

1. Record Nr.	UNINA9910812635803321
Autore	Gotze Wolfgang <1937->
Titolo	Complex dynamics of glass-forming liquids [[electronic resource]] : a mode-coupling theory // Wolfgang Gotze
Pubbl/distr/stampa	Oxford ; ; New York, : Oxford University Press, 2009
ISBN	0191553042 9780191553042
Edizione	[1st ed.]
Descrizione fisica	xi, 641 p. : ill
Collana	International series of monographs on physics ; ; 143
Disciplina	532/.0533
Soggetti	Viscosity Mode-coupling theory Equations of motion Complex fluids Molecular dynamics
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di bibliografia	Includes bibliographical references (p. [621]-633) and index.
Nota di contenuto	Intro -- Contents -- Preface -- 1 Glassy dynamics of liquids-facets of the phenomenon -- 1.1 Stretching of the dynamics -- 1.2 Power-law relaxation -- 1.3 Superposition principles -- 1.4 Two-step relaxation through a plateau -- 1.5 The cage effect -- 1.6 Crossover phenomena -- 1.7 Hard-sphere systems: the paradigms -- 1.8 Hard-sphere systems with short-range attraction -- 2 Correlation functions -- 2.1 The evolution of dynamical variables -- 2.2 Correlation-function description of the dynamics -- 2.3 Spectral representations -- 2.4 Memory-kernel descriptions of correlators -- 2.4.1 Zwanzig-Mori equations -- 2.4.2 Models for correlation functions -- 2.5 Linear-response theory -- 2.6 The arrested parts of correlation functions -- 3 Elements of liquid dynamics -- 3.1 Preliminaries -- 3.1.1 Homogeneous isotropic systems without chirality -- 3.1.2 Densities and density fluctuations -- 3.2 Tagged-particle dynamics -- 3.2.1 Basic concepts and general equations -- 3.2.2 Tagged-particle diffusion -- 3.2.3 The friction coefficient -- 3.2.4 The cage effect and glassy-dynamics precursors of the velocity correlations -- 3.3 Densities and currents in simple liquids -- 3.3.1 Definitions and

general equations -- 3.3.2 Transverse-current diffusion -- 3.3.3 The generalized-hydrodynamics description of transverse-current correlations -- 3.3.4 Visco-elastic features and glassy-dynamics precursors of the transverse-current correlators -- 3.3.5 Representations of the density correlators in terms of relaxation kernels -- 3.3.6 Sound waves and heat diffusion -- 3.3.7 Visco-elastic features and glassy-dynamics precursors of the density-fluctuation correlators -- 4 Foundations of the mode-coupling theory for the evolution of glassy dynamics in liquids -- 4.1 Self-consistent-current-relaxation approaches -- 4.1.1 The factorization ansatz. 4.1.2 Self-consistency equations for density correlators -- 4.2 A mode-coupling theory -- 4.2.1 Equations of motion and fixed-point equations -- 4.2.2 Mode-coupling-theory models -- 4.2.3 The basic version of microscopic mode-coupling theories -- 4.2.4 An elementary mode-coupling-theory model -- 4.3 Glass-transition singularities -- 4.3.1 Regular and critical states -- 4.3.2 Examples for bifurcation diagrams -- 4.3.3 Classification of the critical states -- 4.3.4 Correlation arrest near $A_{[2]}$ singularities -- 4.3.5 Density-fluctuation arrest in hard-sphere-like systems -- 4.3.6 Arrest in systems with short-ranged-attraction -- 4.4 Dynamics near glass-transition singularities -- 4.4.1 Relaxation through plateaus -- 4.4.2 Below-plateau relaxation -- 4.4.3 Structure and structure relaxation -- 4.4.4 Descriptions of some glassy-dynamics data -- 5 Extensions of the mode-coupling theory for the evolution of glassy dynamics of liquids -- 5.1 Extensions of the MCT for simple systems -- 5.1.1 MCT equations for the glassy shear dynamics -- 5.1.2 Glassy-relaxation features of shear correlations -- 5.1.3 MCT equations for the tagged-particle dynamics -- 5.1.4 Idealized transitions from diffusion to localization -- 5.1.5 Glassy-dynamics features of tagged-particle motions -- 5.2 A mode-coupling theory for mixtures of spherical particles -- 5.2.1 The equations of motion -- 5.2.2 Density-fluctuation arrest -- 5.2.3 Hard-sphere mixtures -- 5.2.4 Sodium-disilicate melts -- 5.3 A mode-coupling theory for molecular liquids -- 5.3.1 A theory for interaction-site-density correlators -- 5.3.2 Systems of symmetric dumbbells -- 5.3.3 Glassy Rouse dynamics -- 5.4 Some addenda -- 6 Asymptotic relaxation laws -- 6.1 Dynamics of the first-scaling-law regime -- 6.1.1 Reformulation of the MCT equations of motion -- 6.1.2 The critical dynamics. 6.1.3 Asymptotic description of the $A_{[2]}$ -bifurcation dynamics -- 6.1.4 The scaling-limit description of the generic liquid-glass-transition dynamics -- 6.1.5 Extended scaling-limit description of the generic $A_{[2]}$ -bifurcation dynamics -- 6.2 Dynamics of the second-scaling-law regime -- 6.2.1 Equations of motion for the second-scaling-law regime -- 6.2.2 The second-scaling-law description of the liquid dynamics -- 6.2.3 Asymptotic corrections for the second scaling limit -- 6.3 Relaxation near higher-order singularities -- 6.3.1 Correlation arrest near higher-order singularities -- 6.3.2 Logarithmic relaxation -- A: Mathematical miscellanies -- A.1 Laplace transforms -- A.2 Fourier transforms -- A.3 Positive-definite and positive-analytic functions -- A.4 Harmonic-oscillator correlators -- A.5 Matrix correlators -- A.6 Product correlators -- A.7 Power-law variations -- A.8 Logarithmic variations -- B: Symmetries of fluctuation correlators -- C: Smoothened correlators -- D: Theorems on MCT equations -- D.1 Convergence of the approximant sequences -- D.2 Completely monotonic approximants -- D.3 The maximum-eigenvalue inequality -- D.4 Further properties of stability matrices -- Bibliography -- Index -- A -- B -- C -- D -- E -- F -- G -- H -- I -- K -- L -- M -- N -- O -- P -- Q -- R -- S -- T -- U -- V -- W -- Y -- Z.

Sommario/riassunto

Amorphous condensed matter can exhibit complex motions on time scales which extend up to those relevant for the functioning of biomaterials. The book presents the derivation of a microscopic theory for amorphous matter, which exhibits the evolution of such complex motions as a new paradigm of strongly interacting particle systems.
