

# Mechanical Engineering Seminar Series

- Date: Wednesday, November 16th, 2022
- Time: 5:00 PM KST
- Venue: Academic Building A Room 211

## 2022 Nobel Physics Prize and the Quantum Information Technology



### Prof. Jaewan Kim

Prof. Jaewan Kim is a Vice President of Korea Institute for Advanced Study (KIAS). Also, he is a professor of Computational Sciences, KIAS. He received his Ph.D. in Physics at University of Houston, and B.S in Physics at Seoul National University. His research focuses on Theoretical Study of Quantum Information Science. Also, Prof. Kim was Research associate professor of Physics in KAIST.

### Abstract

Aspect, Clauser, and Zeilinger are receiving 2022 Nobel Prize in physics "for experiments with entangled photons, establishing the violation of Bell inequalities and pioneering quantum information science." In quantum mechanics, physical quantity is not decided until it is measured. Einstein raised questions on this aspect of quantum measurement. He thought physical quantity should be a reality which means that physical quantity should be independent of measurement process. In 1935, Einstein, Podolsky, and Rosen (EPR) published a paper claiming quantum theory does not seem to be complete and presented two particles with correlated physical property demonstrating "spooky action at a distance" which is now called in various names; EPR-pair, entangled pair, Bell pair, Bell state and so on. In 1964, John Bell proposed a mathematical inequality which must be satisfied by the measurement on EPR-pairs if there is "local reality" as Einstein and his colleagues suggested. In 1970's, Clauser designed experiments to test Bell's inequality and found that it is violated by Bell pairs. In 1982, Aspect improved the experiment to avoid loopholes in Clauser's experiment and demonstrated Bell's inequality is indeed violated. Since 1990's up until now, Zeilinger improved the test of Bell's inequality and pioneered many fundamental experiments to test quantum theory including the first quantum teleportation. Einstein's incessant question on quantum theory played an important role in opening the era of quantum information science and technology.