

## INTRODUCTION

Eruptive young stellar objects (YSOs) are highly variable sources whose brightness changes driven by accretion bursts. Multi-band photometric monitoring provides an effective way to trace their brightness and colour evolution. Events with timescales of a few 100 days are commonly called EXor-type objects, which have been observed on many Classical T Tauri stars (Fischer et al., 2024).

**V557 Mon**, located in Rosette Nebula, is a recently discovered eruptive YSO (see Carvalho and Hillenbrand 2025a, RNAAS). The initial outburst was recorded by Gaia science alert and the ALeRCE broker (ZTF time series) in October 2024, reaching **3.5 mag in G-band**. The rising timescale is  $\sim 30$  days (or  $\tau = 15$  d, see Figure 1).

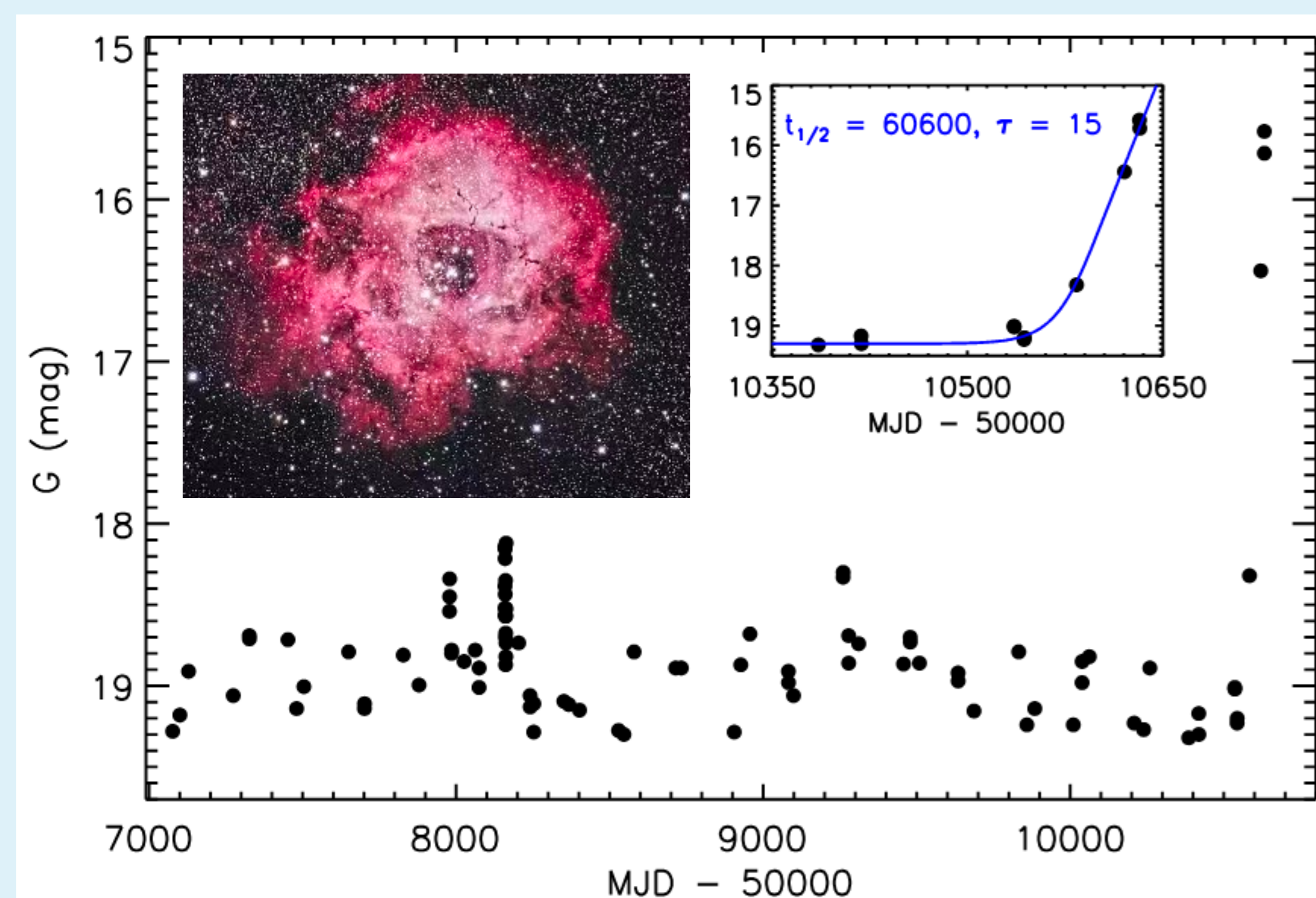


Fig 1: Gaia light curve and the Rosetta nebula. We fit a rising curve adopted from Guo et al., 2024b (MNRAS-Letter). Some low-amplitude variations are observed before the outburst.

