

1. Record Nr.	UNINA9910811165403321
Autore	Gail Hans-Peter <1941->
Titolo	Physics and chemistry of circumstellar dust shells / / Hans-Peter Gail, Erwin Sedlmayr [[electronic resource]]
Pubbl/distr/stampa	Cambridge : , : Cambridge University Press, , 2014
ISBN	1-107-42365-1 1-107-43891-8 1-107-41905-0 1-107-42172-1 1-107-41636-1 1-107-41772-4 1-107-42034-2 0-511-98560-6
Descrizione fisica	1 online resource (xiv, 683 pages) : digital, PDF file(s)
Collana	Cambridge astrophysics ; ; 52
Disciplina	523
Soggetti	Circumstellar matter
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	Title from publisher's bibliographic system (viewed on 05 Oct 2015).
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	; Machine generated contents note: ; pt. I Setting the Stage -- ; 1. Introduction -- ; 1.1. General Scenario and Historical Background -- ; 1.2. Diagnostic Insight into Circumstellar Dust Shells -- ; 1.3. Circumstellar Dust in the Laboratory -- ; 1.4. Circumstellar Shell Dynamics and Stellar Winds -- ; 2. Evolutionary Status of Dust-Enshrouded Objects -- ; 2.1. Evolution from the Main Sequence toward the AGB -- ; 2.2. Abundance Changes by First and Second "Dredge-Up" -- ; 2.3. The Thermally Pulsing AGB -- ; 2.4. Abundance Changes on the AGB by the Third Dredge-Up -- ; 2.5. Post-AGB Evolution -- ; 2.6. Elemental Abundances -- ; pt. II Theoretical Description of Circumstellar Dust Shells -- ; 3. Theory of Circumstellar Dust Shells -- ; 3.1. Multicomponent Medium -- ; 3.2. General Conservation Laws and Balance Equations -- ; 3.3. Multicomponent Mass Equations of Change -- ; 3.4. Momentum Equations of Change. ; 3.5. Multicomponent Approaches -- ; 3.6. Stellar Mass Loss and Winds -- ; 4. Energy Equation for Matter -- ; 4.1. Total Energy Density

and the Bulk Energy Equation -- ; 4.2. External Energy Sources: Gravity and Radiation -- ; 4.3. Multicomponent Energy Equations -- ; 4.4. Equations of Change for the Inner Energy Reservoirs -- ; 4.5. Elementary Forms of Internal Energy -- ; 4.6. Temperature Equations -- ; 4.7. Completion of the System of Transport Equations of Matter -- ; 5. Radiative Transfer -- ; 5.1. Basic Definitions -- ; 5.2. Angular Moments of the Radiation Field -- ; 5.3. Equation of Radiative Transfer -- ; 5.4. Transport Coefficients -- ; 5.5. Stationary Radiative Transfer Equation -- ; 5.6. Stationary Moment Equations of Radiative Transfer -- ; 5.7. Radiation Force Density and Radiative Net Energy Transfer Rate -- ; 5.8. Symmetric Situations -- ; 6. Interaction between Gas and Dust Particles -- ; 6.1. Some Basic Considerations -- ; 6.2. Collision Rate between Gas and Dust. ; 6.3. Momentum Transfer between Gas and Dust -- ; 6.4. Specular Reflection -- ; 6.5. Particle Sticking -- ; 6.6. Thermal Accommodation -- ; 6.7. Diffuse Reflection -- ; 6.8. Particle Drift -- ; 6.9. Drag Force -- ; 7. Extinction by Dust Grains -- ; 7.1. Optical Constants -- ; 7.2. Models for the Dielectric Function -- ; 7.3. Absorption and Scattering by Grains -- ; 7.4. Optical Constants of Abundant Dust Materials -- ; 7.5. Absorption by Dust -- ; 7.6. Radiation Pressure on Dust Grains -- ; 8. Approaches to the Temperature Equations -- ; 8.1. Radiative Equilibrium -- ; 8.2. Local Thermal Equilibrium -- ; 8.3. Radiative Equilibrium Temperature with Local Thermal Equilibrium -- ; 8.4. Non-Local Thermal Equilibrium Aspects -- ; 9. Chemistry in Thermodynamic Equilibrium -- ; 9.1. The Basic Thermodynamic Relations -- ; 9.2. Equilibrium Conditions for Gases and Solids -- ; 9.3. Constraints Set by Element Abundances -- ; 9.4. Some Results of Statistical Mechanics. ; 9.5. Thermodynamic Data -- ; 10. Gas-Phase Chemical Composition -- ; 10.1. Qualitative Considerations on Molecule Formation -- ; 10.2. Restrictions from Element Abundances and Bond Energies -- ; 10.3. Calculation of Chemical Equilibrium Compositions -- ; 10.4. Results for Cosmic Element Mixtures -- ; 10.5. Nonequilibrium Chemistry -- ; 11. Gas-Solid Chemical Equilibria -- ; 11.1. Equilibria in Gas-Solid Mixtures -- ; 11.2. Condensation Equilibria of Pure Phases I: O-Rich Mixture -- ; 11.3. Condensation Equilibria of Pure Phases II: C-Rich Mixture -- ; 11.4. Solid Solutions -- ; 12. Growth of Dust Grains -- ; 12.1. Theoretical Description of Growth Processes -- ; 12.2. Theoretical Description of Vaporization Processes -- ; 12.3. Calculation of Vapor Composition -- ; 12.4. Equation for Grain Growth -- ; 12.5. Equations for Some Important Dust Materials -- ; 12.6. Solid Solutions -- ; 12.7. Experimental Data for Condensation Coefficients. ; 12.8. Core-Mantle Grains -- ; 12.9. Formation of Crystalline Dust -- ; 13. Formation of Seed Nuclei -- ; 13.1. Homogeneous and Heterogeneous Nucleation -- ; 13.2. Bond Energies of Small Clusters -- ; 13.3. Kinetic Theory of Homogeneous Condensation -- ; 13.4. Cluster Densities in Thermodynamic Equilibrium -- ; 13.5. Nucleation Rate and Cluster Size Spectrum -- ; 13.6. Candidates for the Nucleation Process -- ; 13.7. Classical Nucleation Theory -- ; 14. Moment Equations -- ; 14.1. Growth of an Ensemble of Dust Grains in Stellar Outflows -- ; 14.2. Moments of the Distribution Function -- ; 14.3. Consumption of Condensible Material -- ; 14.4. Types of Size Distributions -- ; 14.5. Particle Drift -- ; pt. III Applications -- ; 15. Modeling of Circumstellar Dust Shells -- ; 15.1. Basic Ingredients for Reliable Shell Modeling -- ; 15.2. Spherical Stationary Stellar Dust Winds -- ; 15.3. Shell Chemistry and Transport Coefficients -- ; 15.4. Stationary Dust-Driven Winds. ; 15.5. Models of Stationary Dust-Driven Winds -- ; 15.6. Two-Fluid Wind Models -- ; 15.7. Parameter Limitations for Stationary Dust-Driven Winds -- ; 15.8. General Properties of Stationary Dust-Driven

