CONFORMAL BOOTSTRAP

Bounds on OPE coefficients in 4d CFTs

(arXiv:1406.7845)

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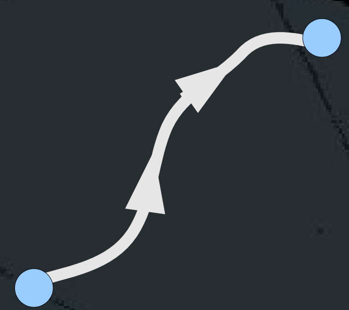
5 facts about CFTs

- Space-time symmetry: Poincare+Dilatations+SCFT
- CFTs are basic building blocks of QFTs
- We know real systems described by CFTs (e.g:3D Ising model)
- There are no particles! Only observables are n-field correlators.
- A CFT is basically a set of CFT DATA : {primary fields, scaling dimensions and OPE coefficients/coupling constants}



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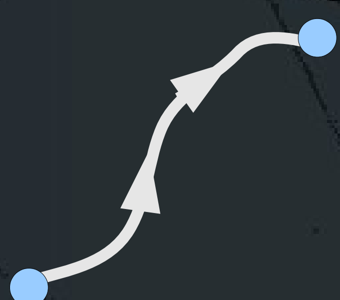


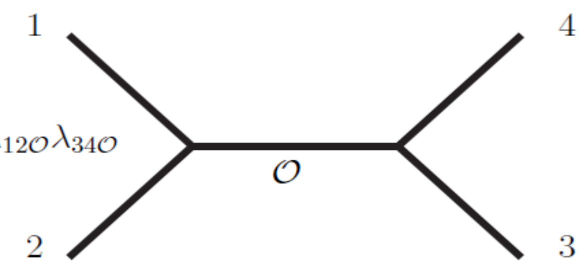
The Bootstrap

- Basic ingredients:
  - Operator Product Expansion
  - Unitarity
  - Associativity of 4-pt functions
  - Kinematics (2 and 3 pt functions “fixed”, 4pt function “almost fixed”)

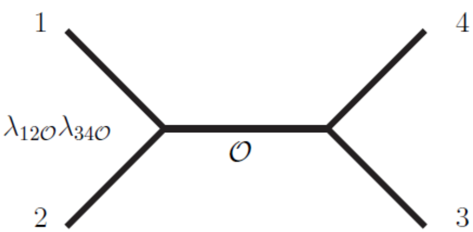
$$\phi_1(x)\phi_2(0) = \sum_{\mathcal{O}} \lambda_{12\mathcal{O}} \left[\mathcal{O}(0) + \text{ descendants}\right]$$

$$\langle \phi_1(x_1)\phi_2(x_2)\phi_3(x_3)\rangle = \frac{\lambda_{123}}{(x_{12})^{2\alpha_{123}}(x_{13})^{2\alpha_{132}}(x_{23})^{2\alpha_{231}}} \ ,$$

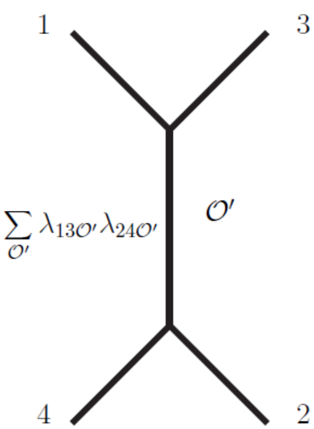
$$\langle \phi(x_1)\phi(x_2)\phi(x_3)\phi(x_4)\rangle = \sum_{\mathcal{O}} \lambda_{12\mathcal{O}}\lambda_{34\mathcal{O}}$$



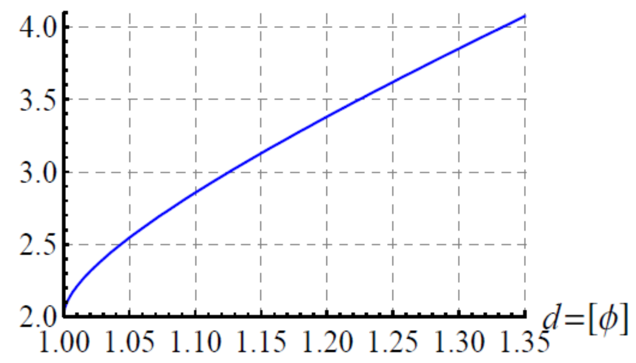
$$\sum_{\mathcal{O}} \lambda_{12\mathcal{O}}\lambda_{34\mathcal{O}}$$

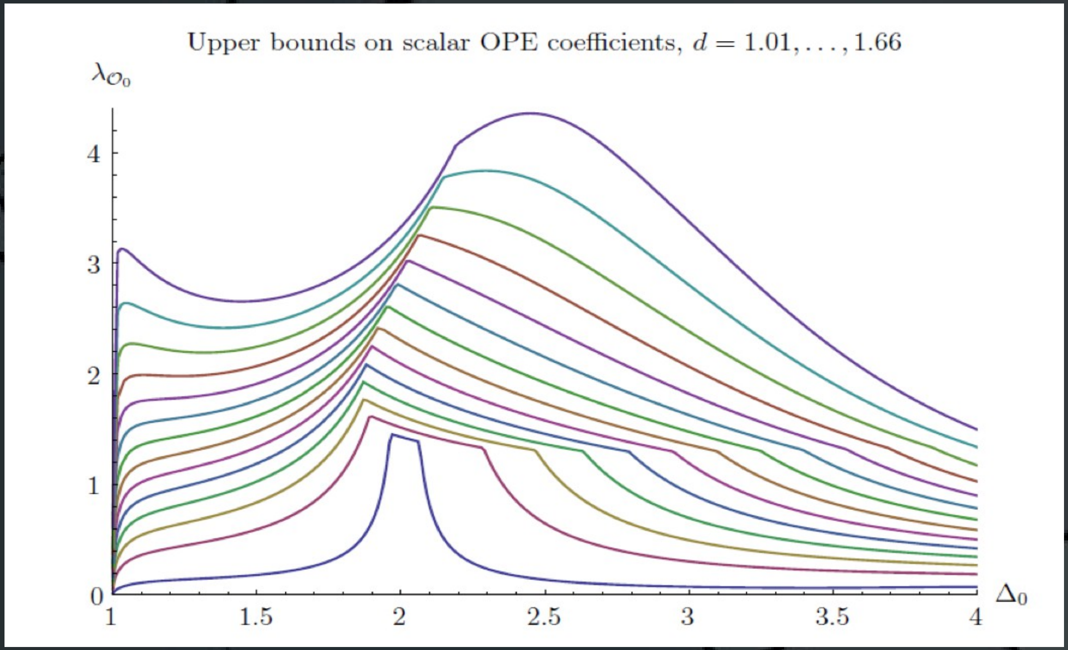


$$= \sum_{\mathcal{O}'} \lambda_{13\mathcal{O}'}\lambda_{24\mathcal{O}'}$$



$$F_{0,0}(u,v) + \sum_{\mathcal{O}\in\phi\times\phi} \lambda_{\mathcal{O}}^2 F_{\Delta,\ell}(u,v) = 0,$$


4.0
3.5
3.0
2.5
2.0
1.00 1.05 1.10 1.15 1.20 1.25 1.30 1.35
d=[ϕ]


Upper bounds on scalar OPE coefficients, $d = 1.01, \ldots, 1.66$
$\lambda_{\mathcal{O}_0}$
4
3
2
1
0
1 1.5 2 2.5 3 3.5 4
Δ_0