



Contribution ID: 6

Type: **not specified**

Classical and quantum dynamics of higher-derivative systems

Friday 22 June 2018 09:50 (25 minutes)

A brief review of the physics of systems including higher derivatives in the Lagrangian is given. All such systems involve ghosts, i.e. the spectrum of the Hamiltonian is not bounded from below and the vacuum ground state is absent. Usually this leads to collapse and loss of unitarity. In certain special cases, this does not happen, however: ghosts are benign.

We speculate that the Theory of Everything is a higher-derivative field theory, characterized by the presence of such benign ghosts and defined in a higher-dimensional bulk. Our Universe represents then a classical solution in this theory, having the form of a 3-brane embedded in the bulk.

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Session Classification: Higher derivatives Gravity and Ghosts