us from the common radio to an illuminating tour of Renaissance Italy. The series doesn't digress with distinctions between science and technology; the word "technology" is mentioned only once during this first program.

The second program, "Change," presents science's grand conservation laws of mass and energy. Morrison carefully measures mass changes in a self-contained box of Rube Goldberg devices at San Francisco's Exploratorium and then looks at the constancy of energy in the Tour de France bicycle race. (Incidentally, the number of "jelly donut units" consumed by a Tour de France racer is astounding.)

In the third program, "Mapping," Morrison measures the size of the Earth with a rental van named "Eratosthenes." He takes his attentive viewers through the entire process, and ends with a generalization to mapping data of all kinds, showing how transforming numbers into visual shapes gives new insights.

The fourth program, "Clues," presents a special type of experimentation: reconstructing the past with the evidence of the present. The search begins in Yellowstone National Park and ends with an impressive collection of clues to a new and dramatic hypothesis about the history of the Mediterranean Sea. This program moved the most slowly for me. I am so fond of Morrison's style and insights that I tired of others telling of their experiences.

Everybody accepts that atoms exist. Morrison shows the viewers why this statement makes sense in the fifth program, "Atoms." In one scene Morrison covers a portion of a pond with olive oil and uses the oil spot's size to calculate an upper limit on the size of the molecule. He enlists Julia Child's expert help and dry humor to show that gourmet soufflés and gem diamonds have a lot more in common than appearance would suggest.

The last program in the series, "Doubt," covers the birth and death of ideas and the continued presence of doubt in science. Beginning with light dispersed by a prism, Morrison sets the stage for learning about the composition of stars. He retraces the footsteps of Cecilia Payne in her stellar spectrum research in the 1930s, which concluded that the universe was 90% hydrogen. Next we visit at Kitt Peak with Vera Rubin [see the news story on page 17], whose work casts doubt on Payne's conclusion. Morrison concludes: "If you ask me now what the universe is made of, I would say that right now we just don't know. What I do know is that we will try very hard to find out."

I highly recommend this series. My only concern cannot be answered until the series is broadcast: Will the balance between truth and clarity chosen by the Morrison writing team keep the viewer's interest? I don't have their faith in the general public's desire to work at learning more about how science knows what it knows. In that same vein, I wish the decision-makers would break out of the one-hour format for these programs. Are the academics fixed in the classroom mode, or are the public television people insisting on some programming consistency? Research shows that even with *Nova* a large percentage of viewers change channels by a half-hour into the program. There are plans to make *The Ring of Truth* videotapes available for individual and classroom viewing in the near future.

Random House is publishing a companion book that follows chapter by chapter the six parts of the television series. It includes personal anecdotes on the making of the series.

Numerical Recipes: The Art of Scientific Computing

William H. Press, Brian P. Flannery, Saul A. Teukolsky and William T. Vetterling
818 pp. Cambridge U. P., New York, 1986.
ISBN 0-521-30811-9 $39.50 hardcover

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William H. Press, Brian P. Flannery, Saul A. Teukolsky and William T. Vetterling
ISBN 0-521-30955-7 $19.95 5¼-inch disk
Cambridge U. P., New York, 1986

As a graduate student I took pride in programming all of my subroutines—no "canned" software for me. I also learned from the experience: Although it took me over three solid weeks to complete, the nonlinear least-squares fitting routine I developed taught me the theory behind the fitting process. This understanding was in striking contrast to what those who blindly used canned packages learned. It wasn't until my routine started to diverge as it tried to separate a Lorentzian contaminating component to give a Gaussian spectral line shape that I started to wonder: Wasn't there some merit in using software packages despite not knowing how the routines actually worked?