## OBJECTIVES

This study aims to monitor the **optical variability of V557 Mon**, construct light curves and colour diagnostics, and investigate the change of mass accretion rate as a function of the optical brightness.

## DATA and METHODS

We obtained optical images from the 1m telescopes of Las Cumbres Observatory (LCO) in SDSS u, g, r and i bands, with MJD between 60669 and 60793. We chose the nearby A0V as the reference star for differential photometry. Source positions were determined from WCS coordinates and refined by 2D Gaussian fitting.

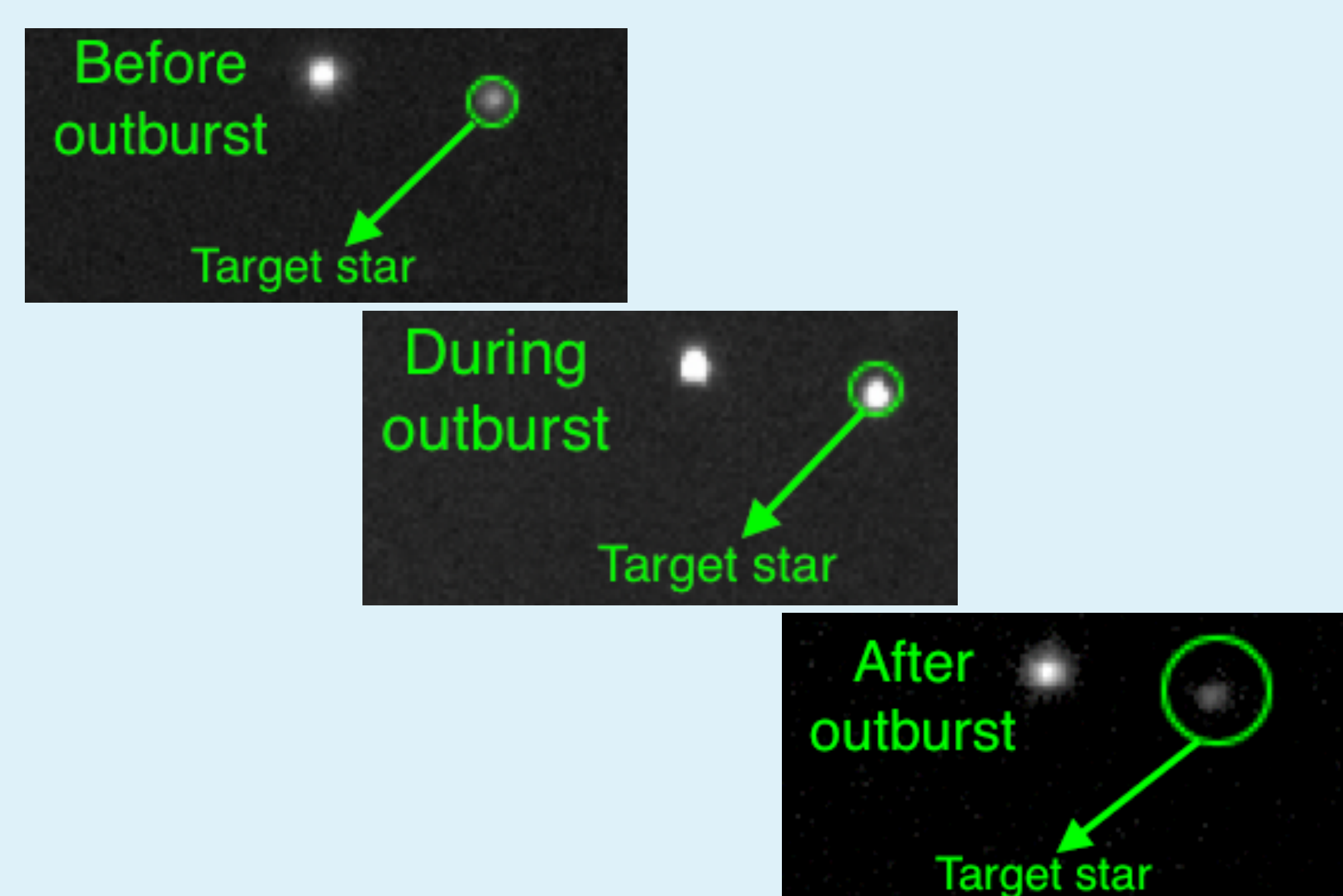


Fig 2: images of V557 Mon before, during and after the outburst (r band).

