Stars and their variability observed from space
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THE PULSATION SPECTRUM OF A MASS-ACCRETING COMPONENT OF AS ERI

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Abstract. We present the results of pulsational analysis of ground-based multi-site and space (TESS and MOST) photometric and high-resolution spectroscopic (using SALT) observations of a mass-accreting pulsating A3V primary component of the semidetached Algol-type system AS Eri. We report about spectroscopic detection of high-degree nonradial modes in AS Eri.

Keywords: Stars: binaries: eclipsing, oscillations

1 Introduction

The 24.39 min pulsations of the primary component of the semi-detached 2.664148-day Algol-type system AS Eri have been discovered by Gamarova et al. (2000) and confirmed by Mkrtichian et al. (2004). The pulsator belongs to the class of mass-accreting pulsating components of Algols (so called oEA stars) (Mkrtichian et al. 2018) currently representing a group of over 100 pulsators (Mkrtichian et al. 2020).

2 Preliminary results of pulsational analysis

In 2013, AS Eri was observed during 41 days (582 orbits) by the MOST space telescope; these observations sampled only 10-15 % of orbital time. These observations in 2013 have been supported by two follow-up ground-based multisite photometric campaigns, first in 2014 (68 nights) was carried out using Skynet Robotic Telescope Network and second in 2018 (30 nights) using Prompt-8 telescope at CTIO, and finally completed by 27-day TESS observations. The analysis of TESS light curves revealed multi-periodic non-radial pulsations(NRPs). Fig. 1 shows the DFT spectrum of the pure pulsational light curve. We revealed a regular spacing of the six dominant modes with 3.75 c/d which is ten times the orbital/rotation frequency f_{orb}. The 2013 MOST and 2014 campaign data confirmed the results of TESS photometry.

High- and medium-resolution spectroscopic time series of AS Eri collected using 10m SALT/HRS and 2.4m Thai National Telescopes show strong line profile variations caused by high-degree non-radial modes (see Fig. 2). The full analysis of Least Square Deconvolved (LSD) line-profiles and the mode identification is in progress. One short run of SALT spectroscopy in 2018 has been obtained simultaneously with TESS telescope observations.

We found orbital phase dependent variability of the intensity and shape of the He I lines. The existence of strong He I is a good spectroscopic indicator of a hot turbulent zone in the upper atmosphere caused by interaction of a gas stream with the atmosphere of the pulsating gainer. Gas stream-atmosphere interaction is in good agreement with expectations from our 3-D hydrodynamic simulations of mass-transfer, which will be the topic of the future paper.

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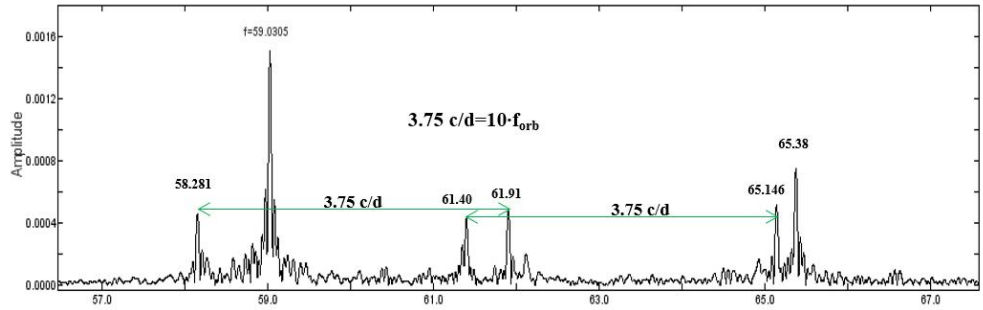

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Fig. 1. The DFT spectrum of the residual pulsational light curve of AS Eri

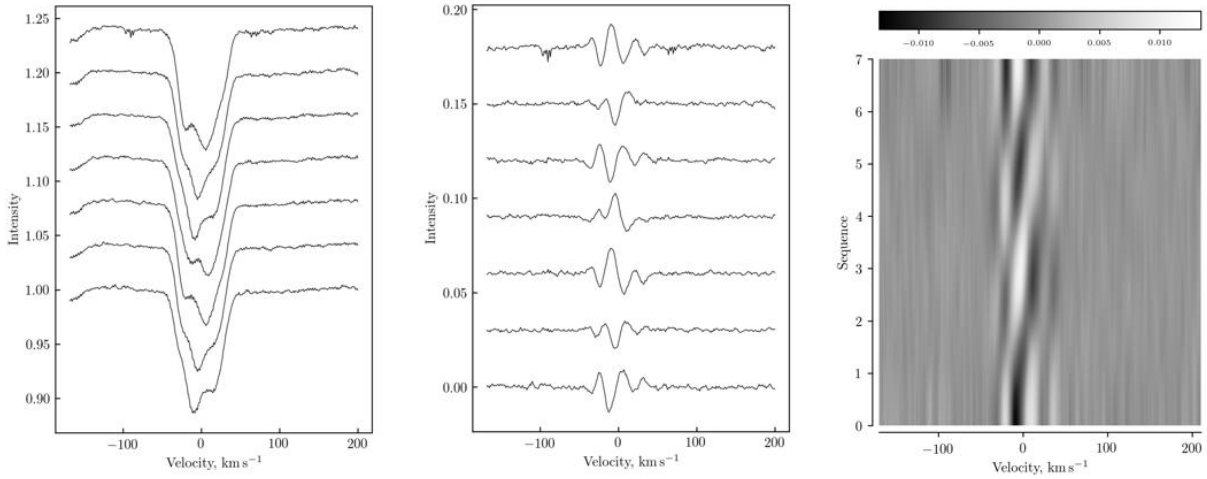

Fig. 2. The high-degree NRPs detected in LSD profiles of primary component of AS Eri

3 Conclusions

The photometric and spectroscopic line-profile analysis of AS Eri revealed the rich spectrum of low- and high degree non-radial modes. We found that the strong orbital phase dependent variability of He I lines is a sensitive indicatior of the mass-transfer and the gas stream atmosphere interaction.

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