

1. Record Nr.	UNINA9910841857903321
Autore	Krieger Martin H.
Titolo	Primes and Particles : Mathematics, Mathematical Physics, Physics / / by Martin H. Krieger
Pubbl/distr/stampa	Cham : , : Springer Nature Switzerland : , : Imprint : Birkhäuser, , 2024
ISBN	9783031497766
Edizione	[1st ed. 2024.]
Descrizione fisica	1 online resource (109 pages)
Disciplina	530.15
Soggetti	Mathematics - Philosophy Physics - Philosophy Mathematical physics Philosophy of Mathematics Philosophy of Physics Mathematical Physics Theoretical, Mathematical and Computational Physics
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Intro -- Preface -- Witten on Mathematics and Physics -- Acknowledgments -- Contents -- About the Author -- Chapter 1: Introduction -- 1.1 Our Examples -- 1.2 The Ising Model in Two Dimensions: An Identity in a Manifold Presentation of Profiles -- 1.3 Dedekind-Weber -- 1.4 The Stability of Matter -- 1.5 Packaging Functions, Riemann Zeta Function -- Appendix -- A.1 Subheads of Dyson and Lenard's 1967-1968 Papers on the Stability of Matter -- A.2 The ``Numbered'' Flow of Theorems and Lemmas of the Dyson-Lenard Proof -- A.2.1 Theorems -- A.2.2 Lemmas -- A.3 The Flow of the Dyson-Lenard Proof, as Lemmas Hanging from a Tree of Theorems -- A.4 The Structure of Lieb and Thirring's Argument in ``Bound for the Kinetic Energy of Fermions Which Proves the Stability of ... -- A.5 Subheads and Subtopics of C.N. Yang, ``The Spontaneous Magnetization [M] of a Two-Dimensional Ising Model'' (1952) -- Chapter 2: Why Mathematical Physics? -- 2.1 The Big Ideas -- 2.2 Ising in Two Dimensions: An Identity in a Manifold Presentation of Profiles -- 2.3 Ising Susceptibility -- 2.4 Where's the Physics? -- 2.5 Dedekind-

Weber and Reciprocity -- Chapter 3: Learning from Newton -- 3.1 Lessons from Newton -- 3.2 Creativity -- 3.3 Mathematical Physics -- 3.4 Influence -- 3.5 The Apocalypse -- Chapter 4: Primes and Particles -- 4.1 The Thermodynamics and Music of the Numbers -- 4.2 A Potted History -- 4.3 Symmetry and Orderliness -- 4.4 Coherence -- 4.5 Decomposition -- 4.6 Hierarchy -- 4.7 Adding-Up and Linearity -- 4.8 Divisibility -- Chapter 5: So Far and in Prospect -- 5.1 Kinship and Particles -- 5.2 Primes and Particles -- 5.3 Effective Field Theory -- 5.4 Packaging Functions Connecting Spectra to Surprising Symmetries -- 5.4.1 Multiple Ways of Computing Packaging Functions, Revealing Other Symmetries in the Spectrum. 5.4.2 Algebraic, Arithmetic, Analytic: An Analogy of Analogies: Syzygies -- 5.5 The Right Particles or Parts -- 5.5.1 Fermions -- Chapter 6: Creation: When Something Appears Out of Nothing -- 6.1 Points -- 6.2 Vacua -- 6.3 Mathematical Sleight of Hand: So to Speak -- 6.4 Points, Again -- Chapter 7: Packaging ``Spectra'' (as in Partition Functions and L-Functions) to Reveal Symmetries in Nature and in Numbers -- 7.1 Geometry and Harmony -- 7.2 Parts and the Right Parts -- 7.3 Plenitude -- 7.4 Manifold Perspectives or Profiles -- 7.5 Layers -- 7.6 Fermions -- 7.7 A Concrete Realization of the Dedekind-Weber Program -- 7.8 Another Multiplicity -- Chapter 8: Legerdemain in Mathematical Physics: Structure, ``Tricks, '' and Lacunae in Derivations of the Partition Function of... -- 8.1 Examples -- 8.2 The Two-Dimensional Ising Model -- 8.2.1 The Meaning of the Numbers -- 8.2.2 An Amazing Invention -- 8.2.3 Employing a Device of the Past -- 8.2.4 Where Did That Come From? -- 8.2.5 ``A Useful Identity, Easily Seen'' -- 8.2.6 Signposting Along the Way -- 8.2.7 ``Further Details of Simplifications Like This Will Not Be Reported Here'' -- 8.3 The Stability of Matter -- 8.3.1 ``Hacking Through A Forest Of Inequalities'' -- 8.3.2 ``Thomas-Fermi Atoms Do Not Bind'' -- 8.3.3 ``An Elementary Identity, Fourier Analysts Are Quite Familiar with It. Gruesome Details, Nasty and Ghastly Calculations,... -- 8.4 Genealogy Reconsidered -- Chapter 9: Mathematical Physics -- Bibliography -- Index.

Sommario/riassunto

Many philosophers, physicists, and mathematicians have wondered about the remarkable relationship between mathematics with its abstract, pure, independent structures on one side, and the wilderness of natural phenomena on the other. Famously, Wigner found the "effectiveness" of mathematics in defining and supporting physical theories to be unreasonable, for how incredibly well it worked. Why, in fact, should these mathematical structures be so well-fitting, and even heuristic in the scientific exploration and discovery of nature? This book argues that the effectiveness of mathematics in physics is reasonable. The author builds on useful analogies of prime numbers and elementary particles, elementary structure kinship and the structure of systems of particles, spectra and symmetries, and for example, mathematical limits and physical situations. The two-dimensional Ising model of a permanent magnet and the proofs of the stability of everyday matter exemplify such effectiveness, and the power of rigorous mathematical physics. Newton is our original model, with Galileo earlier suggesting that mathematics is the language of Nature.
