CLUSTAR

DETECT TRANSIENT ASTROPHYSICAL EVENTS

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COSMIC CHALLENGES

- **Millions of stars have been observed in modern surveys**

TESS and LSST observe millions of stars, generating terabytes daily, but manual light curve analysis can’t keep up.

- **Limited telescope time for follow-up observations of variable stars or transients.**

Telescope time (e.g., JWST, $100K/hour) is limited, and coarse filters miss subtle transient signals.

- **Manual analysis of light curves is slow and misses subtle patterns.**

Missing transients (e.g., supernovae) delays insights into stellar evolution and cosmology.

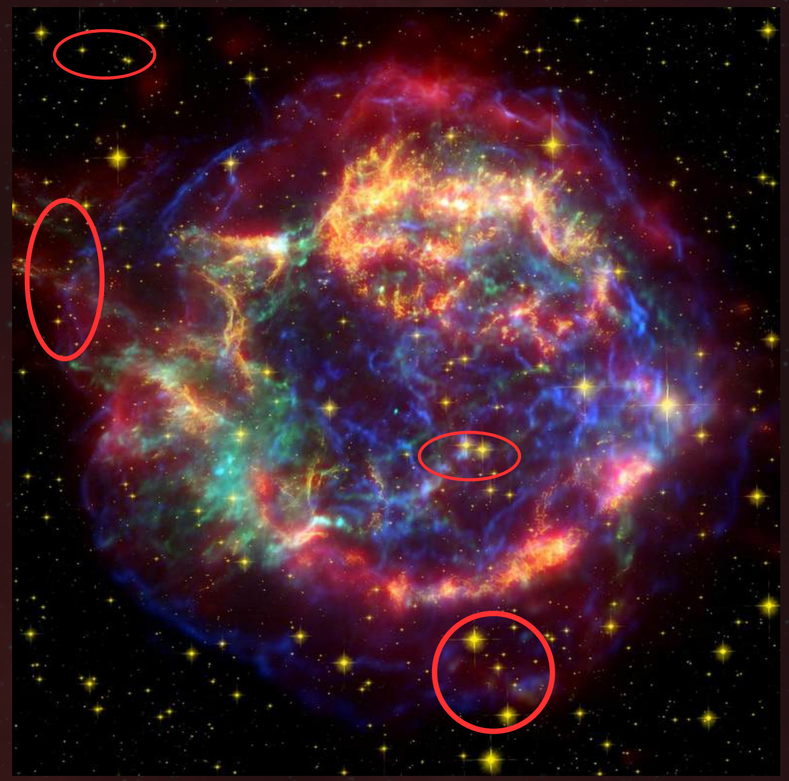
PROPOSED SOLUTION

CLUSTERING STARS BY VARIABILITY PATTERNS

01 Automates detection of **anomalous** variability, scaling to large **datasets**

02 Prioritizes high-variability **clusters**, optimizing **telescope** use.

03 Robust to **noise**, capturing diverse transients (e.g., **supernovae**, **pulsators**).



PROJECT GOALS

This project will transform transient astronomy. By identifying variable stars and transients faster, we'll deepen our understanding of stellar and **galactic** processes. Operationally, clustering will streamline **telescope** use, saving **millions** in costs by focusing on high-priority targets. This project will help us understand the nature of **space** better, potentially answer a lot of questions which the scientific world is struggling with now. One more time will proof Usability of **mathematics**, ML and computational within global challenges

