Inflation as the physical process of Big Bang explains many properties of the observable universe, including the density fluctuations and the large-scale geometry. In the first part of the talk, I will discuss how measurements of the cosmic microwave background (CMB) polarization can provide a crucial piece of information on inflation – its energy scale. I will discuss the status of the South Pole-based BICEP experiment and its recent results that limit the tensor-to-scalar ratio $r$ to $<0.036$ ($\sigma=0.009$). This direct measurement of inflationary energy scale rules out many once-promising models. I will describe the future of the project, which looks to improve this measurement by a factor of 3 in the next few years.

Inflation also has an unfortunate tendency of making the universe boring. It wiped out everything – exotic particles, topological defects, etc. leaving little memory of the early universe. In the second part of the talk, I will discuss other research activities in the Stanford CMB group that could shed light on the physics of inflation through effects on axion dark matter.