

Type Master Thesis

Title **Gabor Discretization of the Schrödinger Equation**

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Description. This project is concerned with the implementation of discretization schemes for the Schrödinger equation

$$i\partial_t u + Hu = 0, \quad u(0, x) = u_0(x).$$

where H is a semilinear elliptic operator, for instance $H = -\frac{1}{4\pi}\Delta + \pi|x|^2$. Recent work shows that the operator mapping initial data u_0 to the solution $u(t, \cdot)$ at time $t > 0$ becomes very sparse if we represent u_0 in a Gabor representation (Cordero, Nicola and Rodino 2009). This way, the Schrödinger equation can be solved efficiently.

The goal of this Master Thesis project is to summarize the results of (Cordero et al. 2009) and, based on it, develop and implement an efficient solver for the Schrödinger equation.

Prerequisites. Numerical analysis, Harmonic Analysis, programming skills (MATLAB and/or C++).

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References

E. Cordero, F. Nicola and L. Rodino (2009), ‘Sparsity of Gabor representation of Schrödinger propagators’, *Applied and Computational Harmonic Analysis* **26**(3), 357–370.