Numerical Recipes by William H. Press, Brian P. Flannery, Saul A. Teukolsky and William T. Vetterling offers the perfect compromise between the desire to write your own software and the necessity to ensure that the programs you use actually work. In a chapter on modeling data, the authors explain nonlinear least-squares fitting by minimization of chi squared using the method of steepest descent, motivate the Levenberg–Marquardt method that prevents the divergence problem I encountered, and derive the confidence intervals of the fitted parameters by referring to the chi-squared surface. A subroutine that implements the numerical method described accompanies each subchapter. After reading the text, I had a sufficient understanding of the theory behind the numerical method and the way it is implemented to feel comfortable using the book's subroutines "out of the can."

Numerical Recipes describes the theory and practice behind numerical methods in 16 different areas together with over 200 subroutines in FORTRAN and PASCAL that implement the numerical methods described. The subroutines are available in machine-readable form (IBM PC or Macintosh) as a separate purchase. The text itself is written in pleasantly informal prose (complete with a few jokes), which makes the book fun to read despite the massive amount of information in its 818 pages. But what is truly impressive is the insight the authors offer throughout into various aspects of the numerical methods presented.

This book can be used as a supplementary text to extend a course in mathematical methods to include computer applications. It would be difficult, however, to use *Numerical Recipes* as a stand-alone text in any one field. The mathematical analysis, although complete, needs to be supplemented by more encompassing descriptions for those students unfamiliar with a particular topic. For example, in only 70 pages on Fourier-transform spectral methods the book covers discrete data, the fast Fourier transform, multidi-

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Heterojunction Band Discontinuities: Physics and Device Applications

edited by **Federico Capasso** *and* **Giorgio Margaritondo**

1987 about 620 pages
Price: US $175.50/Dfl.360.00
ISBN 0-444-87060-1

For many years, heterojunctions have been one of the fundamental research areas of solid-state science. The interest in this topic is stimulated by the wide application of heterojunctions in microelectronics. Devices such as heterojunctions bipolar transistors, lasers and FETs, already have a significant technological impact. This impact is likely to increase in the future, and heterojunction devices promise to play a revolutionary role in the microelectronics industry. Up until now no comprehensive presentation was available for the results obtained after the 1970s and this book will eliminate this gap.

The book describes the properties of semiconductor heterojunctions, and their applications in novel devices. Particular emphasis is given to the interface band discontinuities. The content is divided into 2 parts. Part one illustrates the different methods for measuring band lineups and the current theoretical models to predict them. The second part discusses the role of the band discontinuities in determining the behavior and performance of heterojunction devices. In particular, it discusses the methods to develop novel devices by controlling the band lineup properties.

Written by top experts in the field this book will be welcomed by engineers, physicists and students interested in modern microelectronics.

Contents: Introduction. **Part I: Band Discontinuities: Measurements and Theory.** 1. The theory of heterojunction band lineups *(J. Tersoff)*. 2. The problem of heterojunction band discontinuities *(G. Margaritondo)*. 3. Trends in semiconductor heterojunctions *(A.D. Katnani)*. 4. Interface contributions to heterojunction band discontinuities: X-ray photoemission spectroscopy investigations *(R.W. Grant, E.A. Kraut, J.R. Waldrop and S.P. Kowalczyk)*. 5. Measurements of band discontinuities using optical techniques *(G. Duggan)*. 6. The direct optical determination of GaAs/ $Al_xGa_{1-x}As$ valence-band offsets *(D.J. Wolford, T.F. Keuch and M. Jaros)*. 7. Band discontinuities in HgTe-CdTe superlattices *(J.P. Faurie and Y. Guldner)*. 8. Measurement of energy band offsets using capacitance and current measurement techniques *(S.R. Forrest)*. 9. Measurement of band offsets by space charge spectroscopy *(D.V. Lang)*. **Part II: Physics of Heterojunction Devices: Band-gap Engineering.** 10. Band-gap engineering and interface engineering: from graded-gap structures to tunable band discontinuities *(F. Capasso)*. 11. Modern aspects of heterojunction transport theory *(K. Hess and G.J. Iafrate)*. 12. Hot-electron injection and resonant-tunneling heterojunction devices *(S. Luryi)*. 13. Physics of quantum well lasers *(N.K. Dutta)*. 14. Physics and applications of excitons confined in semiconductor quantum wells *(D.S. Chemla and D.A.B. Miller)*. Author Index. Subject Index.

