

Uniformly Accurate Low Regularity Integrators For the Klein–Gordon Equation

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Abstract

We propose a novel class of uniformly accurate integrators for the Klein–Gordon equation which capture classical $c = 1$ as well as highly-oscillatory non-relativistic regimes $c \gg 1$ and, at the same time, allow for low regularity approximations. In particular, the schemes converge with order τ and τ^2 , respectively, under lower regularity assumptions than classical schemes, such as splitting or exponential integrator methods, require. The new schemes in addition preserve the nonlinear Schrödinger (NLS) limit on the discrete level. More precisely, we will design our schemes in such a way that in the limit $c \rightarrow \infty$ they converge to a recently introduced class of low regularity integrators for NLS.