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Remarks on BPS Wilson loops in non-conformal N=2 gauge theories and localization

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We consider 1/2 BPS supersymmetric circular Wilson loops in four-dimensional N = 2 SU(N) SYM theories with massless matter in a generic representation of the gauge group and a non-vanishing β-function (arxiv:2311.17692). Following Pestun's approach, we can employ localization to map these observables, evaluated on the four-sphere S^4, into a matrix model, provided that the one-loop determinants are consistently regularized. After constructing the regularized matrix model for these set-ups, I will demonstrate that the predictions for the Wilson loop at order g^4 perfectly match the perturbative renormalization based on the evaluation of Feynman diagrams both on the sphere and, remarkably, in flat space, even if conformal symmetry is broken at the quantum level. Moreover, I will revisit the difference theory approach, showing that when β-function is non-vanishing this method does not account for the presence of "evanescent"terms which are activated by the renormalization procedure and contribute to the renormalized observable at order g^6.

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