Mass Loss -- ; 15.9. Reliability of Purely Dust-Driven Wind Models -- ; 16. Miras and Long-Period Variables -- ; 16.1. Basic Model Ingredients -- ; 16.2. Steps toward a Reliable Modeling -- ; 16.3. Consistent Modeling of Pulsational Circumstellar Dust Shells -- ; 16.4. Modeling Procedure -- ; 16.5. Consistent Models of Pulsating C-Star Shells -- ; 16.6. Space-Time Evolution of the Isothermal Reference Model -- ; 16.7. Multiperiodicity -- ; 16.8. Radiative Transfer and Spectral Appearance -- ; 16.9. Main Results of Carbon-Rich Shells -- ; 16.10. Oxygen-Rich Miras and LPVs -- ; 17. Mass-Loss Formulas -- ; 17.1. Formulas Based on Empirical Correlations -- ; 17.2. Synthetic Relations Based on Consistent Models -- ; 17.3. Effects of the Model Parameters -- ; 17.4. Superwind. ; 18. R Coronae Borealis Stars -- ; 18.1. Light Curves of R CrB Stars -- ; 18.2. Stellar Pulsations -- ; 18.3. Attempts at Modeling -- ; pt. IV Appendices -- ; Appendix 1 Solution of the Radiative-Transfer Problem for Spherical Symmetry -- ; A1.1. Method of Mihalas and Hummer -- ; A1.2. Lucy Approximation -- ; A1.3. Unno-Kondo Approach -- ; Appendix 2 Numerics of Time-Dependent Problems -- ; A2.1. Full Discretization and Courant-Friedrichs-Lewy Condition -- ; A2.2. Semidiscretization -- ; A2.3. Basic Characterization of Available Codes -- ; A2.4. Rezoning Scheme -- ; Appendix 3 Non-LTE Effects and Molecular Cooling Functions -- ; A3.1. Radiative Energy Exchange -- ; Appendix 4 Thermochemical Data for Some Solids -- ; A4.1. Vapor Pressure of Ice -- ; Appendix 5 Symbols for Mineral Names.

Sommario/riassunto

Circumstellar dust, the astronomical dust that forms around a star, provides today's researchers with important clues for understanding how the Universe has evolved. This volume examines the structure, dynamics and observable consequences of the dust clouds surrounding highly evolved stars on the Giant Branch. Early chapters cover the physical and chemical basis of the formation of dust shells, the outflow of matter, and condensation processes, while offering detailed descriptions of techniques for calculating dust formation and growth. Later chapters showcase a wide range of modeling strategies, including chemical and radiative transfer and dust-induced non-linear dynamics, as well as the latest data obtained from AGB stars and other giants. This volume introduces graduate students and researchers to the theoretical description for modeling the dusty outflows from cool stars and provides a full understanding of the processes involved.