

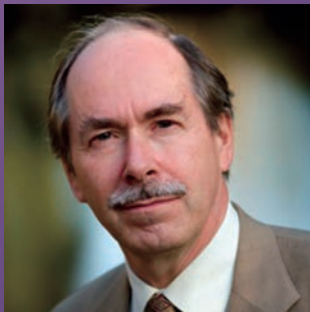


## Tohoku Forum for Creativity Thematic Program 2015

Fundamental Problems in Quantum Physics ; Strings, Black Holes and Quantum Information

# Special lectures on fundamental problems in quantum physics

**VENUE: Science complex C 2F, Aoba Science Hall (Room C201),  
Kita-Aobayama Campus, Tohoku University**



**Gerard 't Hooft**

Spinoza Institute, Utrecht University;  
1999 Nobel prize in Physics

**Monday, April 20, 17:00 – 18:00**

### **Lecture 1: "The role of Black Holes and Conformal Symmetry in Quantum Gravity"**

Abstract: The effects of virtual black holes in elementary quantum processes at Planckian dimensions appear to lead to inconsistencies unless special measures are taken in formulating the theory. Black hole complementarity is a principle that may do this job. The idea behind it is explained. One is lead to make a subsequent step: we must have conformal symmetry that is spontaneously broken by the vacuum. We then explain how this may lead to important information concerning theories for the interactions between sub-atomic particles.

**Wednesday, April 22, 17:00 – 18:00**

### **Lecture 2: "The Cellular automaton interpretation of quantum mechanics"**

Abstract: Quantum mechanics is usually introduced as a totally novel way to look at the behaviour of tiny things such as atoms, molecules and sub-atomic particles, and as such a fundamental departure from classical mechanics as it was formulated by Isaac Newton. In the lecture it is explained that one may nevertheless interpret quantum mechanics as a mathematically advanced description of completely standard classical dynamical laws. Many authors have proclaimed that this should be impossible by citing a theorem by Bell and by other arguments, but we show that one can construct suggestive models anyway. What actually happens with Bell's theorem here is briefly explained.

**% Lectures are included in the course of the spring school**



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