Astrophysical studies of the cosmos began with Galileo and optical telescopes, but within the last century we have built instruments to observe the sky using other bands in the electromagnetic spectrum. Each energy range, e.g. radio waves, infrared, or X-rays, reveals unique information about the source. As technology advanced over time and telescopes became more sensitive across the whole spectrum, there was one range that fell behind: gamma rays in the MeV regime. Now in the era of multi-messenger astrophysics, there is a growing interest in the science uniquely enabled with observations of this unexplored range. We discuss prominent science topics in the high-energy universe and the technological progress towards exploring this gap with a next-generation gamma-ray telescope.