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TITULO: Signature change, dark energy, and Cartan gravity with dynamical symmetry breaking

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ABSTRACT

It is known that General Relativity can be formulated as a SO(1,4) Yang-Mill gauge theory in a symmetry broken phase where the equation of motion is derived from the MacDowell-Mansouri action. The gravitational Higgs field, which admit a crisp Cartan-geometrical interpretation as a `contact point', is typically restricted (ad hoc) to have constant positive norm. This guarantees that one reproduces General Relativity exactly. In this talk we will present recent results that shows how one can relax this ad hoc constraint and instead treat the gravitational Higgs field as a genuine dynamical variable; how to do this in a natural way has been an open problem since the early 80ies. This provides a natural generalization of General Relativity which exhibits new phenomenology. Specifically we show how the extensively studied Peebles-Ratra dark energy model naturally pops up. This result is intriguing as it shows how dark energy can be understood as a gravitational symmetry breaking Higgs field. Furthermore, by imposing FRW symmetry on the MacDowell-Mansouri action we reproduce *exactly* the Hartle-Hawking no boundary proposal: the universe starts out in a Euclidean phase with four spatial dimensions, and then undergoes signature change thus so we get 3 space dimensions and one time. Both of these results follow straightforwardly from equations of motion derived from mathematically simple action principles.