

CQSE Special Seminar

Nov. 12, 2013 (Tuesday)

TIME Nov. 12, 10:20 ~ 11:10
TITLE Heisenberg uncertainty relation re-visited
SPEAKER Prof. Kazuo Fujikawa
RIKEN, Japan
PLACE Rm833, CCMS & New Physics Building, NTU

Abstract

Motivated by the recent experiment on the uncertainty relation which invalidated the naive Heisenberg-type error-disturbance relation, the re-examination of uncertainty relations is actively pursued by the experts of quantum physics and quantum information. In my talk, I would like to briefly review the various past formulations of uncertainty relations. I then show that all the past representative formulations of uncertainty relations including error-disturbance relations are derived from Robertson's relation, $\sigma(A)\sigma(B) \geq (1/2)|\langle [A,B] \rangle|$, which is widely accepted as the standard uncertainty relation. On the basis of this reformulation, it is shown that Heisenberg uncertainty relation given in the elementary textbook, namely Robertson's relation, is sufficient to account for the recent experiment. It is also shown that the failure of the naive Heisenberg-type error-disturbance relation is attributed to the failure of the assumptions of unbiased measurement and unbiased disturbance.

References:

- K. Fujikawa and K. Umetsu, Prog. Theor. Exp. Phys. (2013), 013A03;
- K. Fujikawa, Phys. Rev. A 88, 012126 (2013).

