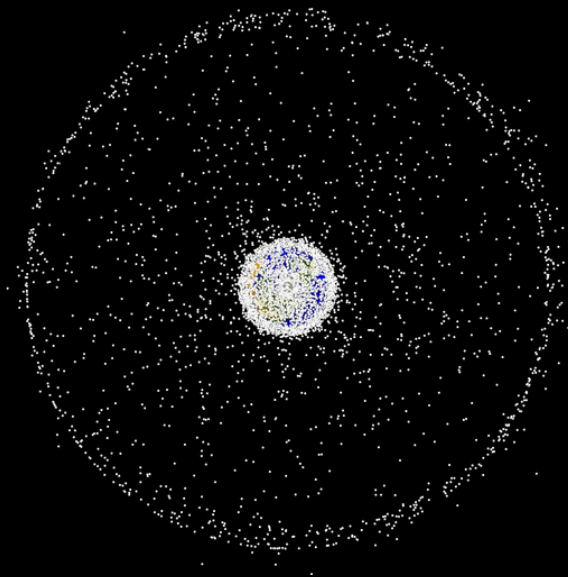


SPARSE-DATA ORBIT ESTIMATION IN LEO USING THE MCMC ENGMF



The growing number of space objects in LEO is straining current tracking infrastructure. Catalog updates rely on frequent observations due to limited TLE accuracy, restricting scalability. This thesis evaluates the Markov Chain Monte Carlo Ensemble Gaussian Mixture Filter (MCMC EnGMF) for sparse, angles-only measurements. Through extensive testing with real tracking data, the filter achieves post-update position errors consistently below 100m, enabling three-day observation gaps by slowing propagation error growth. Additional testing demonstrates the filter's robustness to degraded initial conditions and a wide range of orbital elements. These results demonstrate the potential of the MCMC EnGMF to reduce observation demands and expand tracking capacity.