# Preface

This book originates from lectures given to undergraduate and graduate students over several academic years. Students questions and interests have driven the need to make systematic and comprehensive (we hope) the presentation of the basic principles of a field which is under continuous development. The physics principles of radiation interaction with matter are introduced as a general knowledge background needed to understand how radiation can be detected. Technical developments are making available detectors and detecting media of increasing complexity. Historically, the first nuclear particle detectors (like those based on $X$-rays films) were very simple. In the course of time, the detectors have become more and more sophisticated. In addition, complex systems of detectors generally targeting a wide range of physics goals led to large experimental apparata often constituted by several sub-detectors. These large detector assemblies require dedicated methods of reconstruction and analysis of data to decrease the experimental errors. Therefore, both detectors and detection methods are fields of developments and investigations. To be detected, radiation and particles have to interact during their passage through a medium. Therefore, the first chapters are dealing with collision and radiation energy losses by charged particles, photon absorption and nuclear collision in matter. A particular attention has been given to the discussion of both the energy loss and the energy straggling, and the absorption of photons and hadrons in media. The second part of the book covers the particle energy determination, solid state, wire chambers and droplet detectors, and applications in the field of nuclear medicine. Detailed examples are presented which illustrate the operation of the various types of detectors, and help the understanding of the optimization factors.

We are grateful for the help received from individuals and groups of students in writing this book. The chapters on electromagnetic and hadron interactions in matter have taken advantage of discussions with undergrad-

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