

Asteroseismology from Dome A, Antarctica

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Abstract. Gattini and CSTAR have been installed at Dome A, Antarctica, which provide time-series photometric data for a large number of pulsating variable stars. We present the study for several variable stars with the data collected with the two facilities in 2009 to demonstrate the scientific potential of observations from Dome A for asteroseismology.

1. Introduction

Observations in polar sites open a new window for long, uninterrupted and consecutive time-series photometry/spectroscopy for pulsating variable stars, a powerful tool for asteroseismology. Dome A, located at longitude 77°06'57" E and latitude 80°25'08" S with a 4013-m elevation as the highest point on the Antarctic plateau, is widely predicted to be a very good astronomical site (Saunders *et al.* 2009). The first-generation facilities including Gattini (Moore *et al.* 2013) and CSTAR (Chinese Small Telescope ARray, Liu & Yuan 2009) were deployed on Dome A in 2008 January. We present some progress on asteroseismology, using the time-series multi-color photometric data collected with the two telescopes in the winter of 2009.

2. Bright variable stars observed with Gattini

Gattini is a 10.5-mm fish-eye lens equipped with an Apogee 2k×2k CCD camera. A filter rotator allows frames taken in Johnson *BVR* and a band of OH in turn. The field of view is 90°. In 2009 winter, a total of 377 GB of data were taken. After data reduction and stellar photometry, light curves of 66 variable stars were obtained. Figure 1 shows the light curves of a W Vir type variable star κ Pav ($V = 4.4$ mag) in *B*, *V*, *R* in 2009.

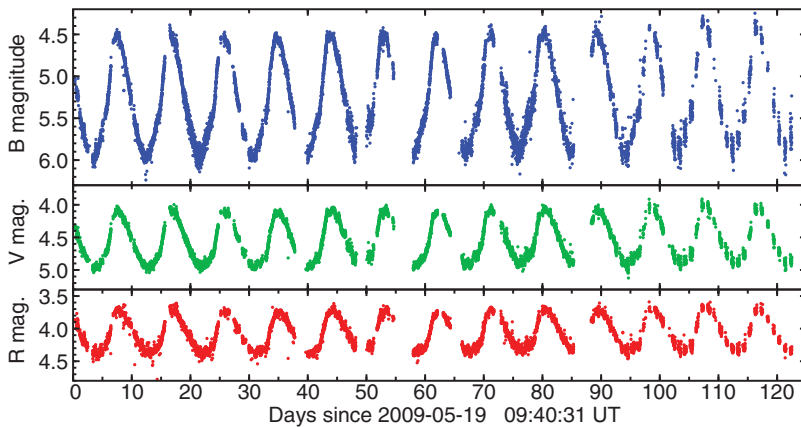


Figure 1. Light curves of κ Pav in B , V and R , data from 2009.

3. Variable stars observed with CSTAR

CSTAR has four telescopes with apertures of 15-cm, equipped with four $1\text{k}\times 1\text{k}$ CCD cameras. The filters of SDSS g' , r' and i' are mounted to three of them while the fourth telescope has no filter. The pointing was fixed to the celestial southern pole with field of view of $4.5^\circ\times 4.5^\circ$. Times-series CCD frames were taken in g' and r' in 2009 winter.

The light curves of HD 92277 ($V = 9.10$ mag, $B - V = 0.38$ mag) show that it is a new variable star. A total of 13 and 24 independent frequencies are detected in g' and r' , respectively. Combining with the available parameters of the star, we classify it as a new δ Scuti star (Zong *et al.* 2013). In addition, light curves of three RR Lyrae stars in the field of view of CSTAR were obtained in g' and r' in 2009.

4. Summary

Variable stars have been studied with the time-series photometric data collected from Dome A, Antarctica. In an epoch of space missions (e.g. *CoRoT* and *Kepler*) which are providing high duty-cycle high precision time-series photometry for variables, observations for pulsating stars can be made through multiple colors simultaneously from Dome A, Antarctica, which provides important information for pulsation mode identification. This might bring a chance of a new break-through in asteroseismology.

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