Problems with the Semiclassical Approximation in Quantum Geometrodynamics

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Some proponents of quantum geometrodynamics [1, 2, 3] claim that the "semiclassical approximation" to the Wheeler-DeWitt equation circumvents the Problem of Time and the Hilbert Space Problem, and makes possible an Everettian theory of canonical quantum gravity. I will show that this claim is false. In particular, I will show that: (1) for a pure state corresponding to a superposition of semiclassical Wheeler-DeWitt wave functionals, such as the Hartle-Hawking wave functional, it is not possible to recover independent functional Schroedinger equations for the matter components of the superposition state, nor can the semiclassical Einstein equations be recovered; (2) the associated reduced density matrix for the 3-geometry is mathematically undefinable because of the Hilbert Space Problem; (3) even if said reduced density matrix was mathematically definable, no decoherence mechanism exists to approximately diagonalize the reduced density matrix in the 3-geometry basis; and (4) as a consequence of (1)-(3), the semiclassical approximation to the Wheeler-DeWitt equation doesn't circumvent the Problem of Time or the Hilbert Space Problem, and doesn't make possible an Everettian theory of canonical quantum gravity.

References

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