Emergent Gravity and N(on)C(ommutative) spaces

expect:

Gravity ↔ Quantum Mechanics

quantum structure of space-time ⇒

explicit realization: Matrix Models of type

$$S[X^a] = -\operatorname{Tr}\Big(\sum_{a,b=1}^{D} [X^a, X^b][X^{a'}, X^{b'}]\delta_{aa'}\delta_{bb'}\Big)$$

describe { nonabelian gauge fields dynamical NC spaces, metric } as solutions

dynamical objects: $X^a \dots N \times N$ matrices, $N \to \infty$

D = 10 preferred by consistency under guantization

Space(time) is realized as 4-dimensional NC brane $\mathcal{M} \subset \mathbb{R}^D$ effective metric on \mathcal{M} emerges:



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$$G^{\mu
u} \sim \theta^{\mu\mu'} \theta^{
u\nu'} g_{\mu'
u}$$

 $i\theta^{\mu
u} \sim [X^{\mu}, X^{
u}]$

examples: quantum plane \mathbb{R}^4_{θ} , fuzzy spheres, ...

 \Rightarrow effective (emergent) gravity, distinct from general relativity advantages upon guantization, related to N = 4 SUSY Yang-Mills