Inverse scattering on the line for Schrödinger operators with Miura potentials

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joint work with Ch. Frayer, Ya. Mykytyuk and P. Perry

We study direct and inverse scattering problems for one-dimensional Schrödinger operators with highly singular Miura potentials $q \in H^{-1}(\mathbb{R})$, i.e., potentials of the form $q = u' + u^2$ for some $u \in L_2(\mathbb{R})$. Under some additional assumptions this Riccati representation is unique, and there is a well-defined reflection coefficient r that determines u uniquely. We show that the map $u \mapsto r$ is continuous with continuous inverse and obtain an explicit reconstruction formula. Among potentials included are, e.g., delta-functions, potentials of Marchenko–Faddeev class, and some highly oscillating unbounded potentials.