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Optimization of the DM Radio 50 L Magnet Design¹ AYA KELLER, ALEXANDER LEDER, UC Berkeley, DM RADIO COLLABORATION - The nature of Dark Matter (DM) has been an outstanding problem in experimental particle physics for the past 80+ years, and attention has recently been turned to new DM candidates such as axions. The DM Radio experiment seeks to scan over a broad range of possible axion masses using a resonant approach with sensitive superconducting devices; the sensitivity for the DM Radio 50 L experiment hinges heavily on its magnet and scales as $B^*(V \text{ to the } 5/6)$, where B is the peak magnetic field and V is the sensitive volume. In order to maximize the sensitivity reach of the DM Radio 50 L and successive DM Radio designs, we ran an optimization study that took into account the sensitive volume, total mass, and other parameters for the toroidal magnet shape. The main constraints for the design stemmed from physical limitations of the experimental setup, such as the total cooling power available in dilution refrigerators. The potential designs we obtained from these studies were used to investigate the trade-offs of varying limitations for certain parameters, with simulations confirming the numerical calculations.

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