Special Issue

Symmetry in Gravitational Waves and Astrophysics

Message from the Guest Editors

Symmetry has an important role in the formulation of modern physics. Although a generic gravitating system possesses no symmetry, some asymptotic symmetry groups live on the boundaries of asymptotically flat spacetimes. Those intimately related to gravitational waves are the celebrated Bondi–Metzner–Sachs groups and their extensions at null infinities. An infinite number of Noether charges of symmetry groups have been defined, and their conservation laws constrain several physical processes. Asymptotic symmetry, the gravitational memory effect, and soft theorem are three corners of the infrared triangle, echoing in many physical systems with a variety of gauge symmetries. Gravitational scattering processes plant soft hairs on black holes, which has prompted studies on the symmetries of black hole horizons and the null boundary of some finite region of spacetime. Through existing and future gravitational wave detectors, a gravitational wave memory effect might be observed soon. The purpose of this Special Issue is to review what has been accomplished, discuss what is to be solved, and examine the future.

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About the Journal

Message from the Editor-in-Chief

Symmetry is ultimately the most important concept in natural sciences. It is not surprising then that very basic and fundamental research achievements are related to symmetry. For instance, the Nobel Prize in Physics 1979 (Glashow, Salam, Weinberg) was received for a unified symmetry description of electromagnetic and weak interactions, while the Nobel Prize in Physics 2008 (Nambu, Kobayashi, Maskawa) was received for the discovery of the mechanism of spontaneous breaking of symmetry, including CP symmetry. Our journal is named *Symmetry* and it manifests its fundamental role in nature.

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