

**Chemistry and Physics of Solid Surfaces VII** (Springer Series in Surface Sciences, Vol 10)

*edited by R Vanselow and R F Howe*

Springer-Verlag : Berlin-Heidelberg-New York-London-Paris-Tokyo-Hong Kong, 1988  
xvii + 616 pages, 315 figures ; price : DM 159 (Hard cover) ; ISBN 3-540-50044-8

This is a collection of twenty reviews contributed by the speakers at the eight International Summer Institute in Surface Science (ISISS, 1987) which was held at the University of Wisconsin-Milwaukee in August 1987. In this volume there are numerous references to works published in 1987 and 1988 apart from unpublished works. Thus, it can be considered as a pretty recent update of the developments in this area. The major emphasis in this volume is understandably on the recent experimental developments. However, the theoretical background has not been neglected. To prove this one may cite in particular the theoretical reviews on surface phonon by Maradudin, on fractals by Pfeifer, on near edge X-ray absorption fine structure (NEXAFS) spectra by Horsley, on desorption dynamics by Kreuzer, on critical phenomena at surfaces by Einstein, on equilibrium crystal shape by Wortis or the one by Van Hove on the analysis of complex and disordered surface structure by LEED. Besides these, the article on IR spectroscopy of semiconductor surfaces by Chabal and the one on surface electronic interactions of slow ions and metastable atoms by Hagstrum and a few others discuss in considerable details the theoretical principles involved.

A wide variety of topics have been covered in the present volume. Ehrlich has reviewed a somewhat neglected topic, characterization and mechanism of activated chemisorption. The physisorption of noble gases as studied by high resolution thermal helium scattering has been discussed by Kern and Comsa. The near edge K-shell excitation spectra of certain bonds and functional groups remain largely unaffected in gas, solid or chemisorbed state or in presence of other groups. Thus the NEXAFS spectra of complex polymers or macromolecules can be considered as a sum of spectra of individual building blocks. Outka and Stohr has discussed the utility and limitation of this approach while Gland has reviewed the application of transient NEXAFS spectroscopy to study surface kinetics. Over the last decade there has been a lot of interest in the so called "Strong-Metal-Support Interaction" (SMSI) because of its implications in heterogeneous catalysis. Baker has given a short update of its present status with special emphasis on electron microscopic studies. Surface morphology and surface crystallography has been the subject of several reviews. The implications of the theoretical article by Wortis in

surface roughening and surface reconstruction have been elaborated by Engel and by Bonzel and Duckers respectively. Van der Veen *et al* discussed the role of surface in initiating melting process in solids. The highly interesting helium liquid-solid interface has been dealt with by Maris. Tromp has reviewed the recent developments in Scanning Tunnel Microscopy and related techniques. In the last article Kasper and Jorke addressed the connection between surface properties and material growth by Silicone Molecular Beam Epitaxy which will be of great interest because of its potential application in microelectronics.

In view of the wide spectrum of the topics covered in this volume and the very rapid growth of the subject this volume will be greeted by researchers of diverse disciplines ranging from surface catalysis, microelectronics to theoretical physics and chemistry. Thus, this volume will be a welcome addition to any physics, chemistry or engineering library.

KANKAN BHATTACHARYYA

*Department of Physical Chemistry,  
Indian Association for the Cultivation of Science,  
Jadavpur, Calcutta-700 032*

**Solvay Conference on Surface Science** (Springer Series in Surface Sciences, Vol 14)

(Invited Lectures and Discussions, University of Texas, Austin, Texas December 14-18, 1987)  
*edited by F W de Wette*

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xii+501 pages, 214 figures ; price : DM 110 (Hard cover) ; ISBN 3-540-50450-8

This volume contains the proceedings of the nineteenth Solvay Conference which was held at the University of Texas at Austin, USA in December, 1987. Ever since the first Solvay Conference on quantum theory of radiation held in 1911, these conferences distinguished themselves by recognising a field at a very early stage of development and thus served as the cradle of new concepts in Physics. The special feature of this particular volume is the interdisciplinary nature of the topic, surface science, which spans a rather wide panorama ranging from very applied topics like catalysis or microelectronic devices to fundamental problems of physics and chemistry in two dimensions apart from biological membranes. The subject of surface science is, of course, not a new field. However, over the last decade it witnessed an explosive growth largely owing to the development of a large number of experimental techniques. This, as J. Solvay pointed out in his opening address, provided the impetus of organising this particular conference. The very fact that

surface science has been chosen as a theme of a Solvay Conference is a testimony to the intense activity going on in this area and its tremendous potentiality.

