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Seminar of the Work Group
Nonlinear Partial Differential Equations
WS 25/26

January 21st, 2026, 11:30 - 13:00
Seminar room: SR 3.069

Spectral Asymptotics of Asymptotically Periodic Sturm-Liouville Operators

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Abstract

We study the Sturm-Liouville eigenvalue problem

$$-u'' = \lambda V(x)u \qquad \text{for} \quad x \in \mathbb{R}$$

where the potential V is uniformly positive, bounded, and piecewise $W^{1,1}$.

First, if V is additionally periodic, we calculate the asymptotic shape of the spectrum as $\lambda \to \infty$ using modified Prüfer angles. We focus on the case where V has exactly one discontinuity per periodicity cell.

Second, if V is only periodic outside some compact interval, we show that the number of eigenvalues in each gap of the essential spectrum is uniformly bounded.

This allows us to extend the class of examples in the paper [J.Henninger, O., W.Reichel; arXiv:2505.13336] where we constructed time-periodic, space-localized solutions to the semilinear wave equation

$$-u_{xx} + V(x)u_{tt} = \Gamma(x)|u|^{p-1}u = 0 \qquad \text{for} \quad x, t \in \mathbb{R}$$

with suitable Γ.

This is based on ongoing work together with Michael Plum.