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Fast computation of the semiclassical Schrödinger equation

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Abstract

The computation of the semiclassical Schrödinger equation presents a number of difficult challenges because of the presence of high oscillation and the need to respect unitarity. Typical strategy involves a spectral method in space and Strang splitting in time, but it is of low accuracy and sensitive to high oscillation. In this talk we sketch an alternative strategy, based on high-order symmetric Zassenhaus splittings, combined with spectral collocation, which preserve unitarity and whose accuracy is immune to high oscillation. These splittings can be implemented with large time steps and allow for an exceedingly affordable computation of underlying exponentials. The talk will be illustrated by the computation of different quantum phenomena.