MSRI–5 minute talks

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Previous:

- PhD 2021–University at Buffalo, The State University of New York
- Advisor–Gino Biondini

Current:

- MSRI postdoc (August–December 2021)
- Mentor–Percy Deift
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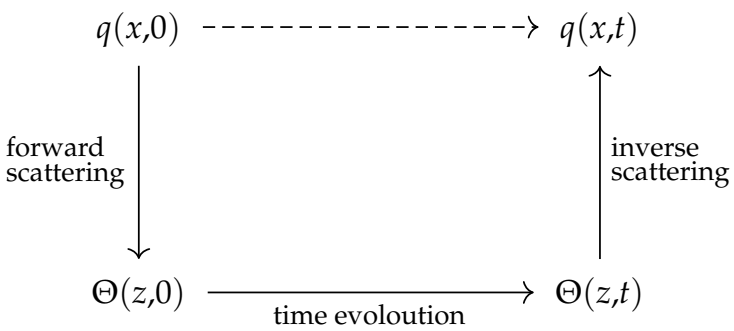
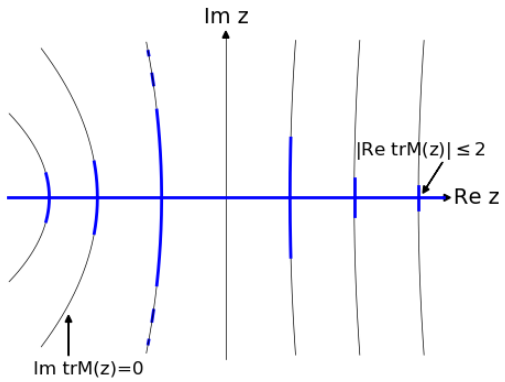
Semiclassical focusing NLS equation on the circle:

$$i\epsilon\partial_t q + \epsilon^2\partial_x^2 q + 2|q|^2 q = 0\,, \qquad q(x+l,t) = q(x,t)\,, \qquad 0 < \epsilon \ll 1 \tag{1}$$





Current and past research

Spectral theory

- Rigorous analysis of the nonselfadjoint Dirac operator with a periodic potential.
  - In this direction I found semiclassical bounds on the Bloch-Floquet spectrum for $q \in H^1_{\text{loc}}(\mathbb{R})$.
- Finite-genus solutions of the focusing NLS equation.
  - In this direction I proved the existence of an explicit two-parameter family of elliptic finite-gap potentials of the focusing Zakharov-Shabat operator. Moreover, one can determine the genus of the solution to NLS using only one of the parameters.
- Focusing NLS on the circle and semiclassical limits
  - Here I studied the spectral data analytically and numerically. For a certain class of periodic initial data a "soliton gas" emerges in the limit $\epsilon \downarrow 0$. Rigorous semiclassical asymptotics?

Orthogonal polynomials

- Orthogonal polynomial problem with logarithmic weight $w(x) = -\log x\,,\ 0 < x < 1$.
  - **Complication:** The local parametrix at $x = 0$ is unknown.
  - **Applications:** Analytic number theory and random matrix theory.