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2d free field correlators, 3d dualities and E-string on Riemann surfaces

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Infra-red dualities for supersymmetric quantum field theories and their dimensional reductions can be effectively investigated using supersymmetric localization. With this technique we can compute exactly some protected quantities, like partitions functions e superconformal indices, that don't depend on the gauge coupling and should thus match between the dual theories. Moreover, it allowed us to discover interesting correspondences, such as gauge/CFT correspondences. I will discuss a particular relation of this kind, between $S^2 \times S^1$ partition functions of $3d \mathcal{N} = 2$ theories and $2d$ CFT correlators in the free field realization. This connection can be used to guess new $3d$ dualities starting from known identities for free field correlators. I will also show that these results can be further uplifted to $4d$. Unexpectedly, some of the resulting $4d \mathcal{N} = 1$ models turn out to correspond to the theories obtained from compactifications of the $6d \mathcal{N} = (1, 0)$ E-string theory on Riemann surfaces with fluxes for its E_8 global symmetry. They enjoy interesting global symmetry enhancements that can be predicted from their $6d$ origin.

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