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K-theory and noncommutative geometry

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K-theory is an important tool from the view point of not only mathematics, but also physics. For example, it is the first example of generalized cohomology, it was used in the proof of Atiyah-Singer index theorem which is one of the greatest theorem in global analysis, and it has a relationship with string theory. *K*-theory has several variations including twisted one and equivariant one. Recently, it was pointed out that twisted *K*-theory is related with representation theory of loop groups of compact Lie groups due to Freed-Hopkins-Teleman theory. Fortunately (especially for me!), the first person in the three mathematicians is one of the invited speakers of this conference.

K-theory has several equivalent definitions just like ordinary cohomology theory. Although it was defined by use of vector bundles for compact Hausdorff spaces by Atiyah-Hirzebruch, it is correct to use classifying spaces to extend it to general spaces if one like *K*-theory to keep nice properties. However, there is another interesting way of generalization: **the formulation of noncommutative geometry (NCG for short).** In a word, NCG is an algebraic geometry of "locally compact crazy spaces". Thanks to NCG, we can "geometrically" deal with various strange spaces including foliations and unitary duals of locally compact groups.

In this talk, I will begin with the core idea of NCG, introduce *K*-theory and compare it with classical one. Then, to show one of many merits of NCG, I will explain that several variation of *K*-theory including twisted one appears as "ordinary *K*-theory of strange spaces".

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