

BOOKSHELF

The Physics of Particle Detection by Dan Green, Cambridge Monographs on Particle Physics, Nuclear Physics and Cosmology, 361 pp, 0 521 66226 5, £65/\$100.

The 12th volume of the *Cambridge Monograph Series on Particle Physics, Nuclear Physics and Cosmology* again concerns particle detectors. In this case the main emphasis is not on the construction of these devices but rather on the underlying physics.

Dan Green has worked in particle detection and identification in many laboratories – from Stony Brook to the ISR, and from Fermilab to the preparation of LHC experiments.

The book begins with a recollection of the size and energy scales involved in different physical processes. The order of magnitude of atomic and nuclear processes is explained by fundamental physics principles and illustrated using everyday examples. The introductory chapter provides the basic numerical data needed to characterize the interaction probabilities of different particle species.

The main body of the book is subdivided into non-destructive measurements, such as time, velocity, ionization, position and momentum measurements, where the interaction of the incident particle transfers very little energy to the detecting medium; and destructive techniques, such as electron and hadron calorimetry, where the lost energy is a significant fraction of the kinetic energy carried by the particle. Characteristic features of different detectors are partially derived using dimensional arguments. For practical oper-

ations, rules of thumb are provided.

All of the methods presented aim to identify the incident particles, a goal that can often only be achieved by combining different techniques. Such a complete set of measurements is presented in the final chapter, using the example of a general-purpose detector.

The author successfully explains the operation of each type of detector from first principles, without rigorously deriving the theoretical background. Readers interested in the theory are referred to the appendices.

The presented applications of particle detectors are illustrated with many numerical examples, which clearly show that Green has “hands-on” experience in constructing and optimizing these devices. Some of the home experiments, however, like deflecting the electron beam of a TV set with a permanent magnet, should be treated with caution. This is fine on a black-and-white screen but can produce irreversible damage on a colour TV.

Various interaction processes are visualized using bubble and cloud chamber events, although these old-fashioned detectors are not described in detail. There is no mention of nuclear emulsions, and very little on neutrino interactions, even though the search for neutrino oscillations and the first direct observation of the tau neutrino have demonstrated that exotic and rare processes can breathe new life into old technologies. There is certainly some demand for the basics of neutrino interactions from the growing number of experiments in astroparticle physics.

Many of the instructive diagrams are taken, with good reason, from the relevant chapters of the excellent *Review of Particle Physics* by the Particle Data Group.

This book presents an attractive and comprehensive introduction to the physics of particle detection. The reader is guided by practical examples from everyday experience. It will be of interest to physics students and will also be a valuable reference for the experienced detector builder. The design of actual particle detectors may be subject to change over the coming years, but the underlying physics principles will stay the same. The book will thus remain useful for some time. The publishers should also be encouraged to issue an affordable paperback edition.

Claus Grupen, Siegen.

Books received

Cosmic Strings and Other Topological Defects by Alexander Vilenkin and E Paul S Shellard, Cambridge Monographs on Mathematical Physics, 0 5216544769 (pbk), £75/\$115.

Now in paperback, this comprehensive textbook looks at a fruitful area of inflationary cosmological dynamics.

Knots and Feynman Diagrams by Dirk Kreimer, Cambridge Lecture Notes in Physics, Cambridge University Press 0 521587611 (pbk), £20.95/\$34.95.

This book should be useful for theoretical physicists and for mathematicians.

NEW PRODUCTS

Fast isotope detection and identification

Berkeley Nucleonics has developed the portable Model 935 SAM that will detect, identify and quantify mixed isotopes in real time. A new concept in spectroscopy utilizes a sodium iodide detector and a patented process to identify mixed isotopes from a large library of over 90 isotopes within 1 s. An additional 1 s of processing confirms the initial result. Confidence levels of more than 97% are achieved, even when weak sources are below background levels of intensity. Sensitive nuclear materials, medical and industrial isotopes are identified, even in the presence of high background.

Time-slice technology coupled with background subtraction will quickly identify

contraband moving through a checkpoint, even when masking is attempted by another isotope.

See “<http://www.berkeleynucleonics.com>”.

Programmable precision pulse generator

The Model PB-5 from Berkeley Nucleonics provides unprecedented performance in a precision pulse generator. It includes a full-featured, highly flexible ramp generator and complete programmability. The PB-5 surpasses or equals all existing designs in the important performance areas of resolution, linearity and stability. The pulse repetition rates, which are variable over a broad range, go up to 0.5 MHz. The higher rates are required when testing for MCA and PHA linearity because of the large number of data points required for a statisti-

cally valid test. The built-in ramp generator allows control of ramp duration, the number of ramps and the ramp limits.

See “<http://www.berkeleynucleonics.com>”.

PC for photon counting

Electron Tubes has launched a new PC interface that can respond directly to TTL pulses without needing an internal card. Although specifically designed for all Electron Tubes TTL photon-counting packages and TTL amplifier discriminators, it can be used with most sources of TTL pulses. The CT2 module connects to a PC and is supplied with software that allows measurements to be made immediately.

See “<http://www.electrontubes.com>”.

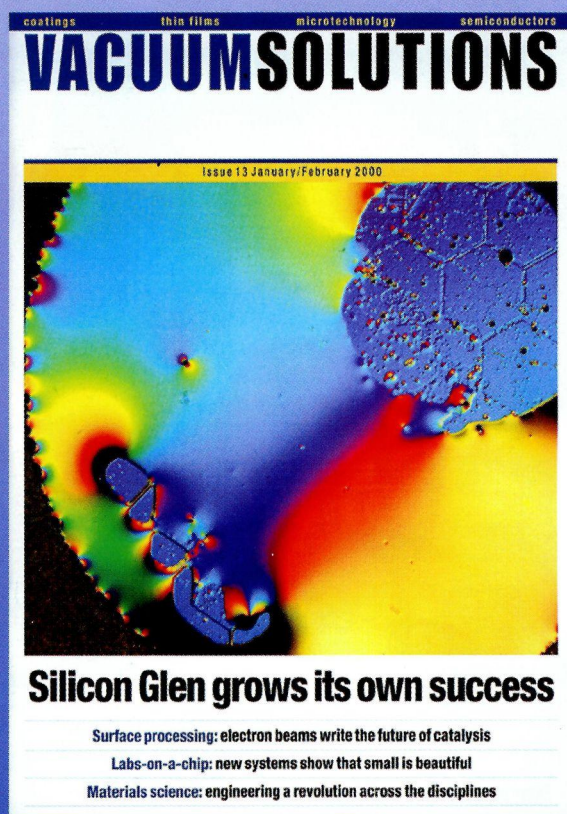
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