

Mario Tosi and Patrizia Vignolo

**Statistical mechanics  
and the physics  
of fluids**

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# Statistical mechanics and the physics of fluids

**Series: Lecture Notes (Scuola Normale Superiore)**

This volume collects the lecture notes of a course on statistical mechanics, held at Scuola Normale Superiore di Pisa for third-to-fifth year students in physics and chemistry. Three main themes are covered in the book. The first part gives a compact presentation of the foundations of statistical mechanics and their connections with thermodynamics. Applications to ideal gases of material particles and of excitation quanta are followed by a brief introduction to a real classical gas and to a weakly coupled classical plasma, and by a broad overview on the three states of matter. The second part is devoted to fluctuations around equilibrium and their correlations. Coverage of liquid structure and critical phenomena is followed by a discussion of irreversible processes as exemplified by diffusive motions and by the dynamics of density and heat fluctuations. Finally, the third part is an introduction to some advanced themes: supercooling and the glassy state, non-Newtonian fluids including polymers and liquid crystals, and dynamic instabilities and turbulence. These topics, which are largely taken over from the book of N.H. March and M. Tosi on Introduction to Liquid State Physics, are meant to stimulate the reader to further study of the literature in these technically important areas.

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