We applied aperture photometry with local sky background estimated from an annulus using sigma-clipped statistics. Net fluxes were converted into calibrated magnitudes through differential photometry.

## LIGHT CURVES

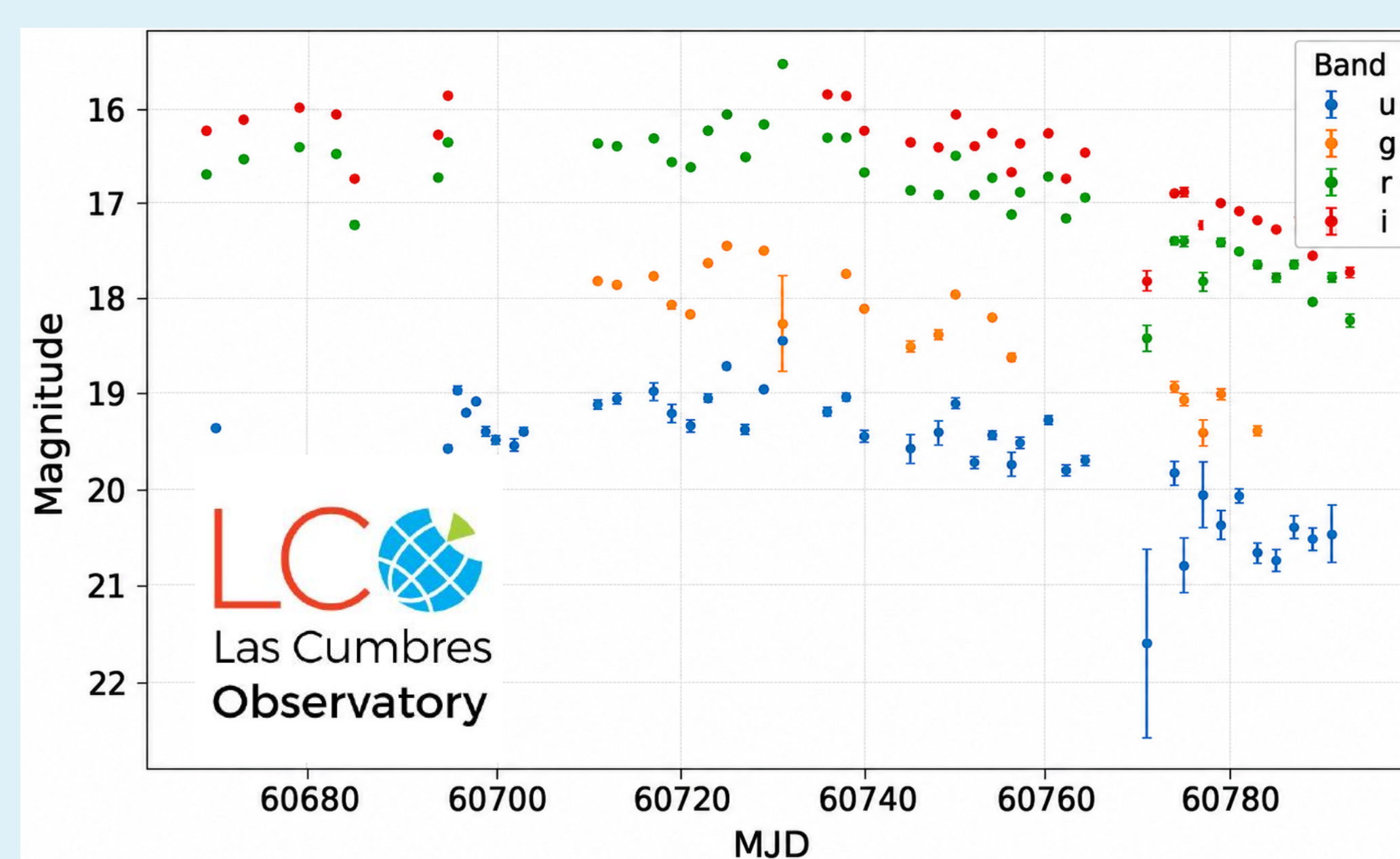


Fig 3: LCOGT u, g, r, i band light curves of V557 Mon, exacted by aperture photometry.

