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Splitting methods for Schrödinger equations with time dependent potentials; many problems, many approaches

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In this talk I will present various numerical approaches for the linear Schrödinger equations with time dependent potentials. As it often happens, the methods should be closely correlated with properties of the problem. We suggest an application of asymptotic Zassenhauss decomposition in tandem with Munthe-Kaas–Owren basis for semiclassical scaling. In case of high oscillations of the potential we resort to simplified commutators in Magnus expansion and integrate the potential function in the very last stage of the algorithm. Magnus-Lanczos with simplified commutators are proposed in case of atomic scaling. Irrespectively of chosen regime, compact splittings are suggested for equations under the influence of laser matter. I will present numerical examples and compare these methods numerically.

This talk is based on results obtained with Philipp Bader, Arieh Iserles and Pranav Singh.

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