Preface

Recent Developments in Superconductivity

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The year 2011 marks the 100th anniversary of the discovery of superconductivity in mercury by Heike Kamerlingh Onnes. This means that January 2012 is just the start of a new century for superconductivity, and The Journal of Physical Society of Japan is publishing this Special Topics on superconductivity to celebrate the anniversary.

In the first 50 years after its discovery, studies of superconductivity were mainly on metals and focused on the understanding of this mysterious and fully quantum phenomenon. Conventional superconductivity was explained reasonably well by the Bardeen–Cooper–Schrieffer theory proposed in 1957. However, after the discovery of superconductivity in the heavy-fermion CeCu$_2$Si$_2$ in 1979 and in the organic compound (TMTSF)$_2$PF$_6$ under pressure in 1980, the superconductivity observed in strongly correlated electron systems became a very attractive area of research in condensed-matter physics. We expected a new era of superconductivity at that time. In 1986, the cuprate superconductivity was discovered with superconducting transition temperatures exceeding 150 K, which would not have been expected when superconductivity was first discovered 100 years ago. Furthermore, in the iron-pnictide superconductors discovered in 2008, Fe atoms, which had been considered to be completely unrelated to superconductivity, were found to play important roles in superconductivity. Presently, research on superconductivity continues to be one of the most important topics in condensed-matter physics, and research is still expanding rapidly in unexpected directions.

In this Special Topics, we have focused on novel superconducting compounds that have been discovered in the last 30 years, and have asked researchers representing each field to write vivid review articles focused on the most prominent recent developments in their fields. We would like to thank all the contributors who were willing to accept our offer and have carried out their hard job despite their extremely busy schedules. We believe that the papers in this Special Topics will be very useful for a wide range of researchers and will also demonstrate that superconductivity is the most challenging playground in emergent physics.