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Localization of $N=1$ Theories on $D2 \times T^2$

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We consider 4d $N=1$ gauge theories with R-symmetry on a hemisphere times a torus. We apply localization techniques to evaluate the exact partition function through a cohomological reformulation of the supersymmetry transformations. Our results represent the natural elliptic lifts of the lower dimensional analogs as well as a field theoretic derivation of the conjectured 4d holomorphic blocks, from which partition functions of compact spaces with diverse topology can be recovered through gluing. We also analyze the different boundary conditions which can naturally be imposed on the chiral multiplets, which turn out to be either Dirichlet or Robin-like. We show that different boundary conditions are related to each other by coupling the bulk to 3d $N=1$ degrees of freedom on the boundary three-torus, for which we derive explicit 1-loop determinants. The talk is based on arXiv 1906.02051 .

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