ulation of the evolution of the large-scale structure of the universe.

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HUGE-LQG- THE LARGEST STRUCTURE IN THE UNIVERSE

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A large quasar group (LQG) of particularly large size and high membership has been identified in the DR7QSO catalogue of the Sloan Digital Sky Survey. It has characteristic size ($volume^{1/3}$) $\sim$ 500 Mpc (proper size, present epoch), longest dimension $\sim$ 1240 Mpc, membership of 73 quasars and mean redshift z=1.27. In terms of both size and membership, it is the most extreme LQG found in the DR7QSO catalog for the redshift range $1.0 < z < 1.8$ of our current investigation. Its location on the sky is $\sim$ 8.8 degrees north ($\sim$ 615 Mpc projected) of the Clowes & Campusano LQG at the same redshift, $z = 1.28$, which is itself one of the more extreme examples. This new, Huge-LQG appears to be the largest structure currently known in the early Universe. Its size suggests incompatibility with the Yadav et al. (2010) scale of homogeneity for the concordance cosmology, and thus challenges the assumption of the cosmological principle.

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SUPER-MASSIVE BLACK HOLE GROWTH IN THE FIRST GIGAYEAR OF COSMIC HISTORY

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As two galaxies collide the super-massive black holes in their centers will merge. The resulting black hole will be ejected with a certain kick velocity. The black hole will move in the galaxy's potential well while it oscillates and returns to its initial position due to dynamic friction processes. In this work we use semi-analytic techniques to follow the amount of mass accreted by the BH since the initial kick until its return to a stationary position at the center of the host galaxy. We focus our study on black holes in the mass range $10^6 - 10^9$ Msun. We use these results to re-interpret the observational constraints on the growth of super-massive black holes during the first gigayear of cosmic history.

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CONTRASTING DISTANCES USING TYPE IA SUPERNOVAE AND GAMMA RAY EVENTS IN THE LOCAL UNIVERSE

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In the year 1998, it is discovered -through Type Ia supernova observation- that the universe is expanding at an accelerating rate. One interpretation, which is not contrary to General Relativity, accepts the existence of a cosmological constant other than zero and of Quintessence, a repulsive force. These supernovae are used as standard candles to measure both distances and the accelerating expansion rate of the universe. Although this is based on well-known and proven facts, it was found that the method employed contains systematic errors. The purpose of this study is to present an alternative method to reduce the errors through the measurement of galactic distances, using gamma-ray events from gamma-ray binaries and microquasars. As the actual supernova population is rather small to be statistically reliable, it is supported with numerical simulations to provide a contrast between Type Ia supernovae and gamma-ray events. To this end, we apply the measurement of Type Ia supernovae to nearby galaxies where is possible to measure the accelerating expansion of the universe. Afterwards, assuming that the observations and instrumentations would enable this possibility, we perform the measurements of a group of microquasars, taking on account their approximate equitable distribution of energy which is contrary to the results of supernovae. Our study remains open to further exploration on whether there is a difference between the distances measured or they are compatible and they manage to minimize the systematic