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High Energy Physics - Theory

The Resurgence of Instantons in String Theory

Inês Aniceto, Ricardo Schiappa, Marcel Vonk

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Nonperturbative effects in string theory are usually associated to D-branes. In many cases it can be explicitly shown that D-brane instantons control the large-order behavior of string perturbation theory, leading to the well-known (2g)! growth of the genus expansion. This paper presents a detailed treatment of nonperturbative solutions in string theory, and their relation to the large-order behavior of perturbation theory, making use of transseries and resurgent analysis. These are powerful techniques addressing general nonperturbative contributions within non-linear systems, which are developed at length herein as they apply to string theory. The cases of topological strings, the Painleve I equation describing 2d quantum gravity, and the quartic matrix model, are explicitly addressed. These results generalize to minimal strings and general matrix models. It is shown that, in order to completely understand string theory at a fully nonperturbative level, new sectors are required beyond the standard D-brane sector.

Comments:	108 pages; v2,v3: references added; v4: improved pedagogical content, final version for CNTP
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