Hexagon OPE in the double scaling limit

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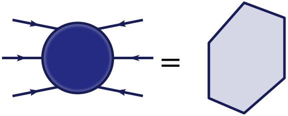
Motivation

- Amplitude bootstrap gives high-order predictions for gluon S-matrix in $\mathcal{N} = 4$ SYM
- Main ingredients: symbol/coproduct and analytical properties
- Needs boundary data: MRL or OPE (expansions in certain kinematics)
- One way to (partially) resum the OPE: double-scaling limit [Drummond, Papathanasiou '15] 5 loops

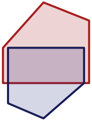
WLOPE expansion

- Wilson loop ⟷ planar amplitude duality [Drummond, Henn, Korchemsky, Sokatchev, ‘09]



- OPE for WL

  [Alday, Gaiotto, Maldacena, Sever, Vieira ‘11, Basso, Sever, Viera ‘13]
- $\mathcal{W} = \sum_{\psi} P(0|\psi) P(\psi|0) e^{-E_\psi \tau + i p_\psi \sigma + i m_\psi \phi}$
- Double scaling limit resums gluon bound states
- 1 state up to 3 loops, 2 states: 8 loops

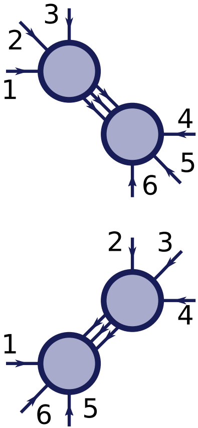


N-state @ g^{2N^2}

Coproduct bootstrap & Steinmann conditions

[Caron-Huot, Dixon, McLeod, von Hippel ‘16]: 5 loops, general kinematics

- $\{n-1,1\}$ coproduct $dF^n = \sum F^{n-1} \mathrm{d} \log \phi_l$
- Steinmann condition: double discontinuities in overlapping channels are 0
- Observation: holds anywhere inside the symbol
- Reduce the complexity from 3^N to 2^N



Overview of the computation

Double scaling limit of $\mathcal{A}_6(u_1, u_2, u_3)$: $u_2 \to 0$, u_1, u_3 fixed.
Given the set of Steinmann functions @ weight = $N-1$:

- Generate functions with proper branch cuts on the first sheet

$u_i = 0$ $\qquad$ $u_i = \infty$

- Impose Steinmann conditions on the produced symbols
- Expand in $u_1 \to 1, u_3 \to 0$ and compare with WLOPE