Preface

*Health Physics in the 21st Century* is intended to bridge the gap between existing health physics textbooks and reference materials needed by a practicing health physicist as the twenty-first century progresses. This material necessarily encompasses emerging radiation-generating technologies, advances in existing technology, and applications of existing technology to new areas. As the twenty-first century unfolds, this gap will rapidly broaden. It is unlikely that the present text will be a definitive health physics work, but it will hopefully encourage other authors to present material that will advance the field and prepare health physicists for upcoming challenges.

The topics selected for inclusion in this text are based on the author’s judgment of areas that merit presentation and development. Some areas involve incremental steps in existing health physics knowledge including aspects of Generation III and IV fission reactors. Other topics, such as deep space missions and muon colliders, require the development of concepts that will be relatively new to some health physicists. Additional knowledge regarding the nature and application of fundamental interactions is also required. For example, health physicists are currently trained to disregard neutrino effective dose values owing to their trivial magnitude. Although this is certainly true for fission reactors and twentieth-century and early twenty-first century accelerators, it is not a valid assumption as muon energies reach the PeV energy range.

Additional skill development is needed in areas such as the planetary and deep space radiation environment with the need to apply special and general relativity to health physics problems. The possibility also exists for the alteration of fundamental radiological properties such as the gamma-ray energy emitted during a nuclear transition. The modification of established physical phenomena is primarily of interest to theoretical physicists, but it could become an important consideration in health physics evaluations of the deep space radiation environment as well. Spatial abnormalities, such as the *Pioneer Anomaly*, may be an early indication of the complexities of deep space travel that could have a profound impact on health physics evaluations.

As a means to facilitate the transition to new concepts, over 200 problems with solutions are provided. These problems are an integral part of the text, and they serve...
to integrate and amplify the chapter and appendix information. Students are encouraged to work carefully on each problem to maximize the benefit of this text.

If in the first few years of the twentieth century a health physicist were to have written the textbook *Health Physics in the 20th Century*, the individual would have invariably missed numerous developments and would have failed to predict a wide range of phenomena that emerged to dominate the twentieth-century field. However, it is the author’s view that such an effort would have been worthwhile because it would serve to stimulate the field and prompt additional publications to correct the incorrect perceptions advanced by *Health Physics in the 20th Century*. This book is written with a similar desire.

This text is primarily intended for upper level undergraduate and graduate health physics courses. *Health Physics in the 21st Century* is also written for advanced undergraduate and graduate science and engineering courses. It will also be a useful reference for scientists and engineers participating in the evolving technologies, including Generation IV fission reactors, fusion technology, advanced accelerators, light sources, free-electron lasers, and space technology and exploration. The author also hopes that this text will be used by the various health physics certification boards (e.g., the American Board of Health Physics) in developing examination questions.

The success of *Health Physics in the 21st Century* will be judged by history. It is hoped that this text will be worthy of at least a footnote by a future author when she writes *Health Physics in the 22nd Century*.

I wish the health physicists of the twenty-first century well in upholding the highest traditions of the field that have been advanced by the founders of the various national and international Health Physics and Radiation Protection Societies. *Bonne chance*.

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