



Department of
Theoretical Physics

THE QUANTUM SPACETIME SEMINAR SERIES

Bifundamental Multi-Scalar Fixed Points

(Zoom Seminar)

Shiroman Prakash

(DEI, Agra)

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Zoom link shall be shared separately



In this talk, I will mostly summarize arXiv:2112.01055 [written jointly with S Kapoor] in which we study fixed points of scalar fields that transform in the bifundamental representation of $O(N) \times O(M)$ in $3-\epsilon$ dimensions, generalizing the classic tri-critical sextic vector model studied by Pisarski and others in the early 1980s. In the limit where N is large but M is finite, we determine the complete beta function to order $1/N$ for arbitrary M . We find a rich collection of large N fixed points in $d=3$, as well as fixed points in $d=3-\epsilon$, that can be studied to all orders in the parameter $\hat{\epsilon}=N\epsilon$. We then study fixed points in the bifundamental large N limit, in which M and N are both large, but the ratio M/N is held fixed. We find a unique infrared fixed point in $d=3-\epsilon$, which we determine to four loops. When $M/N \ll 1$, we also find an ultraviolet fixed point in $d=3$ and $d=3-\epsilon$ that merges with the infrared fixed point at $\epsilon \sim O(M/N)$. The fates of the bifundamental UV fixed point in $d=3$ and the bifundamental IR fixed point in $d=2$ for $\alpha \sim O(1)$ remain uncertain.

We may also briefly discuss work in progress on bifundamental fixed points in $d=6-\epsilon$ generalizing the $5d$ critical $O(N)$ model (studied by Fei, Giombi, Klebanov) and theories that interpolate between vector models and SYK type physics (studied recently by Chang, Colin-Ellerin, Peng, Rangamani).