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Fractons, dipole symmetry breaking and gravity

Fractons are excitations with limited mobility that may appear in dipole-conserving models. I will introduce a family of quantum field theories for monopole and dipole charges, featuring quadratic two-derivative kinetic terms. The dipole symmetry algebra is realized in a discretized internal space, connected to the physical space via a background gauge field. Using Hubbard-Stratonovich transformation and large-N techniques, I will show that the effective action displays a fractonic immobile Nambu-Goldstone mode. Fractons naturally couple to two-index symmetric tensor gauge fields resembling spatial metrics. Additionally, a Lorentz covariant version of dipole symmetry will be introduced, with gauge fields containing massive and massless two-index tensors, resembling linearized gravity with lower-spin modes. I will mention how the theory can be consistently coupled to a curved background metric.

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