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Ryuji Takahashi

Topological States on Interfaces Protected by Symmetry

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Topological States on Interfaces Protected by Symmetry

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- R. Takahashi and S. Murakami, “Gapless Interface States between Topological Insulators with Opposite Dirac Velocities”, Phys. Rev. Lett., **107**, 166805 (2011).

Supervisor's Foreword

Interfaces between two solids often exhibit exotic phenomena that are absent in either of the two parental materials. Interfaces have a number of degrees of freedom such as a combination of two materials, crystallographic orientations of the interface, and even the quality of the interface. Interface electronic states are often quite sensitive to these factors. This sensitivity to a number of factors, some of which cannot be controlled easily, causes various difficulties in theoretical research on interface electronic states and comparison with experiments. Theories on electronic states on interfaces are often restricted to first-principle calculations and phenomenological theories, because simplified effective models may not capture basic properties of interface states.

Historically, surface physics had had a similar aspect. Nevertheless, the discovery of topological insulators has added a renewed interest in the surface physics. It is qualitatively new that some surface electronic properties are robust and are determined by bulk topological properties. Furthermore, such proposals have been confirmed experimentally in various materials.

This book is concerned with theoretical pursuit of such topological phenomena in interface physics. This book, based on the dissertation of Dr. Ryuji Takahashi, theoretically explores possibilities of novel interface states from an interplay between topology and symmetry. Because the topics in this book are based on topology and symmetry, even simplified models with required properties of topology and symmetry turn out to be powerful in predicting new interface phenomena, which is in contrast with conventional interface phenomena. Various predictions in this book are yet to be observed experimentally, but the above-mentioned varieties of interfaces suggest that there is much room for future experimental and theoretical investigations.

Tokyo, Japan
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Prof. Shuichi Murakami

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