

Third KIA Laureate Fundamental Research



- ◆ **Field:** Mathematics
- ◆ **Researcher:** Prof. Shun – Jen Cheng
- ◆ **Nationality :** Taipei
- ◆ **Date of Birth:** February 25, 1963
- ◆ **Position:** Research Fellow
- ◆ **Scientific Affiliation:** Institute of Mathematics, Academia Sinica, Taipei,
- ◆ **Research work title:** Representation Theory of Lie superalgebras and super duality

Abstract: Super symmetry is a concept introduced originally by physicists in order to explain physical symmetries that classical symmetries cannot. The idea of super symmetry today is indispensable in physics, e.g. (super) string theory, and has found remarkable applications in mathematics. Mathematically it led to an intense study of Lie supergroups and Lie superalgebras. The first major mathematical achievement was the classification of finite-dimensional Lie superalgebras over the complex field obtained by Victor Kac in 1977. The next natural question was about concrete realizations of these Lie superalgebras, i.e. their representation theory. Among the most fundamental problems in representation theory is the irreducible character problem for these Lie superalgebras. This problem turns out to be extremely challenging, and remains open in some cases. The principle of Super Duality is a way to relate representation theories of Lie superalgebras and Lie algebras. Roughly speaking, it says that there is no distinction between super symmetry and ordinary symmetry in the suitable limit to infinity. Another reformulation is to say that super symmetry is an elegant way to describe symmetries in infinity. Among its applications, it provides an elegant and conceptual solution of the irreducible character problem for many Lie superalgebras.

Biography: Prof. Cheng received his undergraduate degree from Northwestern University, and his Ph.D. in mathematics from Harvard University in 1993, under the supervision of Prof. Victor Kac. He spent one year at the Max-Planck Institute für Mathematik in Bonn, before being appointed an associate professor at the National Cheng-Kung University in 1994. He became a professor at the National Taiwan University in 2000, and a research fellow in Academia Sinica, Taipei, in 2006. Most of Prof. Cheng's works revolve around notion of supersymmetry which manifests itself in the form of Lie superalgebras and their representation theory. Among his contributions are works related to classification of superconformal algebras and that of Lie superalgebras of vector fields, and super duality which makes remarkable connections between classical symmetry and supersymmetry.