

# **Integrable Systems and Orthogonal Polynomials**

PETER CLARKSON\*, KERSTIN JORDAAN

School of Mathematics, Statistics & Actuarial Science, University of Kent,  
Canterbury, CT2 7FS, UK

*Email:* P.A.Clarkson@kent.ac.uk

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In this talk I will discuss the relationship between orthogonal polynomials with respect to semi-classical weights, which are generalisations of the classical weights and arise in applications such as random matrices, and integrable systems, in particular the Painlevé equations and discrete Painlevé equations. I will show that for some semi-classical weights the coefficients in the three-term recurrence relation can be expressed in terms of Hankel determinants. These determinants are Wronskians that arise in the description of special function solutions of Painlevé equations and also as partition functions in random matrix models and the recurrence coefficients satisfy a discrete Painlevé equation. The semi-classical polynomials discussed will include polynomials orthogonal with respect to a generalization of the Freud weight.