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Photometry of δ Sct and Related Stars: the Results of AD Arietis

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Abstract This paper reports on the preliminary photometric results of $\cdots\cdots$

Key words: techniques: photometric — stars: variables: δ Scuti — stars: individual: IP Vir, YZ Boo

1 INTRODUCTION

In 1996, we started a project to obtain Johnson V and Strömgren $uvby\beta$ photometry for the poorly studied variables of "pulsational interest" $\cdots\cdots$. We used the three-channel high-speed photoelectric photometer designed for the Whole Earth Telescope campaign (Nather et al. 1990; Jiang & Hu 1998), and the four-channel Chevreton photoelectric photometer (Michel et al. 1990, 1992) dedicated to the STEPHI (STEllar Photometry International, Michel et al. 1992).

2 OBSERVATIONS

The photometry of three δ Sct stars AD Arietis, IP Virginis and YZ Bootis was performed from 2000 February 26 to 2001 January 31[1] with the three photometers mounted on the 85-cm telescope at the Xinglong Station of BAO[2]. The typical accuracy yielded from magnitude differences between reference stars is about 0.005 mag. The observing log is given in $\cdots\cdots$

3 DATA REDUCTION

The time-series, i.e. pairs of Heliocentric Julian Day (HJD) versus magnitude, used for pulsation analysis can be quickly established by using an external IRAF task (Zhou et al. 2001) $\cdots\cdots$

[1] Please note the order: year, month, day

[2] Now NAOC

Table 1: Please Capitalize the First Letter of Each Notional Word in Table's Caption.

No	Star	Photometer	References
1	GSC 2683-3076	CCD	Zhou et al. (2001)
2	IP Vir	4-CH	present work
3	YZ Boo	3-CH	present work

3.1 Please Capitalize the First Letter of Each Notional Word in Subsection Title

3.1.1 This is a third-level section — subsubsection

Some applications of the routines are given in Table 1.

3.2 De-noise in the Lower Frequency Domain

To reduce the red-noise in the frequency region, we $\cdots\cdots$

4 DATA ANALYSIS

In this part, we analyze the pulsation contents for the three stars with the period-search program PERIOD98 (Breger 1990; Sperl 1998).

4.1 AD Arietis

AD Ari (=HD 14147=SAO 92873=HIP 10701, V=7.43 mag, ΔV=0.06 mag, P_0=$0\overset{d}{.}2699$, F0) (Kasarovets et al. 1999; Rodríguez et al. 2000) is suspected to be a candidate of γ Doradus-type pulsating variables exhibiting both p- and g-modes in terms of its long period and late spectral type. You can cite a figure like "as shown in Figure 1" or like (Fig. 2).

4.2 IP Virginis

IP Vir ($\alpha = 14^{\rm h}40^{\rm m}08^{\rm s}.0$, $\delta = 00^\circ 01' 45''.0$, equinox=2000.0) was reported by Landolt (1990) to be a δ Sct-type variable $\cdots\cdots$

4.2.1 Wavelet Analysis

Universally, Lebseque integration

$$\int_{\infty}^{\infty} |h(t)|^p dt < \infty, \qquad 1 \le p < \infty \tag{1}$$

presents a measurable function of $L^p(\Re)$. Use Equation (1) to cite an equation, and you can also cite an equation like (Eq. (2)). A function $\psi \in L^2(\Re)$ is called an orthogonal wavelet if

$$\langle \psi_{j,k},\ \psi_{l,m} \rangle = \delta_{j,l} \cdot \delta_{k,m}, \qquad j,k,l,m \in \mathcal{Z} \tag{2}$$

