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FOR BASIC SCIENCES
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DEPARTMENTAL SEMINAR

Department of Astrophysics and High Energy Physics

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SPEAKER

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TITLE OF THE TALK

Quantum correlation in time and applications to quantum science and technology

ABSTRACT

In this presentation I will focus on quantum correlation in time which has far reaching deep implications in devising quantum technologies apart from very foundational interest. Two paradigmatic models for empirical correlation, compatible with classical physics, can be tested via sequential measurements on a single system. First one is non-contextual hidden variable (NCHV) model and the next one is macro-realist (MR) model. NCHV model states that observed value of a measurement exists independent of how it is measured, i.e., independent of the context of measurement, whereas MR assert that the measurement just reveals the preexisting value without influencing future dynamics. It is known that quantum theory violates these classical models which are probed through the violation of KCBS-type and LG-type inequalities respectively. Later, the notion of measurement contextuality has been extended to preparation contextuality. Finding optimal violation of these inequalities at the one hand helps characterizing the boundary of quantum set and on the other hand shows the limit of quantum advantages which can be extracted via some quantum strategy in the context of various tasks towards building quantum technologies. We proposed an analytic method of finding optimal violation of preparation non-contextuality inequalities which reproduces numerical results known so far. The method relies on our finding of the connection between information-theoretic uncertainty relation and a communication game dubbed as parity-oblivious random-access coding. Quantum random access coding (QRAC) is a basic communication protocol that reveals the power of a qubit over its classical counterpart – a bit. This communication task later generalized in various different ways and has been connected with other fundamental aspects of quantum theory and technology as well. Our work identified the underlying quantum correlation empowering QRAC over its classical counterpart by prescribing new inequalities. This particular resource identification enables us to devise better random number generator compared to that solely based on QRAC.

HOST FACULTY

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