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Matrix Models and Fuzzy Spaces

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We study spaces that don't have to be continuous like ordinary space but can instead be built from matrices that replace the usual notion of points. These matrix spaces allow us to explore what happens when geometry itself becomes quantum. Our work includes well-known examples such as the fuzzy sphere and newer constructions like the fuzzy onion, where several fuzzy layers form a richer internal structure. By choosing different actions, we can define a variety of matrix models with distinct symmetries and dynamics, each revealing different aspects of quantum geometry. On these spaces, we build and analyse field theories to understand how their behaviour depends on the underlying structure and parameters of the model. Combining analytic calculations, bootstrap techniques, and large-scale simulations, we investigate how such quantum spaces behave and how classical geometry might emerge from them—creating a playground where geometry, quantum field theory, and statistical physics naturally meet.

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Authors: KOVACIK, Samuel (Comenius University); TEKEL, Juraj (Comenius University, Bratislava); HRMO, Matej; MAGDOLENOVA, Katarina; KUBIS, Adam; RUSNAK, Patrik; Mr BUKOR, Benedek

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