

1167-47-273

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*Reflectionless Canonical Systems.*

We develop a comprehensive theory of reflectionless canonical systems with an arbitrary Dirichlet-regular Widom spectrum with the Direct Cauchy Theorem property. This generalizes, to an infinite gap setting, the constructions of finite gap quasiperiodic (algebro-geometric) solutions of stationary integrable hierarchies. Instead of theta functions on a compact Riemann surface, the construction is based on reproducing kernels of character-automorphic Hardy spaces in Widom domains with respect to Martin measure. We also construct unitary character-automorphic Fourier transforms which generalize the Paley-Wiener theorem. Finally, we find the correct notion of almost periodicity which holds for canonical system parameters in Arov gauge, and we prove generically optimal results for almost periodicity for Potapov-de Branges gauge, and Dirac operators. (Received March 08, 2021)