

# Tunneling and Weyl laws for the $\bar{\partial}$ operator

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Abstract: We study the number of exponentially small singular values for the semi-classical  $\bar{\partial}$  operator on exponentially weighted  $L^2$  spaces on the two-dimensional torus. Accurate upper and lower bounds on the number of such singular values are established with the help of auxiliary notions of upper and lower bound weights. Assuming that the Laplacian of the exponential weight changes sign along a curve, we construct optimal such weights by solving a free boundary problem, which yields a Weyl asymptotics for the counting function of exponentially small singular values. We also provide a precise description of the leading term in the Weyl asymptotics, in the regime of small exponential decay rates. This is joint work with Johannes Sjöstrand and Martin Vogel.