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Scale invariance, Stueckelberg breaking of Weyl gravity and inflation

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Weyl conformal geometry may play a role in early cosmology where effective theory at short distances becomes conformal. We consider the original Weyl gravity action, quadratic in the scalar curvature and in the Weyl tensor of Weyl conformal geometry; this action is invariant under Weyl scaling gauge transformations. In the absence of matter fields, we show that Weyl action has spontaneous breaking of this symmetry: the Weyl gauge field (of local scale transformations) becomes massive (mass ˜ Planck scale) after absorbing a compensator (dilaton), in a gravitational Stueckelberg mechanism. As a result, one obtains the Einstein-Hilbert action, a positive cosmological constant and the Proca action for the massive Weyl gauge field ("photon"). The Einstein-Hilbert action is then just a "low energy" limit of Weyl quadratic gravity which thus avoids its long-held previous criticisms, while Planck scale is an emergent scale of this symmetry breaking (where Weyl geometry becomes Riemannian). The results remain valid in the presence of matter with non-minimal coupling. Successful inflation in Weyl gravity is possible, with results close to the Starobinsky model. Based on arXiv:1812.08613, 1904.06596.

Presenter: Prof. GHILENCEA, Dumitru (IFIN)

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