Interactive Querying and Visualization of Solar Events

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Access to structured solar flare event data is essential for space weather (SWx) research, operational analysis, and machine learning applications. While the solar flare event archive maintained by the Lockheed Martin Solar and Astrophysics Laboratory (LMSAL) provides a widely used curated record of flare activity, the archive is primarily accessible through static web interfaces rather than a programmable query system. This makes automated filtering, dataset generation, and large-scale analysis difficult for researchers. To address this limitation, we developed a full-stack web application that provides programmatic access to LMSAL solar flare event records through a queryable API. A Python-based data ingestion pipeline retrieves and deduplicates event information from LMSAL's rolling snapshot archive and stores it in a structured format. A FastAPI backend exposes endpoints that allow users to filter events by date range and GOES flare classification, enabling rapid dataset generation for analysis workflows. The frontend, implemented in React, allows users to query the event catalog, visualize results in a structured table, and export filtered datasets as CSV or JSON files. To improve data reliability and context, the system cross-references LMSAL event records with NOAA solar flare catalogs, allowing users to compare event metadata across independent data sources. Additionally, the application integrates with the Helioviewer API to display solar imagery corresponding to each event, with derived heliographic positions overlaid onto the solar disk to provide spatial context. The resulting system provides a lightweight platform for exploring, querying, and exporting solar flare event data, lowering the barrier to accessing operational flare records and facilitating dataset generation for space weather analysis and predictive modeling.