## RESULT

We combined the LCOGT photometry with ZTF (g and r-band), ATLAS (o-band) and SOAR (g and r-band) time series (see Fig 4). We fit the rising and decaying stages of the event with analytical functions. Applying the method developed by Guo et al., 2018a and Wang et al., 2023, we measured the mass accretion rate using the u and g-band time series. The accretion rate ranges between  $10^{-8.8}$  to  $-6.3 M_{\text{sun}}/\text{yr}$ .

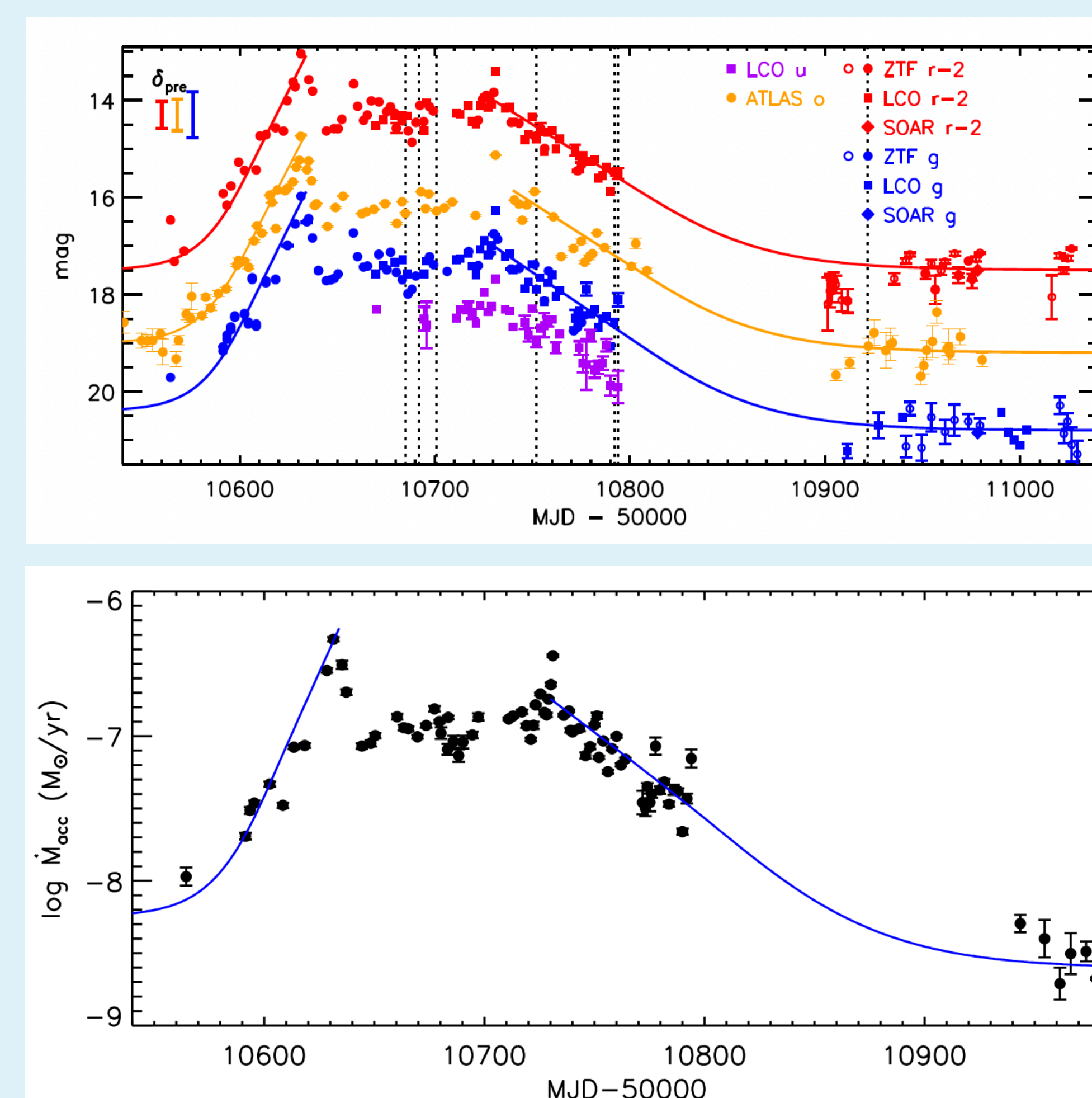


Fig 4: light curves and calculated mass accretion rate of V557 Mon.

