

# The law of the iterated logarithm and data-driven regularizations of ill-posed inverse problems

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## Abstract

The talk deals with recovering an unknown function  $\theta(t)$ ,  $t \in [0, 1]$  from the noisy data  $dY(t) = \int_0^1 A(t, u)\theta(u) du dt + \sigma dW(t)$ ,  $t \in [0, 1]$ , where  $A(t, u)$  is a known function with the bounded  $L_2$  - norm and  $W(\cdot)$  is a standard Wiener process. In order to estimate  $\theta$ , a spectral regularization method is used, and our goal is to choose its regularization parameter with the help of the data at hand. For a very wide class spectral regularization methods, we propose a new method for computing penalties in the principle of empirical risk minimization and show that the third order term in nearly optimal penalties is related to a non-asymptotic version of the law of the iterated logarithm. It is shown that this approach results in sharp oracle inequalities controlling the mean square risks of data-driven spectral regularization methods.