

# The Airy and Pearcey Processes

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(In honor of J. Laurie Snell's 80<sup>th</sup> Birthday)

## Abstract

The *extended Airy kernel* describes the space-time correlation functions for the *Airy process*, which is the limiting process for a polynuclear growth model. The Airy functions themselves are given by integrals in which the exponents have a cubic singularity, arising from the coalescence of two saddle points in an asymptotic analysis. Pearcey functions are given by integrals in which the exponents have a quartic singularity, arising from the coalescence of three saddle points. Corresponding *Pearcey kernels* appear in random matrix theory and a Brownian motion model for a fixed time. We derive an *extended Pearcey kernel* by scaling the Brownian motion model at several times, and a system of partial differential equations whose solution determines associated distribution functions. We expect, but have not proved, that there is a limiting nonstationary process, consisting of infinitely many paths, whose space-time correlations are expressible in terms of this extended kernel. These recent developments will be surveyed. This is joint work with Harold Widom.