The articles of this volume have been divided in eight chapters each containing about five articles. Each chapter starts with a somewhat longer article which gives a broad overview and thus sets the stage for the shorter and more specific articles to follow. The titles of the chapters are structure of surfaces, surface science and catalysis, two dimensional physics/phase transitions, scanning tunnel microscopy, chemical reactions at surfaces, solid-solid interfaces and super lattices and finally surface studies with synchrotron radiation. It is neither possible nor necessary to discuss each article individually. An extremely broad range of surfaces have been covered starting from solid surfaces to liquid supported amphiphiles and even surfaces of "hot" superconductors. A wide assortment of ion, electron and photon spectroscopic techniques have been discussed, the only notable omission being the recent nonlinear optical techniques based on ultrashort lasers. Each article is followed by a short discussion and each chapter by a general discussion. In fact, the discussions are often more stimulating than the actual article because they reflect the instant enthusiasm generated among the audience.

In view of the enormous growth of the subject, many workers will obviously find some areas are either omitted or neglected in this volume. Still because of the participation of several leaders in this area the proceedings of this one, like all other Solvay Conferences, will undoubtedly be a landmark in surface science and hence, this volume will be a must for any science and engineering library.

KANKAN BHATTACHARYYA  
*Department of Physical Chemistry,  
Indian Association for the Cultivation of Science,  
Jadavpur, Calcutta-700 032*

**Tests of the Standard Theory of Electroweak Interactions (Springer Tracts in Modern Physics, Vol 112)**

*by Christian Kiesling*

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x+212 pages, 86 figures ; price : DM 118 (Hard cover) ; ISBN 3-540-17513-x

For almost four decades the issue of the weak interactions has greatly influenced the course of high energy physics. In the early phase of this great exercise, till the time neutral currents were experimentally observed, it remained an arena for speculation indulged only by the brave few. The observation of the neutral current effects opened a floodgate : it dawned on everyone gauge theories combined with the Anderson-Higg's mechanism was acceptable ; everyone built his own gauge

theory. That the final choice in the low energy regime, i.e. till about 100 GeV, had to be the  $SU(2)_L \times U(1)$  theory was not clear till the final determination of all the neutral current parameters were made in the later part of the seventies. A short decade of experiments established what in the fifties began as a conjecture on the wider applicability of the gauge concept ; transformed it into what became the 'standard' theory.

Dr Kiesling has made an effort in putting together a part of the experimental results that went into making the  $SU(2)_L \times U(1)$  the standard theory of the weak and the electromagnetic interaction. The book, which runs to about two hundred pages, is divided into nine chapters. The introductory chapter, about two and a half pages, describes various parameters of this review, namely, the material presented on  $e^+e^-$  experiments are from PEP and PETRA, and a few recent ones from TRISTAN. The author presents a new analysis of all the available  $e^+e^-$  data, giving us an improved set of parameters for the standard model. Aside from  $e^+e^-$ , the book contains an analysis of the recent data from  $\nu$ - $e$  scattering, deep-inelastic  $\nu$ -hadron scattering and atomic parity violation. Combined with the results from  $e^+e^-$  a consistent picture for the neutral current couplings of the three generations of quarks and leptons emerges.

Chapter 2 contains a telegraphic review of the standard model, especially the neutral current interactions of the leptons and the quarks. The charged current interactions are discussed only sparingly. In chapter 3 the neutral current sensitive measurements in  $e^+e^-$  are discussed at some length. It also briefly records the radiative corrections, which tend to 'improve the agreement' suggesting the appropriateness of the quantum theory. Chapter 4 deals with the two-fold ambiguity of the neutral current couplings for the electrons and its resolution using the  $e^+e^-$  results. The lepton-quark scattering is dealt with in the 5th part of this volume providing additional information of the weak couplings of the electron and the muon. The discoveries of the  $W^\pm$  and the  $Z$  is the subject of the chapter 6, while the next one, chapter 7, summarizes the results of the neutral current parameters for the three families of fermion. The last part of the book deals with the alternatives to the standard theory, and their implications for the accelerators of the future, with a concluding section of about one and a half page.

The style of presentation is brief, and if a reader wants more, the book contains a reasonable amount of references that include other reviews. The strength of the book lies in its emphasis on the neutral current sector, and though the results are taken from machines which are currently being surpassed, the results presented here are unlikely to change significantly with the coming of the new generation of accelerators.

