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Nota di contenuto	Part I: Instrumentation and data analysis -- 1. History, present and future of high-resolution X-ray spectroscopy -- 2. X-ray Diffraction Grating Spectrometers -- 3. XMM-Newton grating -- - Introduction to RGS -- - Data reduction for RGS data -- 4. Chandra grating -- - Introduction to LETG/HETG -- - Data reduction for Chandra data -- 5. High-resolution grating spectral analysis -- - Statistics and spectral grouping -- - Line search -- - Spectral analysis with SPEX -- 6. Micro-calorimeters with transition edge sensors -- 7. Hitomi micro-calorimeter -- - Introduction to the micro-calorimeter on Hitomi -- - Data reduction for SXT data -- 8. High-resolution spectral analysis of Hitomi data -- Part II: Science -- 9. Overview of astrophysical plasmas -- 10. Clusters of galaxies -- 11. Active galactic nuclei -- 12. Circumgalactic and intergalactic medium -- 13. Solar wind and charge exchange -- 14. Galactic black hole X-ray binaries -- 15. Supernova remnants -- 16. Galactic cataclysmic variables -- 17. Dynamics of gas and plasma in cool and hot stars.

Sommario/riassunto

NASA's Chandra X-ray Observatory and ESA's XMM-Newton Observatory have been the pioneering satellites for studying the Universe with X-rays and the cornerstone of X-ray spectroscopy since their launches more than 20 years ago. The onboard gratings provide us a unique opportunity to distinguish individual spectral lines from different atoms thanks to their high energy resolutions. Enormous discoveries have been achieved by these two missions when observing a variety of X-ray-emitting astronomical objects, such as black holes, supernova remnants, clusters of galaxies, and stars. However, the data are limited to fairly bright X-ray sources. The recent JAXA's mission Hitomi opened a new window of high-resolution X-ray spectroscopy thanks to its onboard X-ray calorimeter. Although this mission was shortly terminated due to a mishap, Hitomi left behind a few sets of observations awaiting more data mining. The first half of this book introduces the history of high-resolution X-ray spectroscopy and different generations of X-ray spectrometers. A tutorial guide on how to reduce, analyze, and understand the astronomical data from Chandra, XMM-Newton, and Hitomi is also included. The second half of the book reviews past results obtained by the high-resolution spectrometers on these missions on multiple topics and discusses possible discoveries by upcoming missions in the next decade.