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[Final lecture at the retirement
from the Department of Physics, University of Tokyo]

"Renaissance in the condensed-matter physics --- superconductivity, topological systems and nonequilibrium"

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Abstract:

I shall give an overview of my theoretical research in condensed-matter physics over 38 years after I got PhD, putting an emphasis on recent studies. The reason why I say "renaissance" in the title comes from my belief that the developments kicked off by the high-Tc superconductivity and quantum Hall effect in the 1980s have given, and are still giving, fascinating renovations that are remarkable in the long history of the condensed-matter physics. HTC has subsequently witnessed unexpected broadening and diversifying into the iron-based and light-element superconductivity. Topological systems also widen their horizon into topological superconductivity, physics of graphene, etc. These not only produced new phenomena, but have generated new concepts (topological systems as initiated by the quantum Hall effect, electron correlation as initiated by the HTC cuprates). These have also stimulated condensed-matter realisations of field-theoretically interesting phenomena on very

low-energy scales. Another impetus comes from advances in high-performance computations, enabling us to accurately understand the existing materials, and to even perform materials design. Cold-atom systems, on the other hand, are making, with their unprecedentedly high controllability, idealised theoretical models experimentally realisable. My latest main interests are directed to physics of nonequilibrium systems, which are envisaged to open a novel avenue for quantum phases unimaginable in equilibrium, in all of correlation, superconductivity and topological properties. I shall review these studies, collaborations with many people, along with future prospects.