Holography and QCD –Recent Progress and Challenges–

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In the late 1990's, a mysterious duality called the "gauge/string duality" was discovered out of the research in string theory. The claim is that a gauge theory and string theory in a certain curved space-time can be physically equivalent. This duality is also called the "holographic dual," because it is a duality relating two theories in different space-time dimensions. From about 10 years ago, the application of this idea to QCD, which is the theory of strong interaction, has been discussed extensively. This workshop, held on September 24 - 28, is mainly focused on topics related to the research in this direction.

It has been shown that this new technology to analyze QCD using the holographic dual provides very useful and powerful tools to analyze the properties of hadrons and QCD, such as spectrum and interactions of hadrons, QCD phase structure, properties of quark gluon plasma realized at high temperature, and so on. In particular, one of the advantages of this approach is that it can be applied to the systems with time evolution and/or chemical potential, for which other non-perturbative methods like lattice QCD are not useful enough. In fact, it has attracted the attention of hadron physicists as well as string theorists and there have been fruitful interdisciplinary collaborations between string theorists and hadron physicists. One of the successes of the workshop was that we were able to gather together experts of both fields around the world, providing a good opportunity to interact with each other. There were many string theorists showing results in hadron physics and hadron theorists using holography and string theory. It was impressive to see that they were discussing and debating together toward common goals without a serious language barrier.

The topics discussed in the workshop include, calculations of hadron masses including the effects of electro-magnetic interactions, analysis in the Veneziano limit of QCD, descriptions of heavy hadrons, research on the systems with time evolutions that are aimed toward the application to the experiments of heavy ion collisions in RHIC and LHC, study of quark gluon plasma, various phenomena in the presence of strong electric and magnetic fields, phase structure with finite temperature and chemical potential, and so on. There were 25 talks in 5 days, and a lot of new interesting results on various topics related to holography and QCD were reported.

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