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Gauge theory, gravity, and nontrivial constitutive laws

In BF-theory terms, apart from the structure group itself, gravity and Yang-Mills theory or electromagnetism are distinguished in the constitutive law, or the simplicity constraints. This is suggestive of a unified topological phase, which is broken into separate internal and external gauge theory, with clear, almost canonical preferences for the excitation B-field for either part. But what if one component has a modified constitutive law? As the interactions are independent, there should be no effect. We will consider how to formalize this in terms of a constitutive diagram, alongside a discussion of spontaneous simplicity constraints, a heuristic description of internal and external gauge theory, and a geometric issue for the unified phase of spacetime.

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