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3. Ice surface environments 3.1 Ice shelves; 3.1.1 Introduction; 3.1.2 Biology of ice shelf lakes; 3.2 Glaciers and ice sheets; 3.2.1 Supraglacial habitats; 3.2.2 Spatial variations in the biota in supraglacial habitats; 3.2.3 Cryoconite; 3.2.4 Carbon cycling and biological production; 3.2.5 Other debris habitats, including the ice margin; 4. Sea and lake ice; 4.1 Sea ice; 4.1.1 Introduction; 4.1.2 Adaptations; 4.1.3 Community structure and production; 4.2 Lake ice; 4.2.1 Introduction; 4.2.2 Community structure and production; 5. Subglacial environments; 5.1 Introduction
5.2 Biology of subglacial environments 5.2.1 Wet-based glaciers; 5.2.2 Blood Falls; 5.3 Life in glacial ice; 5.4 Subglacial lakes; 5.5 Lake Vida; 6. Astrobiology; 6.1 Introduction; 6.2 Extraterrestrial cryospheric environments; 6.2.1 Mars; 6.2.2 Europa: a Jovian moon; 6.2.3 Enceladus: a small Saturnian moon; 6.2.4 Titan: a large Saturnian moon; 6.3 Weaknesses of terrestrial analogues for extraterrestrial cryospheric environments; 7. Future directions; 7.1 Introduction; 7.2 Priority field sites for future research; 7.3 Remote sensing development; 7.4 Sensor technology; 7.5 Modelling
7.6 Molecular biology7.7 Elucidating the evolution of extremophile communities; Glossary; A; B; C; D; E; F; H; I; K; L; M; N; O; P; R; S; T; U; V; W; References; Index; A; B; C; D; E; F; G; H; I; J; K; L; M; N; O; P; Q; R; S; T; U; V; W; X; Z

Sommario/riassunto

Snow and ice environments support significant biological activity, yet the biological importance of some of these habitats, such as glaciers, has only recently gained appreciation. Collectively, these ecosystems form a significant part of the cryosphere, most of which is situated at high latitudes. These ice environments are important sentinels of climate change since the polar regions are presently undergoing the highest rates of climate warming, resulting in very marked changes in the extent of ice caps, glaciers, and the sea ice. Glacial systems are also regarded as an analogue for astrobiology

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Nota di contenuto	Contents; Introduction and Overview J. V. Jose; References; 1. Early Work on Defect Driven Phase Transitions J. M. Kosterlitz and D. J. Thouless; 1.1. Introduction; 1.2. One-Dimensional Ising Model; 1.3. Vortex Driven Transitions in Superfluid Films; 1.4. Other Systems with Defect-Mediated Transitions; 1.4.1. Two-dimensional magnetic systems; 1.4.2. Isotropic Heisenberg model; 1.4.3. Two-dimensional Coulomb plasma; 1.4.4. Two-dimensional crystals; 1.4.5. Thin film superconductors; 1.5. Scaling Theory; 1.6. Scaling Theory in Analogous Systems 1.6.1. Duality and the roughening of crystal facets1.6.2. Substrate effects; 1.6.3. Melting of a 2D crystal; 1.6.4. Substrate effects on 2D melting; 1.6.5. Scaling in superconducting films; 1.7. Experiments and Simulation; 1.7.1. Measurements on superfluid films; 1.7.2. Experimental measurements on 2D melting; 1.7.3. Simulations of 2D melting; References; 2. Duality, Gauge Symmetries, Renormalization Groups and the BKT Transition J. V. Jose; 2.1. Introduction; 2.2. Duality Transformations in the 2D XY Model; 2.3. Migdal Kadanoff RG

Approximation of the Two-Dimensional XY Model
2.4. Correlation Function Calculations and Renormalization Group Equations2.5. Symmetric Breaking Fields, Duality and RG Equations; 2.6. An Early Experimental Confirmation of the BKT Theory; 2.3. Conclusions; Acknowledgments; References; 3. Berezinskii-Kosterlitz-Thouless Transition through the Eyes of Duality G. Ortiz, E. Cobanera and Z. Nussinov; 3.1. Introduction; 3.2. The XY Model: A Paradigm of BKT Phenomenology; 3.2.1. A transfer operator for the XY model; 3.2.2. Hamiltonian form of the XY model; 3.2.3. Duality of the XY model without the Villain approximation
3.3. The p-Clock Model: A Close Relative of XY3.3.1. A transfer matrix for the p-clock model; 3.3.2. Hamiltonian form of the p-clock model; 3.3.3. Dualities of the p-clock model; 3.3.4. Self-dual classical p-clock model; 3.3.5. Exact and emergent symmetries of the p-clock model; 3.3.5.1. Non-Abelian, discrete symmetries; 3.3.5.2. Emergent U(1) symmetry; 3.4. Phase Diagram: From the p-Clock to the XY Model; Appendix A: Exponential of Shift Operators; Appendix B: Duality of the XY Model to q-Deformed Bosons; Appendix C: The Villain and Its Dual Solid-On-Solid Models
Appendix D: The p-Clock Model for p = 2, 3, and 4Appendix E: Peierls Argument for the p-Clock Model; References; 4. The Berezinskii-Kosterlitz-Thouless Transition in Superconductors A. M. Goldman; 4.1. Introduction; 4.2. Phenomenological Theory - Mostly Films; 4.3. Experimental Evidence - Films; 4.4. Phenomenological Theory - Arrays; 4.5. Experiments - Arrays; 4.6. Comments on Renormalization Effects; 4.7. Summary; Acknowledgments; References
5. Berezinskii-Kosterlitz-Thouless Transition within the Sine-Gordon Approach: The Role of the Vortex-Core Energy L. Benfatto, C. Castellani and T. Giamarchi

Sommario/riassunto

On the 40th anniversary of the Berezinskii-Kosterlitz-Thouless Theory (BKT), this informative volume looks back at some of the developments and achievements and varied physics applications which ensued from the beautiful BKT vortex-unbinding seminal idea.During the last four decades, BKT theory, which is undeniably one of the most important developments in condensed matter and theoretical physics of the second half of the twentieth century, has expanded widely. It has been used and extended from many different theoretical and experimental perspectives. New and unexpected features have been unc