Contribution ID: **862** Type: **Parallel Session Talk**

Bounds on Anomalous Dimensions and OPE Coefficients from Crossing Symmetry in 4D CFTs. Applications to Conformal Technicolor and Unparticles.

Thursday, 22 July 2010 10:06 (18 minutes)

A classic result of 4D CFT says that, in a unitary theory, a scalar operator of dimension d=1 is free. We will present results showing in which sense a scalar O of dimension d>1 but close to 1 is "nearly free". Namely, we analyze the OPE OxO of such a scalar with itself and show that 1) there must be a scalar of dimension 2+O(sqrt(d-1)) in this OPE; 2) in the d->1 limit, no scalars of dimension different from 2 can appear in this OPE. Our methods use the crossing symmetry constrant for the 4-point function <OOOO>. They give numerical bounds on anomalous dimensions and OPE coefficients even as d-1 gets large. Apart from theoretical interest, such bounds have application to phenomenology (models of conformal EWSB and unparticles).

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Session Classification: 12 - Beyond Quantum Field Theory Approaches (including String Theories)

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