



UNIWERSYTET SZCZECIŃSKI
INSTYTUT FIZYKI

Środowe seminarium w Instytucie Fizyki

March 17th – 12:00

Dr. Richard Howl

University of Hong Kong & Oxford University

“Non-Gaussianity as a signature of a quantum theory of gravity in tabletop tests”

Tabletop tests of quantum gravity (QG) have long been thought to be practically impossible. However, rapid progress in experimental quantum information science has meant that such tests may soon be achievable. In this talk, I introduce a theoretical connection between QG and quantum information science (QIS) that allows for a new way of testing QG with QIS experiments. This theoretical connection is that only a quantum, not classical, theory of gravity can create non-Gaussianity, a QIS resource that is necessary for universal quantum computation, in the quantum field state of matter. This allows tests based on QIS in which non-Gaussianity in matter is used as a signature of QG. In comparison to recent QIS proposals for testing QG where entanglement is used to witness QG, a non-Gaussianity witness facilitates tests that are based on just a single quantum system rather than a multipartite quantum system, simplifying experimental setups. Furthermore, in contrast to entanglement, a non-Gaussianity witness does not appear to rely on classical gravity interactions being local, enabling tests that are not constrained by the existence of only local processes. Using this non-Gaussianity witness, a tabletop test of QG is proposed that is based on just a single quantum system, a Bose-Einstein condensate of Caesium atoms, in a single location.