Enrico Fermi International Summer School of Physics, Volume 98

The Evolution of the Small Bodies of the Solar System

edited by **M. Fulchignoni** *and* **L. Kresák**

1987 xii + 308 pages
Price: US $90.25/Dfl.185.00
Subscription Price: US $76.50/Dfl.157.25
ISBN 0-444-87035-0

Apart from the records of spacecraft encounters with micrometeoroids, space research did not yet provide us with direct *in situ* exploration of the interplanetary objects. However, just for the next decade several missions to smaller solar-system objects are under consideration, the Vega, Giotto and Suisei missions to comet Halley representing the first steps in this direction. This Enrico Fermi course was intended to review our current knowledge of these obejcts - based on ground-based observations, laboratory experiments, numerical computations and theoretical considerations - at the milestone set by the beginning of their exploration by spacecraft missions. One of the fundamental problems still awaiting elucidation is the role of the small bodies in the origin and evolution of the solar system, including that of the Earth and of the life on it.

Contents: Introduction *(M. Fulchignoni and L. Kresák)*. **Part I - Overview.** Introduction: history, definitions, nomenclature *(B.G. Marsden)*. The systems of interplanetary objects *(L. Kresák)*. Formation of planetesimals *(A. Coradini, G. Magni and C. Federico)*. **Part II - Asteroids.** Dynamics of asteroids *(H. Scholl)*. Physics, chemistry and collisional evolution of the asteroids *(C.R. Chapman)*. Physical and statistical interpretations of asteroid lightcurves *(V. Zappalà)*. Properties of asteroids from observations and laboratory simulations *(M. Fulchignoni)*. Physical properties of asteroids from radar observations *(S.J. Ostro)*. Near-earth asteroid searches: status and prospects *(E.F. Helin)*. **Part III - Comets.** Comets, and comet Halley 1982-1985 *(J. Rahe, H. Fechtig and R.L. Newburn Jr.)*. The Oort cloud and its galactic environment *(H. Scholl)*. Dynamics of comets *(B.G. Marsden)*. Perturbation computations and numerical modelling experiments *(A. Carusi, E. Perozzi and G.B. Valsecchi)*. Aging of comets and their evolution into asteroids *(L. Kresák)*. On the origin of comets *(V.S. Safronov)*. **Part IV - Meteoroids, Small Satellites and Rings.** Physics and orbits of meteoroids *(B.A. Lindblad)*. The motion of interplanetary dust *(J.A. Burns)*. Small satellites *(P. Farinella)*. Rings around planets *(J.A. Burns)*.

Simulation of Liquids and Solids

Molecular Dynamics and Monte Carlo Methods in Statistical Mechanics

edited by **G. Ciccotti, D. Frenkel** *and* **I.R. McDonald**

1987 about 490 pages
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This book is a collection of key reprints of papers on the computer simulation of statistical-mechanical systems, introduced and commented upon by the editors.

