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Multifractality, freezing and extreme value statistics
in models with logarithmic correlations

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The covariance of the Gaussian random free field in dimension $D = 2$ depends logarithmically on the distance. We consider Gaussian fields in the space of any dimension which have similar logarithmic correlations and use them to study the induced Boltzmann–Gibbs measures. Employing heuristic methods of theoretical physics we show that those measures turn out to be multifractal, and the singularity spectrum experiences a phase transition (“freezing”) with increasing disorder. The most explicit results are obtained in $D = \infty$ and $D = 1$. In particular, the latter case allows us to conjecture the explicit form of the distribution of minimum of the standard 2D gaussian free field sampled along a circle of unit radius. Such a distribution is manifestly non-Gumbel.

The presentation will be partly based on a joint work with J. P. Bouchaud arXiv :0805.0407v2 [J. Phys. A : Math. Theor. 41 (2008) 372001 (12pp)] as well as on unpublished results.