Proposal for a New Quantum Theory of Gravity

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ABSTRACT

We recall a classical theory of torsion gravity with an asymmetric metric, sourced by a Nambu-Goto + Kalb-Ramond string.. We explain why this is a significant gravitational theory, and in what sense classical general relativity is an approximation to it. We propose that a non-commutative generalisation of this theory (in the sense of Connes' non-commutative geometry and Adler's Trace Dynamics) is a 'quantum theory of gravity'. The theory is in fact a classical matrix dynamics with only two fundamental constants – the square of the Planck length and the speed of light, along with the two string tensions as parameters. The guiding symmetry principle is that the theory should be covariant under general coordinate transformations of *non-commuting* coordinates.The action for this non-commutative torsion gravity can be elegantly expressed as an invariant area integral, and represents an atom of space-time-matter. The statistical thermodynamics of a large number of such atoms yields the laws of quantum gravity and quantum field theory, at thermodynamic equilibrium. Spontaneous localisation caused by large fluctuations away from equilibrium is responsible for the emergence of classical space-time and the field equations of classical general relativity. The resolution of the quantum measurement problem by spontaneous collapse is an inevitable consequence of this process. Quantum theory and general relativity, are both seen as emergent phenomena, resulting from coarse-graining of the underlying non-commutative geometry. We explain the profound role played by entanglement in this theory: entanglement describes interaction between the atoms of space-time-matter, and indeed entanglement appears to be more fundamental than quantum theory or space-time. We also comment on possible implications for black hole entropy and evaporation, and for cosmology. We list the intermediate mathematical analysis which remains to be done to complete this programme.

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