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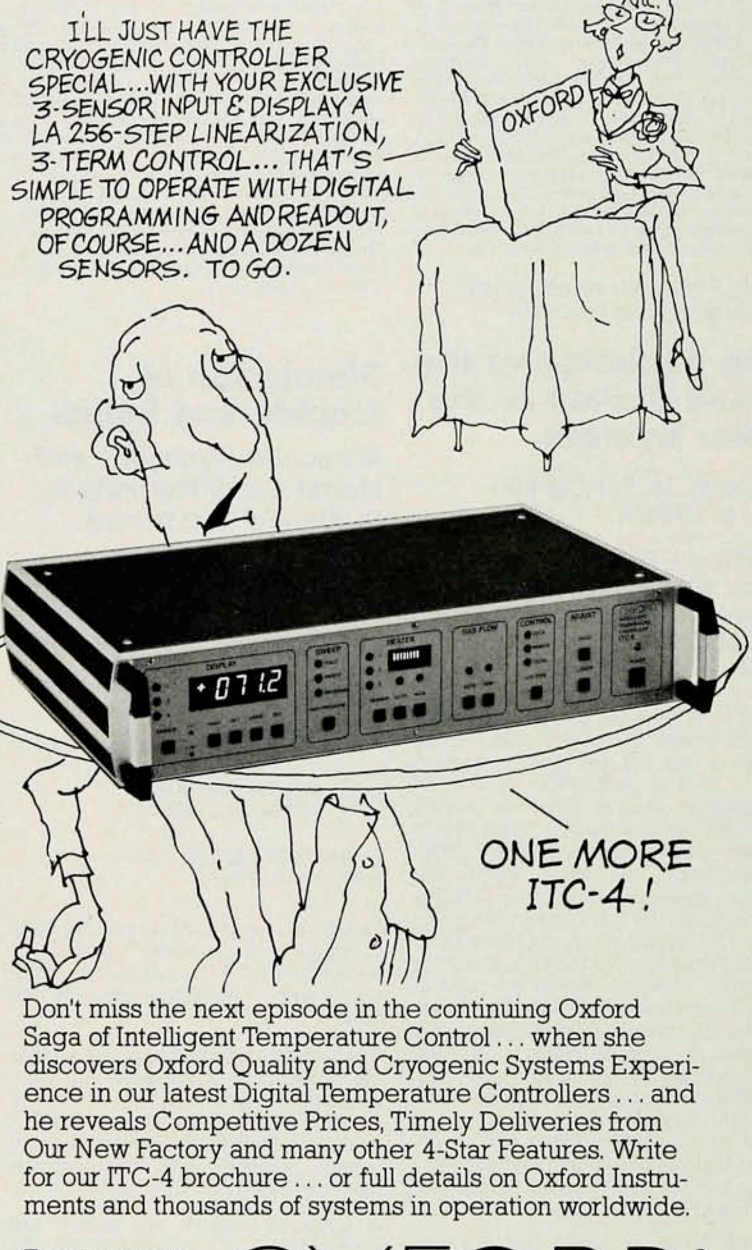

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mensional FFT, convolution and deconvolution, correlation and autocorrelation, optimal filtering, power spectra, maximum entropy, digital filtering and linear prediction. The notation and explanations are excellent (giving me at last an understanding of the optimized FFT algorithm), but a student cannot rely on such terse descriptions for an understanding of this complicated material.

Because of both its style and thoroughness, *Numerical Recipes* is *the* reference text for anyone using computers to do mathematical analysis. Its elegance and the breadth of topics that this remarkable book covers make it truly enjoyable.

PETER B. KRAMER
Special Biological Projects
Johnson & Johnson

Introduction to Percolation Theory

Dietrich Stauffer
124 pp. Taylor and Francis, Philadelphia, 1985.
ISBN 0-85066-315-6 $22.00 paper

If each site of a large lattice is occupied randomly with probability p, groups of neighboring occupied sites are formed. The mean size of these clusters depends on p. Above a critical concentration p_c an "infinite" cluster occurs that spans the system from one end to the other. The physics of the system can be very different below and above p_c. For example, if occupied nearest neighbor sites are connected by metallic bonds the system behaves as an insulator below p_c, but has metallic properties above p_c. Percolation theory investigates the critical behavior of this purely geometric phase transition, the "percolation transition." Historically, percolation theory dates back to the early work of Paul Flory and Walter Stockmayer on the polymerization process. Since then the advances in phase transition theory, as well as the development of large-scale computers, have tremendously stimulated research on percolation systems. Today percolation theory has become a very active field; the applications range from the spread of epidemics and the gelation of branched polymers to transport phenomena in porous materials, doped semiconductors and mixed ionic conductors.

Dietrich Stauffer has made major contributions to this multidisciplinary field and his book represents an easy, accessible and well-organized introduction to the subject. The book starts with two appealing applications of modern percolation theory: forest fires and diffusion in disordered media. In