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Shadow Matter

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I will argue that there are quantum states of the field theories of general relativity and electromagnetism that we typically ignore, but have interesting phenomenological effects. These states amount to loosening the constraint equations known as the Hamiltonian and momentum constraints in GR and Gauss'law in EM. Turning off the Hamiltonian constraint sources non-dynamical parts of the metric which mimic a pressureless dust, and thus these effects may be the explanation as to why we have inferred the existence of dark matter, both locally and cosmologically. Turning off the momentum constraints add additional velocity-dependent source terms to this effective dust, but these effects are not conserved and redshift quickly outside the horizon. Turning off the Gauss'law constraint mimics a charge density that does not respond to electric forces, but follows geodesics, thus adding a charged component to the dust. If this new structure in the gravitational and electric fields explain dark matter, it forbids an early period of inflation and therefore requires a different explanation for density perturbations.

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