Cambridge Elements

Elements in the Philosophy of Physics
edited by
James Owen Weatherall
University of California, Irvine

FOUNDATIONS OF STATISTICAL MECHANICS

Roman Frigg
The London School of Economics and Political Science
Charlotte Werndl
University of Salzburg

CAMBRIDGE UNIVERSITY PRESS

Shaftesbury Road, Cambridge CB2 8EA, United Kingdom

One Liberty Plaza, 20th Floor, New York, NY 10006, USA

477 Williamstown Road, Port Melbourne, VIC 3207, Australia

314–321, 3rd Floor, Plot 3, Splendor Forum, Jasola District Centre,
New Delhi – 110025, India

103 Penang Road, #05–06/07, Visioncrest Commercial, Singapore 238467

Cambridge University Press is part of Cambridge University Press & Assessment,
a department of the University of Cambridge.

We share the University's mission to contribute to society through the pursuit of
education, learning and research at the highest international levels of excellence.

www.cambridge.org
Information on this title: www.cambridge.org/9781009468237

DOI: 10.1017/9781009022798

First published 2023

A catalogue record for this publication is available from the British Library.

ISBN 978-1-009-46823-7 Hardback
ISBN 978-1-009-01649-0 Paperback
ISSN 2632-413X (online)
ISSN 2632-4121 (print)

Foundations of Statistical Mechanics

Elements in the Philosophy of Physics

DOI: 10.1017/9781009022798
First published online: December 2023

Roman Frigg
The London School of Economics and Political Science

Charlotte Werndl
University of Salzburg

Author for correspondence: Charlotte Werndl, charlotte.werndl@sbg.ac.at

Abstract: Statistical mechanics is the third pillar of modern physics, next to quantum theory and relativity theory. It aims to account for the behaviour of macroscopic systems in terms of the dynamical laws that govern their microscopic constituents and probabilistic assumptions about them. In this Element, the authors investigate the philosophical and foundational issues that arise in SM. The authors introduce the two main theoretical approaches, Boltzmannian statistical mechanics and Gibbsian statistical mechanics, and discuss how they conceptualise equilibrium and explain the approach to it. In doing so, the authors examine how probabilities are introduced into the theories, how they deal with irreversibility, how they understand the relation between the micro and the macro level, and how the two approaches relate to each other. Throughout, the authors also pinpoint open problems that can be the subject of future research. This title is also available as Open Access on Cambridge Core.

Keywords: statistical mechanics, probability, equilibrium, Boltzmann, Gibbs

ISBNs: 9781009468237 (HB), 9781009016490 (PB), 9781009022798 (OC)
ISSNs: 2632-413X (online), 2632-4121 (print)

Contents