

Gauge Theory and cosmology

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What are gauge theories?

Gauge theory is the area in physics in which we construct Lagrangians by their invariance in the system.

QED Lagrangian is invariant under $U(1)$.

QCD Lagrangian is invariant under $SU(3)$.

Einstein-Hilbert Action is invariant under Poincare group.

How can they be used?

In cosmology, matter perturbations between the transition of different eras (radiation to matter ; matter to radiation) are described respectively by Heun and Hypergeometrical equations. Both can be associated with Seiberg-Witten curves, arising from $N=2$ supersymmetric gauge theories.

How can they be used?

Since 1997, when Maldacena proposed the AdS/CFT correspondence, Gauge/Gravity duality has become a major area of study in theoretical physics, specially between string theorists, as it is used to provide a duality relating gravity to qft. So far, all descriptions of it are incompatible with cosmological models observed.