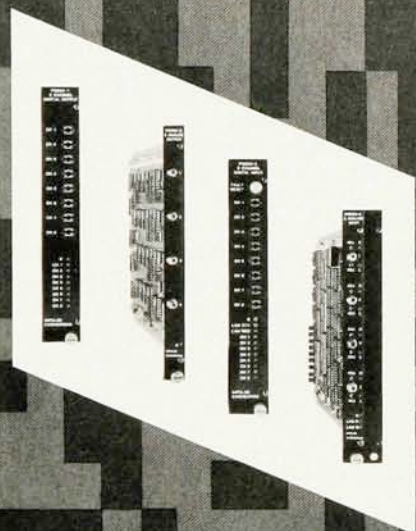


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level of a "duty."

Heilbron believes that this dedication defined Planck as a conservative. But one could also argue that Planck was in part a classical liberal, fashioned like John Stuart Mill. Like Mill, Planck supported the education of women and eschewed universal suffrage. Most importantly, Planck, like Mill, did not adopt Immanuel Kant's categorical imperative as a guide to action, as Heilbron believes that Albert Einstein did. Instead, Planck was guided by an "obligation of conscience." He worked from within the Third Reich, did not speak out against the regime, and did not resign or emigrate. One could act, Planck believed, prior to acquiring full knowledge of circumstances and their outcomes. So although he did not like working with the Nazis, he did so on occasion for what he saw as the higher good of either preserving elements of German life as he knew it or alleviating the suffering of his colleagues. Planck was in this sense guided by a liberal utilitarian ideal. To have left Germany would have meant abandoning these ideals of conscience. In short, Planck, like Mill, believed that under certain circumstances, the ends justified the means.

Heilbron leaves open the question of whether Planck's ideals ennobled or betrayed him. It is easy to read Planck's story as a tragedy. But his sense of duty and responsibility was not as excessive as, say, that of Julien Sorel in Stendhal's *Le Rouge et le Noir*. Sorel's sense of duty was selfish; Planck's, more altruistic. The sense of duty that kept Planck active as he grew older was directed at helping the helpless, a point that is reinforced by the metaphors Heilbron uses to describe Planck's actions: doctor, captain, chaplain. Yet one could also read Planck's story as a success. From his strategic institutional positions he created of himself a malleable symbolic image. The Nazis viewed him as a safe German patriot, and in 1938 the much anticipated institute of physics for the Kaiser Wilhelm Gesellschaft was named the Max-Planck-Institut für Physik. But in 1946 when the British needed a name for the new scientific organization in their zone of occupation in Germany, they chose Planck's to demonstrate that it was not aligned with the Third Reich. The persistence of his image and what it stood for is testimony to the delicate balance he struck between ideals and reality, between thought and action.

This book was originally written as the introduction to a German edition of Planck's essays that grew out of the

Inventory of Sources for Twentieth Century Physics, a project that Heilbron directs at the Office for the History of Science and Technology at Berkeley. Heilbron's book is a testament to the use that can be made of large-scale bibliographical projects. The recent issuance of a paperback edition will greatly facilitate assigning it in class, where it deserves to be read, discussed and debated by students of science, ethics and German history.

Modern Techniques of Surface Science

D. P. Woodruff and
T. A. Delchar

Cambridge U. P., New York,
1986. 453 pp. \$89.50 hc
ISBN 0-521-30602-7

It is quite difficult to find a subfield of condensed matter physics that has had a greater emphasis on the development of techniques than surface physics during the 1970s and early 1980s. In fact this trend began in the early 1960s with the introduction of a commercial version of a low-energy electron diffraction apparatus by the vacuum division of Varian Associates, already then a successful manufacturer of nuclear magnetic resonance and electron spin resonance research apparatus. Thus began a somewhat slow but steadily accelerating increase in the employment of a multitude of techniques in a single ultra-high-vacuum chamber to perform more and more detailed studies of surfaces. Today it is normal to do at least three or four uhv measurements in a single chamber. The reason for there being so many techniques is twofold:

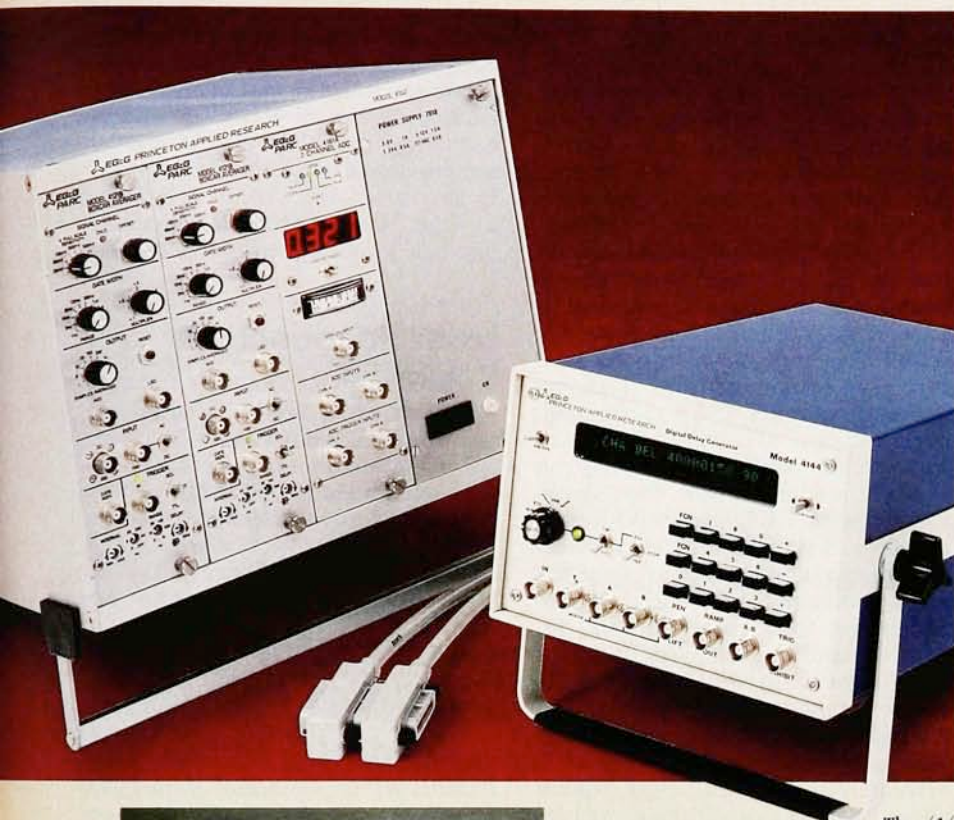
▷ To keep most surfaces atomically intact on a submonolayer scale one must make, characterize and study the surface without exposing it to pressures higher than the uhv range—around 10^{-13} atmospheres.

