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Nota di contenuto	Anomalous Transport; Contents; Preface; List of Contributors; 1 In Memoriam: Radu Balescu; 1.1 Radu Balescu's Abstract for the Conference on Anomalous Transport in Bad Honnef; 1.2 The Scientific Career of Radu Balescu by Boris Weyssow; 1.3 My Memory of Radu Balescu by Angelo Vulpiani; 1.4 My Memory of Radu Balescu by Francesco Mainardi; 1.5 In Memoriam: Radu Balescu by Raul Sanchez; 1.6 Remembering Radu Balescu by Diego del-Castillo-Negrete; References; Part I Fractional Calculus and Stochastic Theory; Introduction to Part I; 2 Threefold Introduction to Fractional Derivatives 2.1 Historical Introduction to Fractional Derivatives 2.1.1 Leibniz; 2.1.2 Euler; 2.1.3 Paradoxa and Problems; 2.1.4 Liouville; 2.1.5 Fourier; 2.1.6 Grunwald; 2.1.7 Riemann; 2.2 Mathematical Introduction to Fractional Derivatives; 2.2.1 Fractional Integrals; 2.2.2 Fractional Derivatives; 2.2.3 Eigenfunctions; 2.3 Physical Introduction to Fractional Derivatives; 2.3.1 Basic Questions; 2.3.2 Fractional Space; 2.3.3 Fractional Time; 2.3.4 Identification of from Models; Appendix A: Tables; Appendix B:

Function Spaces; Appendix C: Distributions; References

3 Random Processes with Infinite Moments 3.1 St. Petersburg Paradox; 3.2 Holtsmark Distribution; 3.3 Activated Hopping; 3.4 Deterministic Examples of Long Tail Distributions; 3.5 Random Walks and Master Equations; 3.6 Random Walks and Upper Critical Dimensions; 3.7 Weierstrass Random Walk; 3.8 Fractal Time Random Walk; 3.9 Coupled Memory Random Walks: Diffusion or Telegraph Equation; 3.10 Random Walks: Coupled Memory Levy Walks: Turbulent and Relativistic; References; 4 Continuous Time Random Walk, Mittag-Leffler Waiting Time and Fractional Diffusion: Mathematical Aspects; 4.1 Introduction 4.2 An Outline of the Gnedenko-Kovalenko Theory of Thinning 4.3 The Continuous Time Random Walk (CTRW); 4.4 Manipulations: Rescaling and Respeeding; 4.5 Power Laws and Asymptotic Universality of the Mittag-Leffler Waiting-Time Density; 4.6 Passage to the Diffusion Limit in Space; 4.7 The Time-Fractional Drift Process; 4.8 Conclusions; Appendix A: The Time-Fractional Derivatives; Appendix B: The Space-Fractional Derivatives; Appendix C: The Mittag-Leffler Function; References; 5 Introduction to the Theory of Levy Flights; 5.1 Levy Stable Distributions; 5.2 Underlying Random Walk Processes 5.3 Space Fractional Fokker-Planck Equation 5.4 Free Levy Flights in the Semi-Infinite Domain; 5.4.1 First Passage Time and Leapover Properties; 5.4.2 Levy Flights and the Method of Images; 5.5 Levy Flights in External Fields; 5.5.1 Reminder: Stationary Solution of the Fokker-Planck Equation, $\alpha = 2$; 5.5.2 Levy Flights in an Harmonic Potential; 5.5.3 Levy Flights in a Quartic Potential, $1 < \alpha < 2$; 5.5.4 Levy Flights in a More General Potential Well; 5.5.5 Kramers Problem for Levy Flights; 5.6 Levy Flights in Phase Space; 5.6.1 Langevin Description; 5.6.2 Velocity-Fractional Klein-Kramers Equation 5.6.3 Space-Homogeneous Relaxation in Absence of External Field

Sommario/riassunto

This multi-author reference work provides a unique introduction to the currently emerging, highly interdisciplinary field of those transport processes that cannot be described by using standard methods of statistical mechanics. It comprehensively summarizes topics ranging from mathematical foundations of anomalous dynamics to the most recent experiments in this field. In so doing, this monograph extracts and emphasizes common principles and methods from many different disciplines while providing up-to-date coverage of this new field of research, considering such diverse applications as plasma