SOLITON EQUATIONS AND THE RIEMANN-SCHOTTKY PROBLEM (80 MINUTES × 2)

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A one-to-one correspondence between commutative subring of certain non-commutative ring of operators, and geometric data consisting of an algebraic curve, one or more points on it and a torsion-free sheaf over it, was discovered and applied to a construction of explicit solutions of certain nonlinear equations by Krichever in 1970s. The correspondence also leads very naturally to a solution of the Riemann-Schottky problem, i.e., a characterization of Jacobians among all ppav's, using the same class of equations: an indecomposable ppav is a Jacobian of a curve iff its Riemann theta function solves those equations. One can reduce the number of equations and characterize the Jacobians using just one PDE called the KP equation, or as proved by Krichever recently, its difference analogue called Fay's trisecant identity. I would also like to point out that since those equations involve derivatives or differences of the theta function, we have not obtained (vector-valued) modular forms that characterize the Jacobian locus.