Abstract Submitted
for the APR10 Meeting of
The American Physical Society

Particle Production and Big Rip Singularities JASON BATES, Wake Forest University — In 1929, Edwin Hubble found that objects in our Universe generally recede from us at a rate proportional to their distance, suggesting that the Universe as a whole is expanding. More recently, astronomers have observed that this expansion is accelerating. According to Einstein's theory of gravity, all normal matter in the Universe should act to slow the rate of expansion, so there must be something new which is causing this acceleration. Cosmologists call this "Dark Energy." One of the possibilities for dark energy leads to a Universe which expands to an infinite size in a finite amount of time. This scenario is called a "Big Rip," because near the end of time this expansion overcomes all other forces in the Universe - even atoms are ripped apart. However, Quantum Mechanics predicts that as the Universe expands particles will be created. If enough particles are created, this process could slow or even halt the expansion, and the "Big Rip" might be avoided. Using numerical methods, we considered the quantum effects for massive and massless scalar fields, and found that while at late times quantum effects do grow large, they do not become comparable to the dark energy until very near the singularity when the curvature of the Universe approaches the Planck scale.

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Date submitted: 19 Oct 2009 Electronic form version 1.4