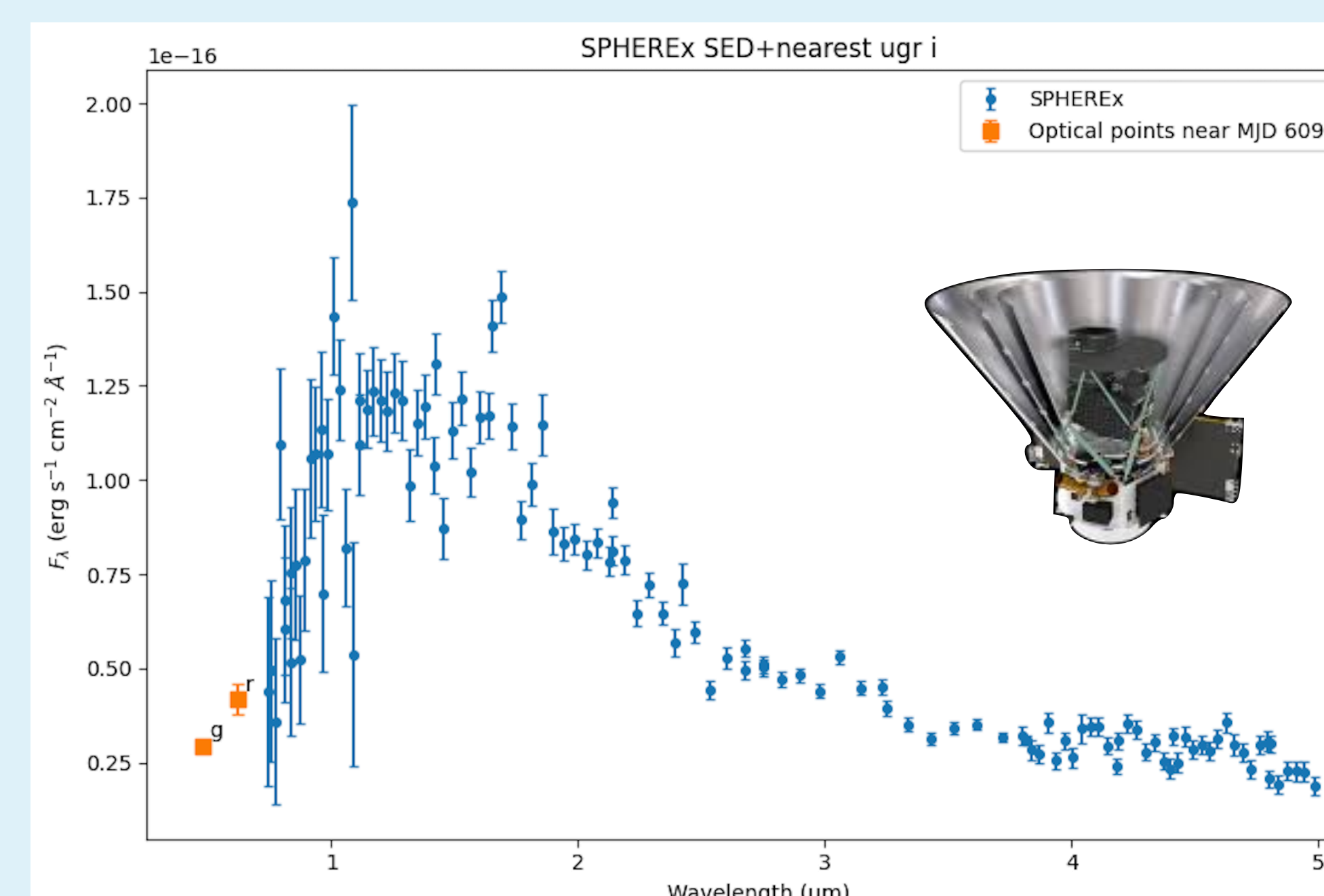


Fig 5: near-infrared SED of V557 Mon during the fading stage of the outburst, at MJD 60950.

## RESULT

We present the colour-magnitude diagram of this event. We found that during the outburst, the g-band brightness of the accretion front (represented by veiling) reached more than 40 times of the stellar photosphere.

