360

4.5. Adsorbed ^3He

Nuclear Magnetic Susceptibility of Adsorbed ^3He , G. CARERI, M. SANTINI, AND G. SIGNORELLI.....	364
Search for a Magnetically Ordered State of Adsorbed ^3He , H. WEINSTOCK AND C. E. LONG	366
The Specific Heat of Adsorbed Monolayers of ^3He , D. L. GOODSTEIN, W. D. McCORMICK, AND J. G. DASH	368
Surface Effects in ^3He at Low Temperatures, D. F. BREWER, A. J. SYMONDS, AND A. L. THOMSON	370

5. Superconductivity

5.1. Ultrasonics, Microwaves, Tunneling

Ultrasonic Absorption in Superconducting Lanthanum, T. OLSEN, L. T. CLAIBORNE, AND N. G. EINSPRUCH	375
On the Problem of Ultrasonic Attenuation in Superconductors Containing Magnetic Impurities, L. P. KADANOFF AND I. I. FALKO	378
Microwave Transmission and Reflection Coefficients of Thin Superconducting Films, N. M. RUGHEIMER, C. V. BRISCOE, A. LEHOCZKY, AND R. E. GLOVER, III	381
Magnetic Field Dependence of the Microwave Surface Impedance of Super- conducting Aluminum, R. GLOSSER AND D. H. DOUGLASS, JR.	385
Millimeter Wave Absorption in Superconducting Silver-Doped Aluminum Single Crystals, M. A. BIONDI, M. P. GARFUNKEL, AND W. A. THOMPSON	387
Effect of a Static Magnetic Field on Millimeter Wave Absorption in Super- conducting Aluminum, W. V. BUDZINSKI AND M. P. GARFUNKEL	391
RF Losses in Superconducting Lead and Niobium, J. M. PIERCE, H. A. SCHWETTMAN, W. M. FAIRBANK, AND P. B. WILSON	396
The Superconducting Energy Gap of Lead Above H_c , Y. GOLDSTEIN	400
Effect of Magnetic Fields on Energy Gap of Superconductors, K. MAKI.....	405
Anomalous Densities of States in Normal Tantalum and Niobium, A. F. G. WYATT	411
Tunnel Junction RF Modes Driven by the AC Josephson Current, R. E. ECK, D. J. SCALAPINO, AND B. N. TAYLOR	415
Persistent Currents and Flux Quantization in Superconducting Rings Inter- rupted by Josephson Junctions, A. M. GOLDMAN.....	421
Tunneling Between a Type II Superconductor and a Very Thin Superconduct- ing Aluminum Film in a Magnetic Field, W. J. TOMASCH	424

Method for Obtaining Second Derivatives in Electron Tunneling, J. W. T. DABBS	428
Flux Quantization and Josephson Tunneling, T. I. SMITH AND H. E. RORSCHACH, JR.	432
Tunneling Density of States for a Superconductor Carrying a Current, P. FULDE	438
DC Pair-Tunneling Between Two Superconductors at Finite Voltages, C. B. SATTERTHWAITE, M. G. CRAFORD, R. N. PEACOCK, AND R. P. RIES	443
5.2. Quantized Flux, Rotating Superconductors, Superconducting Transition	
DeBroglie Wavelength of a Current-Carrying Superconductor, R. C. JAKLEVIC, J. J. LAMBE, A. H. SILVER, AND J. E. MERCEREAU.....	446
Quantized Flux in Superconducting Cylinders, A. L. KWIRAM AND B. S. DEAVER, JR.	451
Measurement of the Absolute Value of the Penetration Depth Using Flux Quantization, R. MESERVEY	455
Superconducting Transition of a Rotating Superconductor—The Hollow Cylinder, A. F. HILDEBRANDT AND M. M. SAFFREN	459
The Magnetic Field Generated by a Rotating Superconductor, C. A. KING, JR., J. B. HENDRICKS, AND H. E. RORSCHACH, JR.	466
Measurement of the London Moment, M. BOL AND W. M. FAIRBANK.....	471
Experiments Concerning the Effect of Surface Charging on the Superconducting Transition Temperature, W. RÜHL	475
The Superconducting Transition Width in Pure Lead, J. E. NEIGHBOR, J. F. COCHRAN, AND C. A. SHIFFMAN	479
Anomalies in the Superconducting Transition of hcp Titanium Alloys, E. BUCHER, F. HEINIGER, AND J. MULLER	482
Positron Annihilation in V ₃ Si, T. W. MIHALISIN AND R. D. PARKS	487
Nuclear Spin Relaxation in Superconducting Gallium, R. H. HAMMOND AND G. M. KELLY	492
The Temperature Dependence of the Ginzburg-Landau Coefficient in Type I Superconductors, A. PASKIN, M. STRONGIN, P. P. CRAIG, AND D. G. SCHWEITZER	496
Field Penetration in Superconductors with Surface Layers, D. G. SCHWEITZER, P. P. CRAIG, M. STRONGIN, AND A. PASKIN	503
Effect of Impurities on the Critical Temperature of Superconductors, D. M. GINSBERG	508
Neutron Diffraction by Vortex Lines in Superconducting Niobium, D. CRIBIER, B. FARNOUX, B. JACROT, L. MADHAV RAO, B. VIVET, AND M. ANTONINI	509
5.3. Thermal Phenomena	
Magnetocaloric Effects in a High-Field Superconductor, R. R. HAKE AND L. J. BARNES.....	513
The Efficiency of Superconducting Thermal Switches, V. P. PESHKOV AND A. YA. PARSHIN	517
Specific Heat Evidence for Gapless Superconductivity, D. K. FINNEMORE AND F. H. SPEDDING	521
Electronic Thermal Conductivity and Other Properties of Superconductors Containing Paramagnetic Impurities, A. GRIFFIN AND V. AMBEGAOKAR	524

