AGGIENOVA – Supernova Analysis

TEXAS A&M UNIVERSITY Physics & Astronomy

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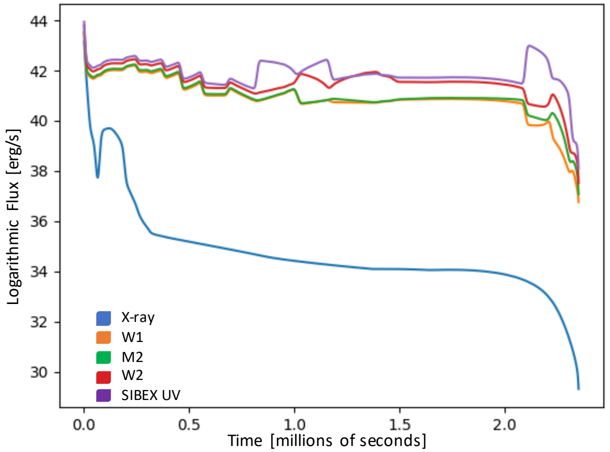
Background:

The Swift orbital observatory is composed of a system of three telescopes that work together to view gamma-ray bursts as well as supernovae. Swift is the first system that can provide a precise measurement of the location and time of these bursts, while also observing them through 6 variable filters (M2, W2, W1, U, B, V), resulting in an observational range of 1600Å to 6,000Å. These observations give insight into composition of supernovae and the extensive network of supernovae in the universe.

Predicted Energy Flux vs. Time:

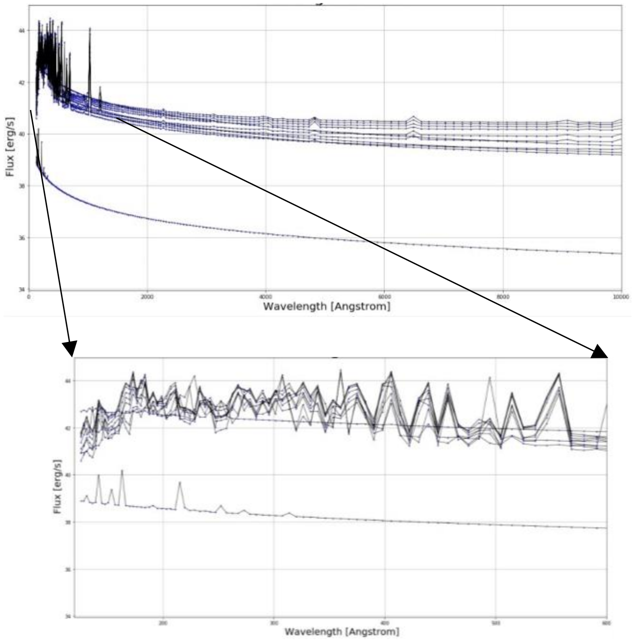


This plot depicts the predicted energies of electromagnetic radiation emitted during the shock breakout and early 11-day decay of a blue supergiant. The energy flux over time is given in the Swift UV band W1, M2, and W2 ranges as well as the X-ray and UV ranges of a proposed future mission called SIBEX. This plot was successfully generated using python code. Comparisons with observed Swift data will constrain which models are more correct and allow us to predict what could be observed by SIBEX or other future missions.

Abstract:

The AGGIENOVA team is using observations from the Swift Ultraviolet Optical Telescope and data from Swift's Optical/UV Supernova Archive (SOUSA) to compare observational data with that of theoretical explosion models. These models, which start with a progenitor star exploding into an assumed environment, model possible supernova explosions occurring throughout the universe. The AGGIENOVA team will be writing Python code to verify the theoretical predictions of observed supernova explosions and constrain the assumed progenitor environment.

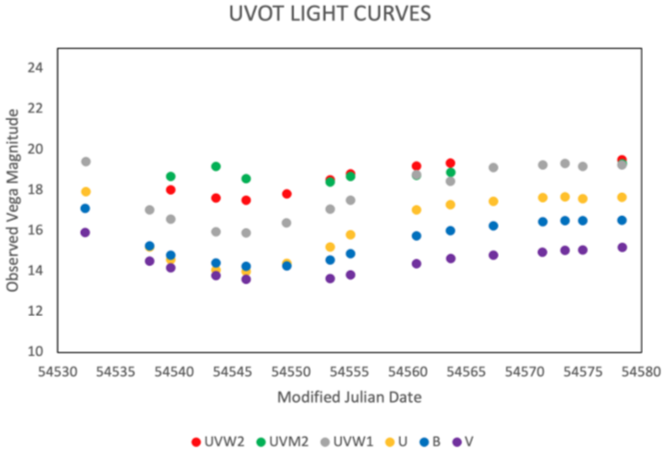
Predicted Energy Flux vs. Wavelength:



This plot displays multiple depictions the spectral variance of flux, for a modelled blue supergiant, over a range of wavelengths. The observation and analysis of this data assists in the photometric classification of the supernova based on its flux peaks. Most notable activity is observed in the low-ultraviolet range between 100Å and 600Å. This is characteristic of extremely high energy ejecta that is expected to be seen in observed supernovae of similar conditions.

Our goal is to separate this photometric data into figures that are more straightforward and more readily available for analysis in order to simplify the determination process of progenitor environments and ease the process of SN classification.

Observed Light Curve Data:



This excel-generated graph depicts the observed Vega magnitude of supernova SN2008ax (located in NGC 4490), notable due to its initial envelope-cooling phase immediately following shock breakout and a later rise powered by radioactive decay. All observations were made using the SWIFT telescope system. We are working towards eventually using python to auto-generate figures such as this.

Future of AGGIENOVA:

The future work of the AGGIENOVA research team will consist of reading in different supernova explosion models using python code and comparing them to real observables such as a star's energy flux over time, ultraviolet light curves, and explosion timelines. The comparison of real data against current theoretical models helps to better explain the circumstances of supernovae throughout the universe, while also allowing astronomers to refine and develop new theoretical models to better understand these explosions.