# Discussion on Consistent Truncations: Uplifting the GPPZ Solutions

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In the context of the AdS/CFT correspondence, the duality between Type IIB supergravity on $AdS^5 \times S^5$ and $N = 4$ SYM has been well established. However, finding new supergravity solutions that represent deformations of this theory or other SYM variations is complex due to the non-linear nature of Type IIB supergravity equations. A powerful approach involves consistent truncations, where one reduces the dimensionality of the supergravity theory while preserving key features. The GPPZ solution, a deformation of the $N = 4$ SYM theory, provides a rich playground for exploring such truncations and their uplifts to 10D supergravity. The GPPZ solution, named after Girardello, Petrini, Porrati, and Zaffaroni, is a solution to 5D gauged supergravity that corresponds to a specific deformation of $N = 4$ SYM. To construct its 10D uplift, we start with a consistent truncation of the 5D $N = 8$ gauged supergravity theory. This truncation retains only a subset of the original 42 scalar fields, focusing on those that define the GPPZ solution. Given the consistency of this truncation, the corresponding 10D uplift aligns with the Type IIB supergravity framework. The resulting solution is obtained by expanding the 5D solution onto the $S^5$, accounting for symmetries and ensuring that the fields' Lagrangian and supersymmetry variations remain consistent with Type IIB supergravity. The explicit construction of the 10D uplift involves finding compact expressions for all fields in the Type IIB supergravity theory. This is achieved by utilizing specific coordinates on the $S^5$ that align with the symmetries of the problem, thereby allowing for a consistent uplift of the GPPZ solution. These coordinates and the underlying consistency checks ensure that the metric, axion-dilaton fields, and fluxes obey all necessary equations of motion within Type IIB supergravity. In addition to these consistency checks, the solutions must also address potential singularities. The GPPZ solution in its 5D form has an integration constant that can take any real value, which has implications for the behavior of the solution in the 10D uplift. Two criteria for addressing singularities in supergravity are the 'Gubser criterion' for 5D and the 'Maldacena-Nuñez criterion' for 10D, providing guidance on how to manage naked singularities. An essential aspect of this study is understanding the symmetry breaking in the uplifted solutions. The GPPZ solution and its 10D uplift can be connected to a broader understanding

of symmetry enhancement in the context of the AdS/CFT correspondence. The original $N = 4$ SYM theory has an SO(6) R-symmetry, which is partially broken in the GPPZ deformation, leading to further insights into symmetry breaking in holographic scenarios. The implications for holography and the interpretation of these results in terms of dual gauge theories are significant. By connecting the 10D uplift to the original SYM theory, we gain insights into the broader context of supersymmetric vacuums and their interpretation within supergravity.