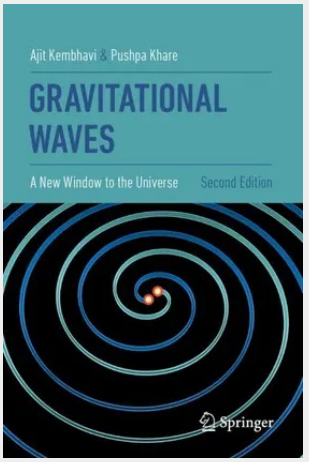
Kembhavi / Khare

Gravitational Waves

A New Window to the Universe



Gravitational waves were first predicted by Albert Einstein in 1916, a year after the development of his new theory of gravitation known as the general theory of relativity. This theory established gravitation as the curvature of space-time produced by matter and energy. To be discernible even to the most sensitive instruments on Earth, the waves have to be produced by immensely massive objects like black holes and neutron stars which are rotating around each other, or in the extreme situations which prevail in the very early ages of the Universe. This book presents the story of the prediction of gravitational waves by Albert Einstein in 1916, the early attempts to detect the waves, the development of the first LIGO detector and its current form, and the extremely accurate measurements that are needed to detect gravitational waves. That is followed by descriptions of the first detection in 2016, the subsequent detections until the end of 2025, and the many unexpected and very interesting sources which have been found so far. All concepts are described without the use of any mathematics and advanced physics. To set the stage for understanding gravitational waves, the book contains descriptions of electromagnetism, Einstein's special theory and general theory of relativity, white dwarfs, neutron stars and black holes and other concepts. The book covers these ideas in a simple and lucid fashion which should be accessible to all interested readers. The detection of gravitational waves and related stories, and the LIGO-India project have been widely covered in the print and electronic media. So, the curiosity of the non-technical audience has been aroused about what gravitational waves really are and why they are so important. This book seeks to answer such questions.

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