This also is a major limitation of this book : its concentration on purely the neutral current sector of the standard model. Within this sector it deals insufficiently with issues such as the flavour-changing<sup>1</sup> neutral currents. The hadronic part of the standard model is not given its due share. Even though this has the

merit of making the presentation clear—the author does not have to deal with the hadronic matrix elements, and its attendant ambiguities—it severely limits its readership. The issues that dominated the agenda of the seventies have been discussed extensively. The new interests: the hadronic mixings, CP violations, the neutrinos do not find the place they deserve in a book on the experimental tests of the standard model. The symmetry breaking in the standard model presently exercises the minds of a great many physicists; as the lower bound on the higg's mass continues to move up this issue becomes more acute for the standard model. The data presented on some of these issues are not discussed sufficiently, or their presentation is far too diffuse to be of interest.

The neutral currents have played a key role in the seventies in bringing out the importance of the gauge theories. For the  $SU(2)_L \times U(1)$  theory it was a tortuous climb. In the end it was ironic the discovery of the  $W^\pm$  and the Z was such a foregone conclusion. Dr Kiesling presents a smooth ride over an easy, familiar road. Yet, a major element—the Anderson-Higgs mechanism, crucial for the standard model—remains experimentally so utterly untested.

J CHAKRABARTI

*Department of Theoretical Physics,  
Indian Association for the Cultivation of Science,  
Jadavpur, Calcutta-700 032*

### **Determination of Dose Equivalents from External Radiation Source-Part 2 (ICRU Report No 43)**

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51 pages; price: \$ 17.00

This report is an updated version of the ICRU Report No 39 issued in 1985. The report provides specification of radiation dose equivalents received by exposed individuals when all the conditions of irradiation are known eg. (i) identity of ionising radiation (photons, electron, beta rays, neutrons, their penetrating power etc.) and (ii) additivity of effect in case of mixed fields.

ICRU has specified data of dose equivalent levels received by a 30 cm diameter tissue equivalent sphere of specified composition for environmental monitoring. For individual monitoring, however, the superficial dose equivalent  $H_s(d)$  and penetrating dose equivalent  $H_p(d)$  have been emphasised depending upon the beam size (broad or parallel beam etc.). An attempt is made to rationalise various units actually referred viz. air Kerma, fluence, dose to air/tissue etc. The radiation monitoring instruments and the calibration procedures which are essential in correlating the dose equivalents applicable to individuals have been discussed in detail. Depending upon the penetrating power of external radiation, angular distribution, phantom constitution etc, the ICRU has selected four operational dose

equivalent quantities viz. (i) Ambient dose equivalent, (ii) Directional dose equivalent, (iii) Individual dose equivalent (Penetrating) and (iv) Individual dose equivalent (superficial). Organ dose conversions applicable for male and female individuals in anthropomorphic and 30 cm dia unit density sphere have been presented. Dose equivalents for different tissues for a range of photon and neutron energies of practical significance have been shown in the form of diagrams. The concepts discussed in this report are very useful in judging the conformity of the dose equivalent limits specified by the International Commission on Radiological Protection (ICRP). The report is recommended as an essential reference material to all researchers of radiation protection and dosimetry and libraries of large scale radiation handling installations.

P SUBRAHMANYAM AND M C SUNTA

*Health Physics Division,  
Bhabha Atomic Research Centre,  
Trombay, Bombay-400 085*

### **Complex Differential Geometry and Supermanifolds in Strings and Fields**

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edited by P J M Bongaarts and R Martini

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v+252 pages, price : DM 55 (Hard cover) ; ISBN 3-540-50324-2

This is a collection of lectures delivered at the Scheveningen Conference held in August 1987. The topics were mostly concentrated around complex differential geometry.

A large part of the material presented in the book is aimed at those who are interested in understanding in a rigorous way the extension of Berezin integration to infinite dimensional spaces. This is the subject of Rogers' lectures, who also gives as by product a proof of the Gauss-Bonnet theorem. Batchelor's discussion of graded manifolds and Bryant's discussion of supermanifolds are of related interest. Jarvis' lecture too falls in the same area.

Kähler manifolds receive a lot of attention. Forger discusses mathematical issues. Wess shows how to calculate curvatures. Caldi reviews string compactification and discusses the Bowick-Rajeev approach to strings through the Kähler geometry of loop space.

Sanchez discusses strings in spacetimes where the effects of curvature are not negligible. This article, the one by Caldi and perhaps the one by Wess may be of some interest to strings theorists. The other lectures are for mathematical physicists.

P MITRA

*Theoretical Nuclear Physics Division,  
Saha Institute of Nuclear Physics,  
93, A. P. C. Road, Calcutta-700 009*