PHOTOMULTIPLIER TUBES
principles & applications

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FOREWORD

For more than sixty years, photomultipliers have been used to detect low-energy photons in the UV to visible range, high-energy photons (X-rays and gamma rays) and ionizing particles using scintillators. Today, the photomultiplier tube remains unequalled in light detection in all but a few specialized areas.

The photomultiplier's continuing superiority stems from three main features:
— large sensing area
— ultra-fast response and excellent timing performance
— high gain and low noise
The last two give the photomultiplier an exceptionally high gain x bandwidth product.

For detecting light from UV to visible wavelengths, the photomultiplier has so far successfully met the challenges of solid-state light detectors such as the silicon photodiode and the silicon avalanche photodiode. For detecting high-energy photons or ionizing particles, the photomultiplier remains widely preferred. And in large-area detectors, the availability of scintillating fibres is again favouring the use of the photomultiplier as an alternative to the slower multi-wire proportional counter.

To meet today's increasingly stringent demands in nuclear imaging, existing photomultiplier designs are constantly being refined. Moreover, for the analytical instruments and physics markets, completely new technologies have been developed such as the foil dynode (plus its derivative the metal dynode) that is the key to the low-crosstalk of modern multi-channel photomultipliers. And for large detectors for physics research, the mesh dynode has been developed for operation in multi-tesla axial fields. Recent developments include very large hemispherical photomultipliers with excellent time response for cosmic ray experiments, and ultra-fast tubes with a time jitter of less half a nanosecond.

This book describes the operating principles of the photomultiplier tube and surveys its many diverse applications, such as medical imaging, nuclear and high-energy physics including the latest cosmic-ray research aimed at opening new windows on the universe.

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