

Abstract Submitted  
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**Can a supersonically expanding Bose-Einstein Condensates be used to study cosmological inflation?** SWARNAV BANIK, STEPHEN ECKEL, AVINASH KUMAR, TED JACOBSON, IAN SPIELMAN, GRETCHEN CAMPBELL, Univ of Maryland-College Park — The massive scale of the universe makes the experimental study of cosmological inflation difficult. This has led to an interest in developing analogous systems using table top experiments. Here, we present the basic features of an expanding universe by drawing parallels with an expanding toroidal Bose Einstein Condensate (BEC) of  $^{23}\text{Na}$  atoms. The toroidal BEC serves as the background vacuum and phonons are the analogue to photons in the expanding universe. We study the dynamics of phonons in both non-expanding and expanding condensates and measure dissipation using the structure factor. We demonstrate red shifting of phonons and quasi-particle production similar to pre-heating after the inflation of universe. At the end of expansion, we also observe spontaneous non-zero winding numbers in the ring. Using Monte-Carlo simulations, we predict the widths of the resulting winding number distribution, which agree well with our experimental findings.

Swarnav Banik  
Univ of Maryland-College Park

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