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There is a rapidly growing scientific community consisting of astrophysicists, numerical relativists, and nuclear physicists who perform research related to compact stars worldwide. There are the excellent classic textbooks by Shapiro and Teukolsky (1983) with an emphasis on relativistic astrophysics and by Glendenning (2000) with a focus on the field theoretical description of compact stars. In view of the rapid development in the research field, this textbook is intended to give an updated introduction to the physics of compact stars, covering many new facets and developments in the field since Shapiro and Teukolsky, and Glendenning. It is based on courses given at Goethe University Frankfurt, at the Ruprecht-Karl University of Heidelberg, and several lectures given at summer and winter schools.