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*Gap probability in critical unitary random matrix ensembles and the coupled Painlevé II system*

We study Fredholm determinants of the Painlevé II and Painlevé XXXIV kernels. In certain critical unitary random matrix ensembles, these determinants describe special gap probabilities of eigenvalues. We obtain Tracy-Widom formulas for the Fredholm determinants, which are explicitly given in terms of integrals involving a family of distinguished solutions to the coupled Painlevé II system in dimension four. Moreover, the large gap asymptotics for these Fredholm determinants are derived, where the constant terms are given explicitly in terms of the Riemann zeta-function. This talk is based on a joint work with Dan Dai.