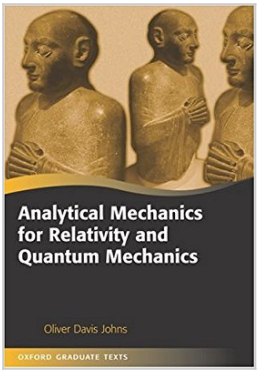

Analytical Mechanics for Relativity and Quantum Mechanics (Oxford Graduate Texts)

By Oliver Johns

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Analytical Mechanics for Relativity and Quantum Mechanics is an innovative and mathematically sound treatment of the foundations of analytical mechanics and the relation of classical mechanics to relativity and quantum theory. It is intended for use at the introductory graduate level. A distinguishing feature of the book is its integration of special relativity into teaching of classical mechanics. After a thorough review of the traditional theory, Part II of the book introduces extended Lagrangian and Hamiltonian methods that treat time as a transformable coordinate rather than the fixed parameter of Newtonian physics. Advanced topics such as covariant Langrangians and Hamiltonians, canonical transformations, and Hamilton-Jacobi methods are simplified by the use of this extended theory. And the definition of canonical transformation no longer excludes the Lorenz transformation of special relativity.

This is also a book for those who study analytical mechanics to prepare for a critical exploration of quantum mechanics. Comparisons to quantum mechanics appear throughout the text. The extended Hamiltonian theory with time as a coordinate is compared to Dirac's formalism of primary phase space constraints. The chapter on relativistic mechanics shows how to use covariant Hamiltonian theory to write the Klein-Gordon and Dirac equations. The chapter on Hamilton-Jacobi theory includes a discussion of the closely related Bohm hidden variable model of quantum mechanics. Classical mechanics itself is presented with an emphasis on methods, such as linear vector operators and dyadics, that will familiarize the student with similar techniques in quantum theory. Several of the current fundamental problems in theoretical physics - the development of quantum information technology, and the problem of quantizing the gravitational field, to name two - require a rethinking of the quantum-classical connection.

Graduate students preparing for research careers will find a graduate mechanics course based on this book to be an essential bridge between their undergraduate training and advanced study in analytical mechanics, relativity, and quantum mechanics.

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Editorial Review

Review
The author deserves to be congratulated on the production of what soon will establish itslef as a well-respected and useful book which I am pleased to have on mu shelf. In short, it would be difficult to conceive of any initial course of instruction and study on the subject of analytical mechanics for relatively and quantum mechanics which would not benefit from use of this well-planned and conceived and refreshing presentation. Current Engineering Practice. Volume 48 2005

About the Author

For the past 30 years, Professor Johns has taught graduate classical and quantum mechanics courses at San Francisco State University. This teaching experience has given him a sensitivity to the intellectual needs of physics graduate students. For the past fifteen years, he has had an association with the Department of Theoretical Physics at Oxford, making yearly visits. He does research in the foundations of physics: Hidden variable models, foundations of relativity, foundations of quantum mechanics. He has also done research work in theoretical Nuclear Physics and Nuclear Astrophysics, at the Niels Bohr Institute, Orsay, and the CEA laboratories in Paris.

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