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INTRODUCTION TO THE SKY SURVEY SCHEDULE (SSS) FRAMEWORK

Abstract

To fulfill the requirements of space object cataloging and enable automated intelligent responses to anomalous events, we designed a novel observation scheduling system named Sky Survey Schedule (SSS). This framework facilitates coordinated operations across multi-site observational networks comprising dozens of instruments, while simultaneously supporting asteroid monitoring and time-domain astronomy studies. The system implements two principal observation modes: fixed sky regions and target-centered tracking. The former is used for sidereal or static observation, while the latter provides dedicated follow-up capabilities for transient targets. The sky regions are divided into latitude bands, each of which is subdivided into sectors to ensure minimal overlap and comprehensive coverage. These sectors are mapped to high-level HEALPix sky grids, enabling rapid cross-referencing and correlation between instruments. At the core of SSS lies an adaptive weighting architecture that integrates multiple parameters. Initial target priorities are determined from orbital catalogs containing both known and uncorrelated objects according to cataloging requirements. The system implements dynamic weight adjustments through feedback mechanisms: confirmed stable objects receive decaying weights, long-unobserved targets experience weight recovery, while anomalies (e.g., newly detected or lost objects) trigger priority escalation. These target-specific weights combine with observational factors - including phase angle constraints, lunar interference, Earth shadowing, and elevation limits - to generate space-time priority matrices. This quantitative framework systematically incorporates operator-defined priorities for specific regions/targets through configurable weight modifiers. Observation plans are dynamically optimized considering: 1) Instrument-specific constraints; 2) Site-level observational redundancy; 3) Weather-induced schedule disruptions; 4) Equipment availability. The system features an extensible API supporting customized observation requirements. For resource-rich sites (¿100 deg collective field coverage), an all-sky scan along the right ascension direction can be initiated.