5.4. Type II Superconductors, Thin Films

Flux Penetration and Mobility in Type I and II Superconductors, W. DESORBO	530
Oscillatory Longitudinal Paramagnetic Effect in a Semireversible Type II Superconductor, M. A. R. LEBLANC	531
Magnetothermal Effects in Type II Superconductors, N. H. ZEBOUNI, A. VENKATARAM, G. N. RAO, C. G. GRENIER, AND J. M. REYNOLDS	535
Experiments on Type II Superconductors, R. A. FRENCH, J. LOWELL, AND K. MENDELSSOHN	540
Crystallographic Properties of Lattices of Vortex Lines in a Type II Superconductor, J. MATRICON	544
On the Mixed State of a Type II Superconductor, P. M. MARCUS	550
Density of States of Second-Kind Superconducting Films Near Their Upper Critical Fields, J. P. BURGER AND E. GUYON	556
Surface Superconductivity and Supercooling in Weak and Strong Coupling Type I Superconductors, M. CARDONA AND B. ROSENBLUM	560
Distinctive Properties of Quantized Vortices in Superconducting Films, J. PEARL	566
Dynamic Vortex Effects in Thin Superconductors, J. M. MOCHEL AND R. D. PARKS	571
Critical Fields of Superconducting Films, F. ODEH AND W. LINIGER	575
Superconductivity in the Systems Nb-Sn, Nb-Al, V-Si, and V-Ga, W. KUNZ AND E. SAUR	581
The Influence of Magnetic Fields on the Transition of High-Field Superconductors with A-15 Structure, G. MEYER AND H. WIZGALL	584
Superconducting Behavior of Indium-Lead Alloys, S. GYGAX, J. L. OLSEN, AND R. H. KROPSCHOT	587
Magnetic Field Penetration Into Nb ₃ Sn Disks, K. G. PETZINGER AND J. J. HANAK	591
The Motion of Magnetic Flux in a Type II Superconductor, P. H. BORCHERDS, C. E. GOUGH, W. F. VINEN, AND A. C. WARREN	596

5.5. Superconducting Materials

Superconductivity in GeTe and in the Monoxides of Titanium and Niobium, J. K. HULM, C. K. JONES, R. MAZELSKY, R. C. MILLER, R. A. HEIN, AND J. W. GIBSON	600
Superconductivity in the SnTe System, T. A. HEIN, J. W. GIBSON, R. S. ALLGAIER, B. B. HOUSTON, JR., R. MAZELSKY, AND R. C. MILLER	604
Theory of the Thermodynamic Behavior of the Strong-Coupling Superconductors Lead and Mercury, J. C. SWIHART, D. J. SCALAPINO, AND Y. WADA	607
Niobium Oxy-Nitrides with High Transition Temperatures, G. K. GAULÉ, J. T. BRESLIN, R. L. ROSS, J. R. PASTORE, AND J. R. SHAPIRIO	612
Experimental Relations for Electron Interactions in Transition Metals Determined from Superconductivity Data, E. BUCHER, F. HEINIGER, J. MULLER, AND J. L. OLSEN	616