▷ To derive several complementary results on a single surface it is most reliable to make several measurements *in situ*.

Clearly there has been a need for an authoritative monograph text on the proper utilization of the many uhv surface techniques now available. In fact, this field is so broad that it is commonly called surface science rather than surface physics. *Modern Techniques of Surface Science* is designed to fill such a role, and it does a good job. It follows a succession of similar monographs in recent years: *Fundamentals of Surface and Thin Film Analysis* by L. C. Feldman and

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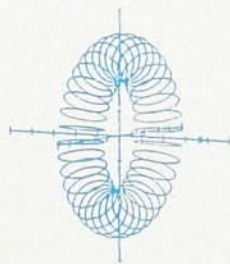
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J. W. Mayer (North Holland, New York, 1986); *Low Energy Electrons and Surface Chemistry* by G. Ertl and J. Küppers (VCH, Weinheim, FRG, 1985); and *Surface Crystallography: An Introduction to Low Energy Electron Diffraction* by L. J. Clarke (Wiley, New York, 1985; reviewed in *PHYSICS TODAY*, April 1987, page 83). The present book by D. P. Woodruff and T. A. Delchar offers a balanced treatment of the various electron and ion spectroscopies, including LEED, Auger electron spectroscopy and photoelectron spectroscopy, which in this book is still artificially separated into ultraviolet and x-ray photoelectron spectroscopy, but has been blurred into a single technique by the widespread use of synchrotron radiation.

Thus Woodruff and Delchar's book will not be all things to all people working in surface science. But it does provide a solid explanation of the physics inherent in the various measurement techniques that it treats. One can certainly find a clearer and more detailed exposition of each of these techniques in other sources; an example is Clarke's book cited above, which treats LEED in great detail. However, it is difficult to find a better concise exposition of the array of the most commonly used uhv surface techniques than these authors discuss. I found the summary on LEED in *Modern Techniques* to be quite useful for some of my own recent studies of stepped surfaces; the discussion of electron analyzers also is extremely good for its length. Other areas that are well done include sputter-depth profiling by Auger and secondary ion emission techniques as well as electron-stimulated desorption. In each case, the authors place their emphasis on the fundamental physics inherent in the measurement process rather than on a recipe for a particular measurement. Thus *Modern Techniques of Surface Science* is well suited to a course on the principles of the measurements, such as an advanced undergraduate or beginning graduate physics lab course. For a course that emphasizes the rules and methodology of surface analysis and is aimed at thin-film materials scientists, the book by Feldman and Mayer is perhaps more suitable.

Perhaps the book that comes closest to Woodruff and Delchar's is the volume by Ertl and Küppers, which is already in its second edition. This book treats LEED and XPS on a level nearly equal to that of Woodruff and Delchar, but is somewhat superior in its treatment of electron energy loss spectroscopy and UPS, at the expense of a nearly complete neglect of the

important techniques of ion scattering and molecular beam methods. Woodruff and Delchar's book is the better choice for a university course on a variety of the important techniques, while that by Ertl and Küppers is probably the better choice for a somewhat more specialized use involving mainly electron methods, such as the short courses now offered in conjunction with many scientific meetings. The strongest recommendation that I can think to give *Modern Techniques of Surface Science* is that I would use it as the text of a course on surface science methods such as the one I taught at AT&T Bell Labs about ten years ago.

J. E. ROWE

AT&T Bell Laboratories
Murray Hill, New Jersey

Laser Handbook, Volume 4

Edited by Malcolm L. Stitch
and Michael Bass
North Holland, New York,
1985. 594 pp. \$141.50 hc
ISBN 0-444-86927-1

Laser Handbook, Volume 5

Edited by Michael Bass
and Malcolm L. Stitch
North Holland, New York,
1985. 692 pp. \$161.00 hc
ISBN 0-444-86934-4

As with previous volumes of the *Laser Handbook*, volumes 4 and 5 include authoritative articles on lasers and key laser-related technologies. (See *PHYSICS TODAY*, December 1980, page 59, for a review of volume 3.) Although both volumes have 1985 publishing dates, their articles present information and concepts that remain timeless. The handbooks provide a unique introduction to the field for the beginner, along with a clear presentation of the scientific and technological context and a comprehensive list of references. Every serious researcher in quantum electronics should have access to these books.

The editors have consistently obtained qualified authors who have carefully written chapters that are well researched and documented. Volume 4 covers free-electron lasers, color center lasers, the ring laser gyro, optical phase conjugation and optical bistability. Volume 5 contains articles on uv lasers and tunable solid-state lasers as well as on the uses of lasers in high-resolution spectroscopy, microfabrication and thermonuclear plasma diagnostics.