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(G*) (POS-24) Emergent cosmology from matrix theory

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Despite its success in explaining the large-scale evolution of the universe, standard big bang cosmology has many unsolved problems. For example, it cannot explain why the universe is homogeneous and flat to the degree of precision we observe today. Moreover, as one goes back to the time of the big bang, the universe's energy density is expected to reach infinity, leading to an initial singularity. String theory is the leading candidate to resolve these problems, as it is expected to correctly describe gravity at high energies and unite all forces of nature under a single theory. Our poster presentation will describe ways that string theory can resolve the issues of standard big bang cosmology. We will explain a new and recently published string-inspired scenario (see arXiv:2107.11512) in which our universe emerges as a gas of strings described by a matrix model. In this model, the homogeneity problem is automatically resolved since the universe emerges in a thermal state, and the singularity problem is resolved by the non-commutative properties of the matrix model. In addition, we obtain an approximately scale-invariant spectrum of cosmological perturbations and a scale-invariant spectrum of gravitational waves, as one would expect from observations. Finally, we will go over other possible predictions of this new model which are currently the subject of our studies, namely that the dimensionality and flatness of our universe can be respectively explained by energy and entropy arguments.

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