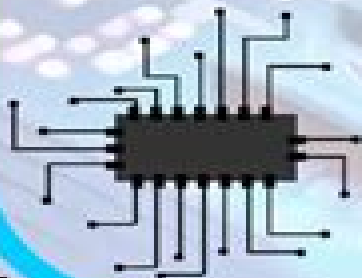


Metal insulator transitions

- Metal-insulator transitions are phase changes where a material switches between conductive (metallic) and non-conductive (insulating) states due to external factors like temperature or pressure
- This phenomenon is crucial for understanding and designing materials with switchable electrical properties, important in electronics and sensors
- The transition involves changes in the electronic structure of a material, often influenced by electron interactions and lattice structure
- Studying these transitions helps in developing advanced materials for energy storage and smart technology

Practical example: Electronics

- Metal-insulator transitions are a fascinating aspect of physics that can be observed in the behavior of certain materials used in electronics
- These materials can switch between being conductors (metallic) and non-conductors (insulators) under different conditions such as temperature or electric field
- This unique property is crucial for developing advanced electronic devices like memory storage systems and sensors, enabling better performance and more efficient energy use in technology that permeates daily life



Metal Insulator Transitions

Nevill F. Mott



Metal Insulator Transitions:

Metal-Insulator Transitions Nevill Mott, 2004-01-14 This is a second edition of a classic book Written by the late great Sir Nevill Mott Britain's last Nobel Prize winner for Physics Metal Insulator Transitions has been greatly updated and expanded to further enhance its already enviable reputation

Metal-insulator Transitions Nevill F. Mott, 1974 *Localization and Metal-Insulator Transitions* Hellmut Fritzche, David Adler, 1985-08 This volume and its two companion volumes entitled Tetrahedrally Bonded Amorphous Semiconductors and Physics of Disordered Materials are our way of paying special tribute to Sir Nevill Mott and to express our heartfelt wishes to him on the occasion of his eightieth birthday Sir Nevill has set the highest standards as a physicist teacher and scientific leader Our feelings for him include not only the respect and admiration due a great scientist but also a deep affection for a great human being who possesses a rare combination of outstanding personal qualities We thank him for enriching our lives and we shall forever carry cherished memories of this noble man Scientists best express their thanks by contributing their thoughts and observations to a Festschrift This one honoring Sir Nevill fills three volumes with literally hundreds of authors meeting a strict deadline The fact that contributions poured in from all parts of the world attests to the international cohesion of our scientific community It is a tribute to Sir Nevill's stand for peace and understanding transcending national borders The editors wish to express their gratitude to Ghazaleh Koefod for her diligence and expertise in deciphering and typing many of the papers as well as helping in numerous other ways The blame for the errors that remain belongs to the editors

The Mott Metal-Insulator Transition Florian Gebhard, 1997-03-20 Little do we reliably know about the Mott transition and we are far from a complete understanding of the metal insulator transition due to electron-electron interactions Mott summarized his basic ideas on the subject in his wonderful book Metal Insulator Transitions that first appeared in 1974 11 1 In his view a Mott insulator displays a gap for charge-carrying excitations due to electron correlations whose importance is expressed by the presence of local magnetic moments regardless of whether or not they are ordered Since the subject is far from being settled different opinions on specific aspects of the Mott transition still persist This book naturally embodies my own understanding of the phenomenon inspired by the work of the late Sir Nevill Mott The purpose of this book is twofold first to give a detailed presentation of the basic theoretical concepts for Mott insulators and second to test these ideas against the results from model calculations For this purpose the Hubbard model and some of its derivatives are best suited The Hubbard model describes a Mott transition with a mere minimum of tunable parameters and various exact statements and even exact solutions exist in certain limiting cases Exact solutions not only allow us to test our basic ideas but also help to assess the quality of approximate theories for correlated electron systems

Metal-insulator Transitions in Mott Insulators Ellen June Yoffa, 1978 *The Mott Metal-Insulator Transition* Florian Gebhard, 2003-07-01 Little do we reliably know about the Mott transition and we are far from a complete understanding of the metal insulator transition due to electron-electron interactions Mott summarized his

basic ideas on the subject in his wonderful book *Metal-Insulator Transitions* that first appeared in 1974 [1]. In his view a Mott insulator displays a gap for charge-carrying excitations due to electron correlations whose importance is expressed by the presence of local magnetic moments regardless of whether or not they are ordered. Since the subject is far from being settled, different opinions on specific aspects of the Mott transition still persist. This book naturally embodies my own understanding of the phenomenon inspired by the work of the late Sir Nevill Mott. The purpose of this book is twofold: first to give a detailed presentation of the basic theoretical concepts for Mott insulators and second to test these ideas against the results from model calculations. For this purpose the Hubbard model and some of its derivatives are best suited. The Hubbard model describes a Mott transition with a mere minimum of tunable parameters and various exact statements and even exact solutions exist in certain limiting cases. Exact solutions not only allow us to test our basic ideas but also help to assess the quality of approximate theories for correlated electron systems.

