The 2nd School & Conference on Noncommutative Geometry,
April 19-30, 2009, IPM, Tehran

Quantum Field Theory on Noncommutative Geometries

(3 Lectures)

R. Wulkenhaar
University of Münster
Germany

The geometry of Nature depends on the energy scale at which we measure. For small energies we measure the geometry of Riemannian manifolds. At the typical energy of particle accelerators, the geometry is well described by the almost-commutative geometry of the standard model. It is expected that at much higher energy the space itself becomes a noncommutative geometry. The transition into the standard model requires that quantum field theories on such noncommutative spaces are meaningful.

I will review the present knowledge about quantum field theories on noncommutative spaces. Particular emphasis is put on their behaviour at smaller energy scales, which is difficult to bring into agreement with experiment. As a consequence, the region of spacial noncommutativity must be limited to a finite range of the scale parameter. I will outline models which potentially show a phase transition from noncommutative to commutative geometry.