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Protected couplings and BPS black holes

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After compactification on a thermal circle, BPS black holes in dimension D yield BPS instantons in dimension $D-1$. Thus, BPS saturated couplings in the low energy effective action in dimension $D-1$ conveniently encode BPS black hole degeneracies. I will demonstrate this connection in the case of R^4 and $D^4 R^4$ couplings in string vacua with 32 supercharges, and F^4 , $D^2 F^4$ couplings in string vacua with 16 supercharges, all of which can be determined exactly using constraints from U-duality and supersymmetry. In particular, the $D^2 F^4$ couplings provide a new point of view on the celebrated DVV formula counting BPS dyons in $D=4$.