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***Physics & Astronomy Building (PAB) 4-330***

## **Pitting Weyl against Conformal Invariance in Quantum Field Theory: Does Conformal imply Weyl Invariance?**

**Valentina Prilepina (UC Davis)**

We investigate the problem of the enhancement of conformal invariance in flat spacetime to Weyl invariance in curved spacetime. We restrict attention to all unitary quantum field theories and put forward a compelling argument for the statement that for all spacetime dimensions  $d \leq 10$ , conformal invariance in flat spacetime implies Weyl invariance in a general curved background metric. In addition, we examine possible curvature corrections to the Weyl transformation laws of operators and show that these corrections are in fact absent for sufficiently low operator dimension and spin. In particular, we demonstrate this for an important class of operators, namely relevant scalar operators in  $d \leq 6$ , and find that the Weyl transformations of these operators are the standard ones. Moreover, we find a class of consistent 'anomalous' curvature corrections proportional to the Weyl (Cotton) tensor in  $d > 3$  ( $d = 3$ ) spacetime dimensions. The arguments rely on algebraic consistency conditions reminiscent of the famous Wess-Zumino consistency conditions employed for the classification of Weyl anomalies. We anticipate that they can be extended to higher spacetime dimensions and for more general operators at the price of higher algebraic complexity.