A new class of semi-discrete schemes for solving the Gross-Pitaevskii equation at low regularity

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In this talk I will introduce a novel time discretization for the Gross-Pitaevskii equation at low-regularity on an arbitrary domain $\Omega \subset \mathbb{R}^d$, $d \leq 3$, with non-smooth potential. I will first show the construction of our first and second order low-regularity integrators. I will discuss the stability issues which arise during the construction of the second-order low-regularity integrator, and will then propose two different approaches to guarantee the stability of our proposed scheme.
I will also present a local and global $L^2(\Omega)$ and $H^1(\Omega)$ error analysis for the first and second low-regularity integrators, and for a class of solutions and potential in appropriate Sobolev spaces.
These new schemes, together with their optimal local error, allow for convergence under lower regularity assumptions than required by classical methods.