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Frozen Gaussian Approximation for the Dirac equation in semi-classical regime

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In this talk, we introduce the Frozen Gaussian Approximation (FGA) for the Dirac equation in the semi-classical regime. Unlike the strictly hyperbolic system studied in [J. Lu and X. Yang, *Comm. Pure Appl. Math.*, 65, 759–789, 2012], the Dirac equation possesses eigenfunction spaces of multiplicity two, which demands more delicate expansions for deriving the amplitude equations in FGA. Moreover, we prove that the nonrelativistic limit of the FGA for the Dirac equation is the FGA of the Schrödinger equation, which shows that the nonrelativistic limit is asymptotically preserved after one applies FGA as the semiclassical approximation. Numerical experiments including Klein-Paradox are presented to illustrate the method, and confirm part of the analytical results.

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