The Tenth Pacific Rim Conference on Stellar Astrophysics
ASP Conference Series, Vol. 482
Hee-Won Lee, Kam-Ching Leung, and Young Woon Kang, eds.
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The Pulsation Amplitude of the Cepheid Polaris Continues to Increase

D. E. Mkrtichian,[1,2] H. Brunt,[3] Byeong-Cheol Lee,[4] J. Eaton,[5]
M. Williamson,[5] F. Fekel,[5] N. Evans,[6] and I. Han[4]

[1]*National Astronomical Research Institute of Thailand, Siripanich Building, 191 Huay Kaew Road, Muang, Chiangmai, Thailand 50200*

[2]*Crimean Astrophysical Observatory, 98409, Nauchny, Crimea, Ukraine*

[3]*SAC, University of Aarhus, Denmark*

[4]*Korea Astronomy and Space Science Institute, Korea*

[5]*Center of Excellence in Information Systems, Tennessee State University, USA*

[6]*Smithsonian Astrophysical Observatory, USA*

Abstract. We present recent results of precise radial velocity measurements of Polaris collected during 2003-2011. We confirm that the pulsation amplitude of the Polaris continues to increase and that Polaris is entering to new epoch of the pulsation amplitude variability.

1. Historical Amplitude Decay in Polaris

The anomalous low-amplitude, P=3.97-day Cepheid Polaris is the closest Cepheid variable. Over the last 150 years the pulsation amplitude of Polaris gradually decreased (Turner et al., 2005). It has been predicted that the 3.97-day pulsation would disappear around 1994 (Fernie, Kamper & Seager, 1993). However, several investigations conducted at the end of the millennium showed that the decrease in amplitude had ceased (e.g., Kamper & Fernie,1998, Hatzes & Cochran, 2000). The data of Hatzes & Cochran (2000) indeed show the slow increase of amplitude, but Hatzes & Cochran did not state this explicitly. In 2008, three groups of researchers (Lee et al., 2008, Spreckley & Stevens, 2008 and Bruntt et al., 2008) independently reported the discovery of a clear increase in the radial velocity(RV) and photometric amplitudes of Polaris, which happened in the time interval 2003-2007.

2. New Spectroscopic Data

We continued to collect new precise RV measurements of Polaris during 2007-2011 using the 2 m Tennessee State University Automatic Spectroscopic Telescope (AST; Eaton & Williamson 2004, 2007) and the BOES spectrometer on the 1.8m tel. of the Bohyunsan Optical Astronomy Observatory (BOAO) in South Korea. BOAO precise relative RV-data were obtained using the iodine absorption cell as a reference. New

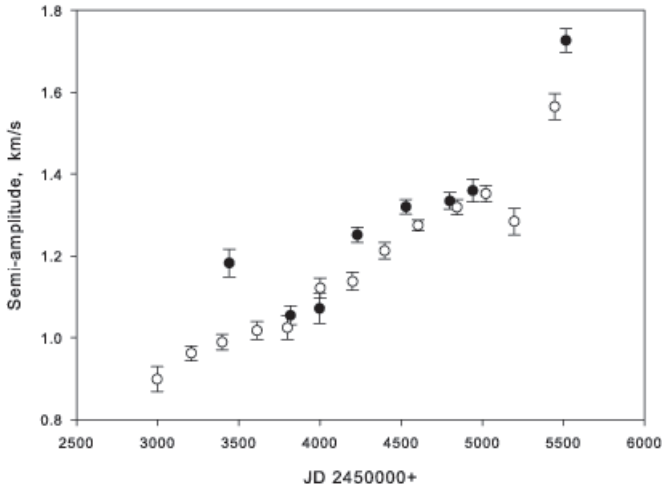

Figure 1. Variation of pulsation semi-amplitude of Polaris during last decade: dots- BOAO data, open circles- AST data

data were combined with the data obtained in 2003-2007 for the analysis of pulsation amplitude variations over this 9-year interval. For these reasons, all the 2003-2011 data obtained at each observatory were divided into time sub-intervals: 8 intervals for the BOES data and 13 intervals for the AST data. For each time interval, we searched for the best sine-wave period, amplitudes and phase to fit the data. Resulting semi-amplitudes of pulsation versus the JD are shown on Figure 1. As seen, the results coming from the two instruments clearly show the continuous pulsation amplitude increase of Polaris since 2003. We confirm that the earlier registered switch of the amplitude variability from decay to standstill happend in 1990 was replaced by an amplitude increase at the beginning of new millenium, and that this is continuing. Our result clearly shows that Polaris is entering a new long-term epoch of pulsation amplitude increase. A detailed analysis of Polaris spectroscopy and a discussion of possible reasons for the amplitude growth will be given in our next paper.

3. Conclusions

We have made progress in the collection of precise radial velocity measurement of Polaris in recent years. Based on our radial velocity data obtained between 2003 to 2011 we safely confirm that the pulsation amplitude increase is still ongoing and that Polaris is entering a new epoch of amplitude increase.

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