Metal-insulator Transitions Masatoshi Imada, Atsushi Fujimori, Yoshinori Tokura, 1998 [New Spin on Metal-Insulator Transitions](#) Andrej Pustogow, 2023-04-04

Metal insulator transitions (MITs) constitute a core subject of fundamental condensed matter research. The localization of conduction electrons occurs in a large variety of materials and engenders intriguing quantum phenomena such as unconventional superconductivity and exotic magnetism. Nearby an MIT, minuscule changes of the interaction strength via chemical substitution, doping, physical pressure, or even disorder can trigger spectacular resistivity changes from zero in a superconductor to infinity in an insulator near $T = 0$. While approaching an insulating state from the conducting side, deviations from Fermi liquid transport in bad and strange metals are the rule rather than the exception. As the drophila of electron-electron interactions, the Mott MIT receives particular attention from theory as it can be studied using the Hubbard model. On the experimental side, organic charge transfer salts and transition metal oxides are versatile platforms for working toward solving the puzzles of correlated electron systems. This Special Issue provides a view into the ongoing research endeavors investigating emergent phenomena around MITs.

Metal-insulator and Superconductor-insulator Transitions in Correlated Electron Systems Masatoshi Imada, Tōkyō Daigaku. Bussei Kenkyūjo, 1998 **Metal-insulator Transitions and Strong Electron Correlations** Kristel Francine Lucia Michielsen, 1993 **Spectroscopy of Mott Insulators and Correlated Metals** Atsushi Fujimori, Yoshinori Tokura, 2012-12-06

Extensive studies of high T_c cuprate superconductors have stimulated investigations into various transition metal oxides. Mott transitions in particular provide fascinating problems and new concepts in condensed matter physics. This book is a collection of overviews by well-known active researchers in this field. It deals with the latest developments with particular emphasis on the theoretical spectroscopic and transport aspects.

Metal-insulator Transitions Thomas Maurice Rice (Physicist, United States, Ireland, Switzerland), Troisième Cycle de la Physique en Suisse Romande, 1983 *Superconductor-metal-insulator Transitions in Two Dimensions* Nadya Mason, 2001

Magnetic Order and Metal-insulator Transitions in Transition and Rare Earth Metal Compounds: a Unified

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Correlation Alvaro Ferraz,1980 *Metal-insulator Transitions* Thomas Maurice Rice,1984 A Study of Metal-insulator
Transitions in the Binary Alloy and Ionic Hubbard Models Norman Paris,2007 **International Euroconference on**
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Würzburg),1995 **Reentrant Metal-insulator Transitions in Silicon-MOSFETs** John William M. Campbell,1995 This
thesis describes a study of reentrant metal insulator transitions observed in the inversion layer of extremely high mobility Si
MOSFETs Magneto transport measurements were carried out in the temperature range 20mK 4 2 K in a sp³ He sp⁴ He
dilution refrigerator which was surrounded by a 15 Tesla superconducting magnet Below a melting temperature T_{sb} M
sim500 mK and a critical electron density n_{sb} s sim9 times10 sp cm sp 2 the Shubnikov de Haas oscillations in the diagonal
resistivity enormous maximum values at the half filled Landau levels while maintaining deep minima corresponding to the
quantum Hall effect at filled Landau levels At even lower electron densities the insulating regions began to spread and
eventually a metal insulator transition could be induced at zero magnetic field The measurement of extremely large
resistances in the milliKelvin temperature range required the use of very low currents typically in the 10 sp 12 A range and
in certain measurements minimizing the noise was also a consideration The improvements achieved in these areas through
the use of shielding optical decouplers and battery operated instruments are described The transport signatures of the
insulating state are considered in terms of two basic mechanisms single particle localization with transport by variable range
hopping and the formation of a collective state such as a pinned Wigner crystal or electron solid with transport through the
motion of bound dislocation pairs The experimental data is best described by the latter model Thus the two dimensional
electron system in these high mobility Si MOSFETs provides the first and only experimental demonstration to date of the
formation of an electron solid at zero and low magnetic fields in the quantum limit where the Coulomb interaction energy
dominates over the zero point oscillation energy The role of disorder in favouring either single particle localization or the
formation of a Wigner crystal is explored by considering a variety of samples with a wide range of mobilities and by varying
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