The Time-Dependent Approach to Inverse Scattering

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In this talk I present the time-dependent approach to inverse scattering, that has been applied to many linear and non-linear scattering problems. The cases of potential scattering and of the non-linear Schroedinger equation with a potential are discussed in detail. We prove that the scattering operator uniquely determines the potential and the nonlinearity, and we give formulae for the reconstruction of both. The results for other two-body and N-body problems are briefly reviewed. The proofs follow closely physical intuition. Key observations are that in the linear case at high energies translation of wave packets dominates over spreading during the interaction time and that in the non-linear case at low energies the dispersive effect of the linear part dominates the nonlinearity.