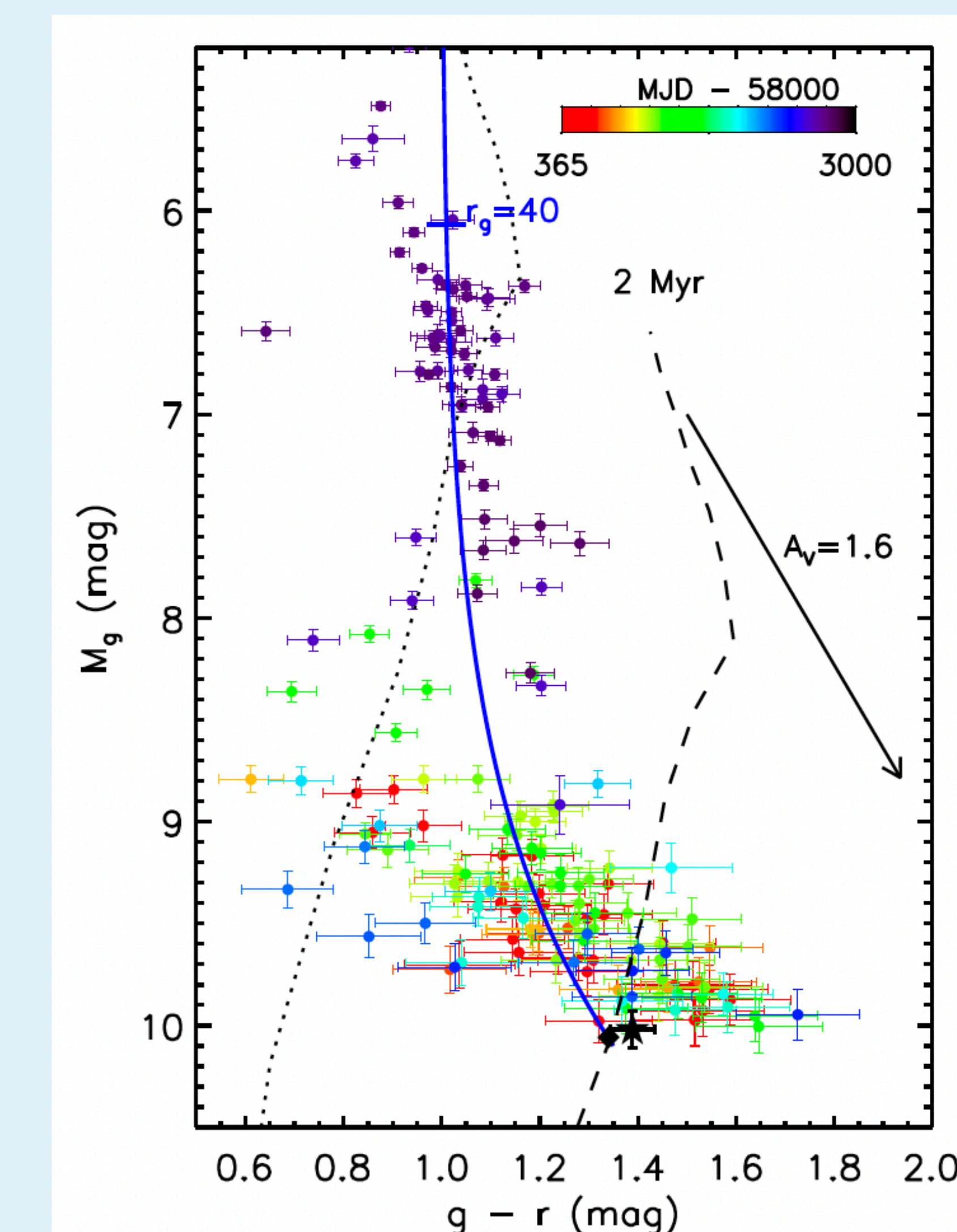


Fig 6: Optical colour-magnitude diagram with evolution tracks from BAHC models (Baraffe et al., 2015), with the veiling models from Herczeg and Reipurth 2025.

## Conclusion

- We captured the eruptive event on V557 Mon with LCOGT light curves and confirmed that **it is an EXor-type outburst**.
- The variation of mass accretion rate reached **2.5 orders of magnitude**.
- The colour magnitude diagram shows an **accretion dominated** variation.

## Acknowledgement

Yuting Zhou is a second-year high school student in Nanjing, China. ZG acknowledge the support from FONDECYT Initiation project No. 11260176. ZG, VF and JO are supported by the China-Chile Joint Research Fund (CCJRF No.2301).