SCIENTIFIC VALUE

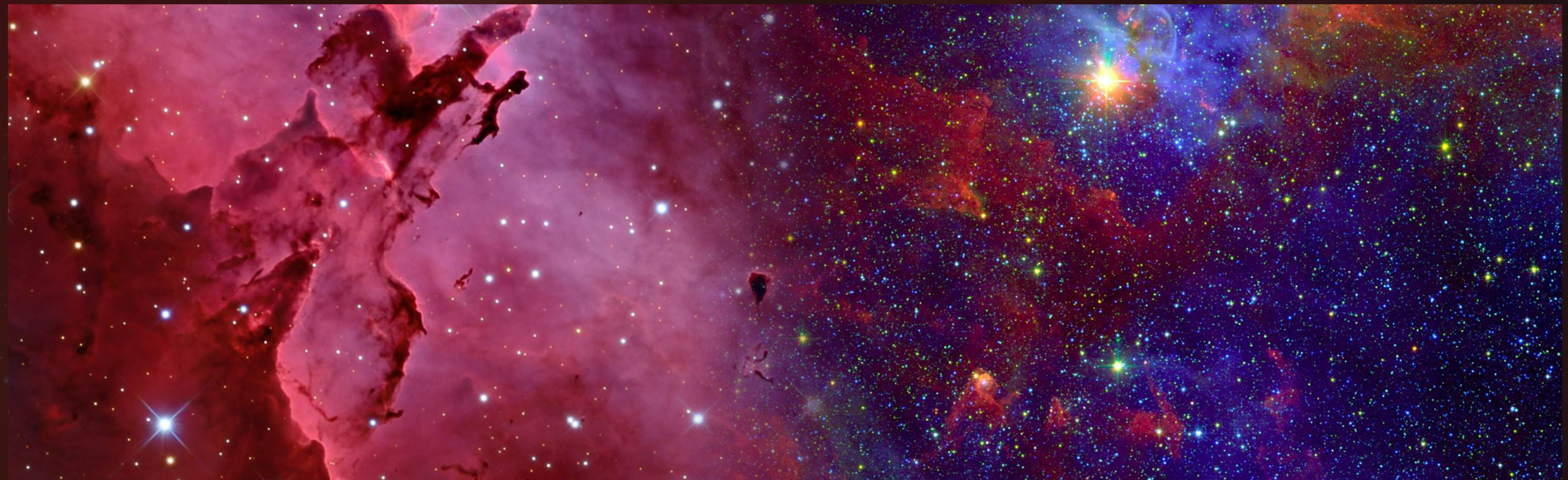
01

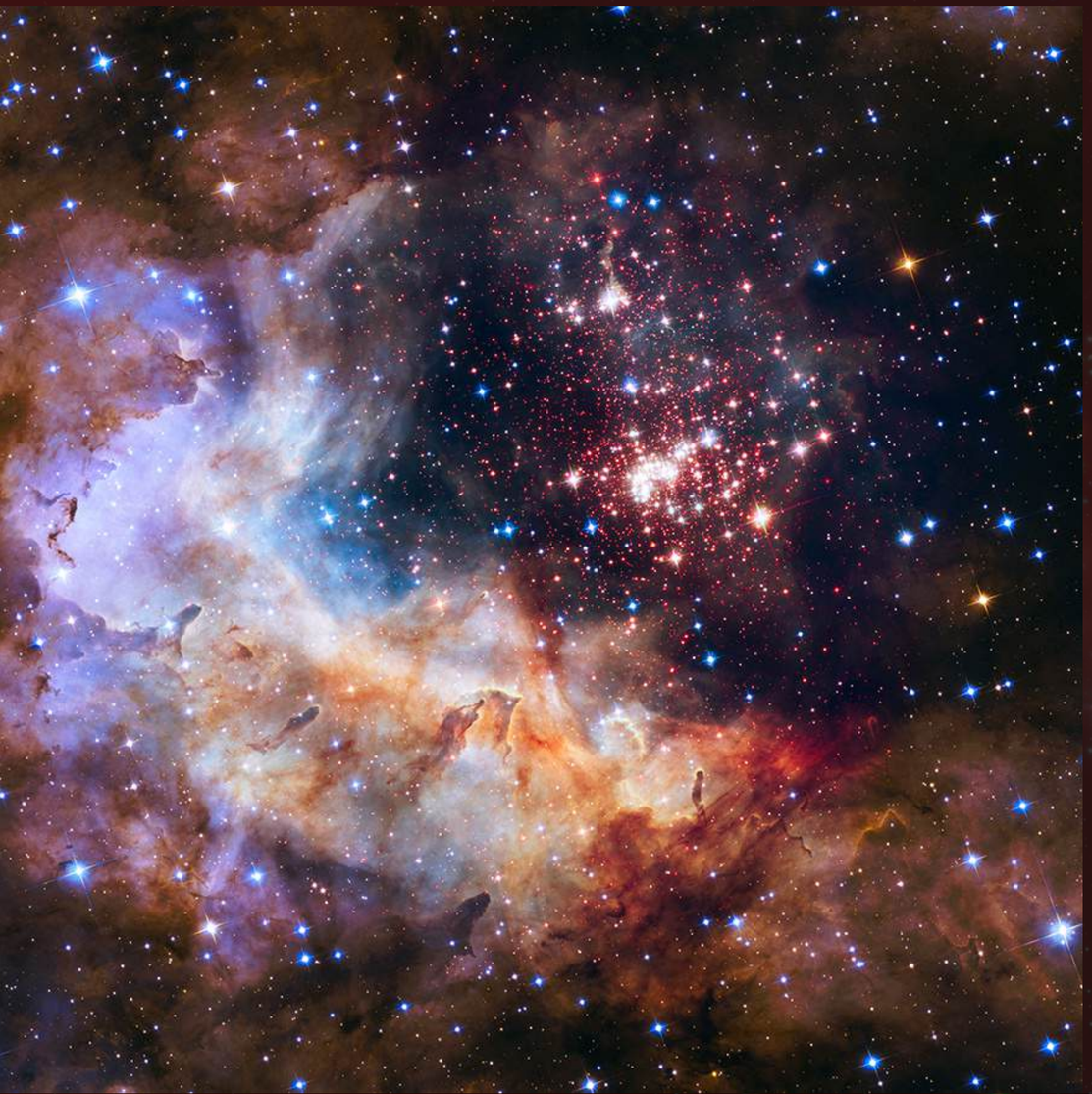
- Accelerate the discovery of variable stars, **supernovae**, and other transients.
- Enhance understanding of stellar **evolution** and **galactic** dynamics.

OPERATIONAL VALUE

02

- Optimize telescope scheduling, saving millions in observation costs (e.g., **$1M-$5M** annually).
- Prioritize follow-up for high-impact targets.





DATASET AND IMPLEMENTATION

01

Our dataset taken from A service of **NASA** Exoplanet Science Institute, with its detailed photometric and light curve data, is perfectly suited for this project. Features like magnitudes, colors, and light curve variability—captured in **lcfil** and **npts**—provide a rich basis for clustering. The dataset's scale and error measurements ensure reliable results, making it an ideal tool for uncovering transient events and advancing astronomical research.

02

Implementation itself includes extracting data from **NASA** database, loading, preparing for processing, feature analysis, processing raw data into the valuable dataset, transformations such as standardisation using a scaler, processing dimension reduction and clustering approaches using different algorithms **KMeans, PCA**, and etc within a various range of parameters in parallel with visualisation and result checking with respective interpretability. conclusion, such asa report within dataset, features and assuming words about implemented result