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Four-point correlators with BPS bound states in AdS3 and AdS5

by F. Aprile, S. Giusto, R. Russo

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Plaza de las Ciencias, 1 28040 Madrid, Spain

www.ucm.es/iparcos/



UNIVERSIDAD
COMPLUTENSE
MADRID



Abstract

We consider heavy-heavy-light-light (HHLL) correlators in AdS/CFT, focussing on the D1D5 CFT₂ and the $\mathcal{N}=4$ super Yang-Mills theory. Out of the lightest $1/2$ -BPS operator in the spectrum, \mathcal{O} , we construct a particular heavy operator \mathcal{O}_H given by a coherent superposition of multi-particle operators \mathcal{O}^n , and study the HHLL correlator. When n is of order of the central charge, we show that the bulk equation that computes our boundary HHLL correlators is always a Heun equation. By assuming that the form of the correlator can be continued to the regime where n is $\mathcal{O}(1)$, we first reproduce the known single-particle four-point correlators for $n=1$ and then predict new results for the multi-particle correlators $\langle \mathcal{O}^n \mathcal{O}^n \mathcal{O} \mathcal{O} \rangle$. Explicit expressions can be written entirely in terms of n -loop ladder integrals and their derivatives, and we provide them for $n=2$ and $n=3$ both in position and in Mellin space. Focussing on the AdS₅ case, we study the OPE expansion of these multi-particle correlators and show that several consistency relations with known CFT data are non-trivially satisfied. Finally, we extract new CFT data for double and triple-particle long operators.