$\delta_{j,k}$ is Kronecker sign and for any $f(x) \in L^2(\Re)$

$$f(x) = \sum_{j,k=-\infty}^{\infty} C_{j,k} \psi_{j,k}(x) \tag{3}$$

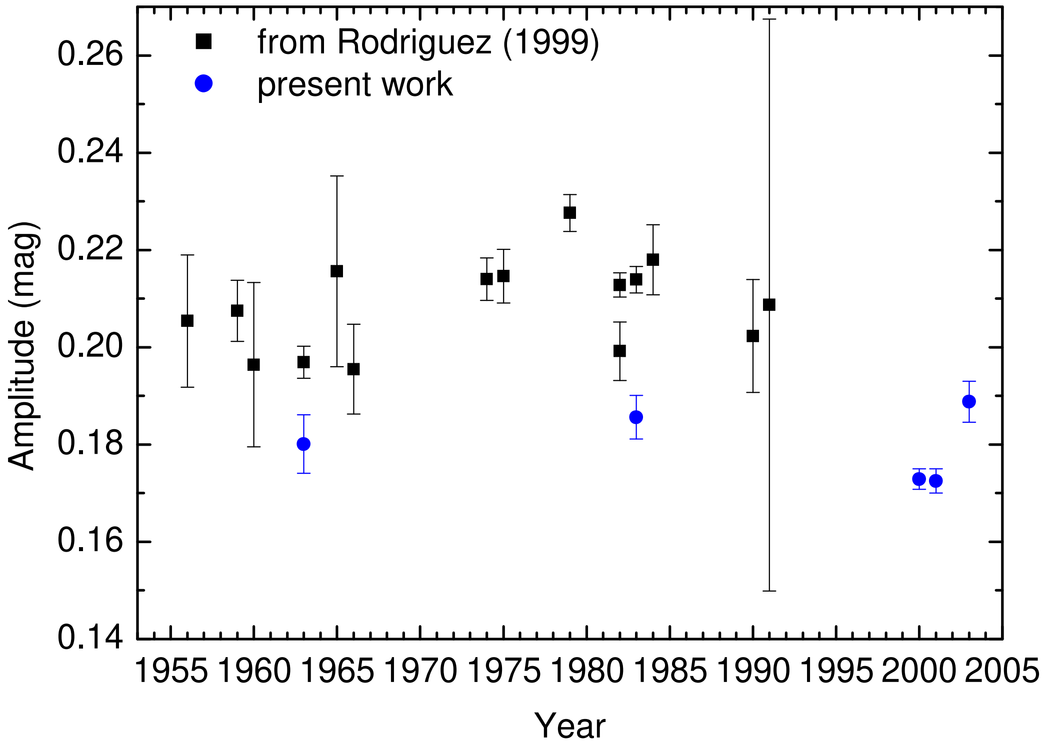

Fig. 1: Demo1: A figure as large as the width of the column using package ‘graphicx’.

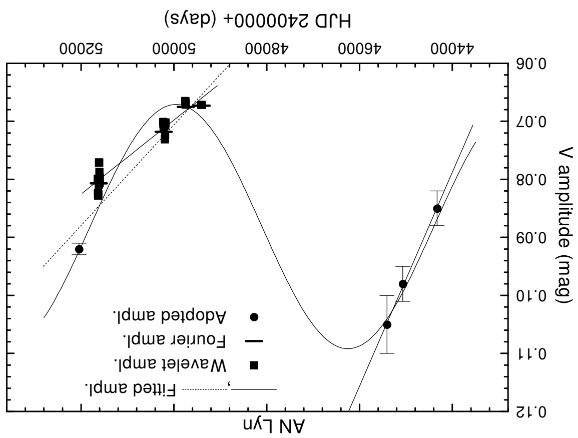

Fig. 2: Demo2: One column rotated figure using package ‘graphicx’.

This is wavelet series representation of $f(x)$. The most simplest example of an orthogonal wavelet is Haar function:

$$\psi_{\mathrm{H}}(x) \equiv \begin{cases} 1 & 0 \le x < 0.5 \\ -1 & 0.5 \le x < 1 \\ 0 & x < 0,\ x \ge 1. \end{cases} \tag{4}$$

Additionally, a Mexcian hat is also a wavelet.

Similar to Fourier series, wavelet coefficients $C_{j,k}$ is given as

$$C_{j,k} = \langle f,\ \psi_{j,k} \rangle = \int_{-\infty}^{\infty} f(x)\overline{\psi_{j,k}(x)}\,\mathrm{d}x \tag{5}$$

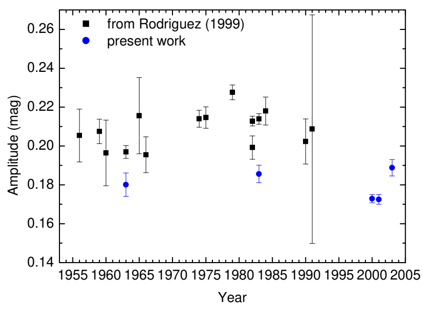

Fig. 3: Amplitudes evolution of . . .

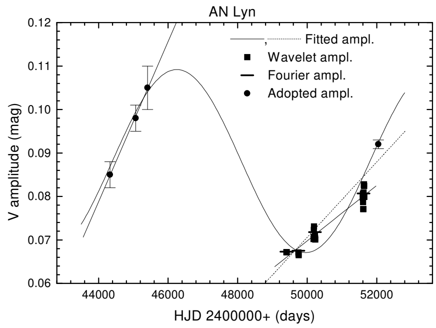

Fig. 4: Amplitude variation of AN Lyn.

and we have

$$(W_\psi f)(b,a) \equiv |a|^{-\frac{1}{2}} \int_{-\infty}^{\infty} f(t)\overline{\psi(\frac{t-b}{a})}, \qquad a,\ b,\ f \in L^2(\Re),\ a \neq 0 \tag{6}$$

If $\psi,\ \hat{\psi}$ satisfy the window function condition, then $\hat{\psi}(0) = 0$ or follows $\int_{-\infty}^{\infty} \psi(t)dt = 0$. Mother wavelet $\psi(x)$ oscillates and decays, preferably rapidly. The oscillation property is expressed mathematically by insisting that wavelets integrate to zero. Wavelet functions are constrained, by definition, to be zero outside of a small interval. This is what makes the WT able to operate on a finite set of data, a property which formally called “compact support”. Compact support means that a basic wavelet like Harr wavelet vanishes outside of a finite interval. If a mother wavelet is zero outside of some interval—compactly supported, then it is the “fastest” decay of all. This is the reason why we name ψ “wavelet”.

5 DISCUSSION

I would like to give my discussion on the results elsewhere.

6 CONCLUSIONS

The preliminary photometric results on the $\cdots\cdots$ are reported along with an introduction to the user-compiled IRAF task $\cdots\cdots$

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Appendix A: THIS SHOWS THE USE OF APPENDIX

A postscript file is actually an ASCII text file (you may even edit it). However, you need to transfer a PDF file or any compressed or packaged file in binary mode when using FTP.

Appendix B: WHAT IS SCI?

SCI is the abbreviation of Science Citation Index system powered by the Institute for Scientific Information (ISI). For details please visit *http://apps.isiknowledge.com*.

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