Journal of Physics: Conference Series **728** (2016) 072007 doi:10.1088/1742-6596/728/7/072007

Near IR observations of η Car: Reaching its critical rotation?

Kazunori Ishibashi[1], Andrea Mehner[2] and Takahiro Nagayama[3]

[1] Graduate School of Science, Nagoya University, Japan
[2] ESO European Organisation for Astronomical Research in the Southern Hemisphere, Chile
[3] Department of Physics and Astronomy, Graduate School of Science and Engineering, Kagoshima University, Japan

E-mail: [1] bish@nagoya-u.jp

Abstract. We report a preliminary result in the monitoring of η Carinae in JHKs bands through the "spectroscopic" event of 2014.5 at InfraRed Survey Facility (IRSF) located in South African Astronomical Observatory (SAAO). The latest photometric data, combined with the data taken with the MK-II photometer [1], show a sign of the same cyclic variation in the J-H vs. H-K diagram reported by Mehner et al.[2]. The change can still be attributed to an apparent increase in black-body temperature, potentially reaching 3,000 to 6,000K as of March 2015.

NIR Monitoring of η Carinae

Near-Infrared monitoring of η Carinae continued throughout the spectroscopic event of 2014.5 (for those who are not familiar with the star and its 5.5yr cyclic and other secular changes, please see [2] and references therein). As the last event occurred in August 2014, some observations were proven difficult to conduct (η Carinae being too close to the Sun for many observatories), though we managed to obtain a few crucial data points during the phase of expected rapid changes in JHK colors.

Figure 1 shows the H-K vs. J-H color-color diagram of η Carinae, corrected for its long secular change in reddening. With those few data points in hand (marked in light green), the same rapid, cyclic change is confirmed to recur at the last event, as well as the increasing trend in apparent black-body temperature (of η Car's stellar atmosphere). While depending on an assumption on intrinsic reddening correction, it seems that the apparent plasma temperature has reached 6,000K (or as low as 3,000K), a jump in temperature at 5,000K (or 2,700K) in 2009.0, respectively.

Is η Carinae Spinning Up?

A cause of the cyclic changes is not clearly understood, though naturally we suspect it to be driven by interaction between η Carinae and its massive companion. As for the apparent jump in temperature, a tidal interaction between the two stars may play a significant role. As the companion passes its periastron, it swings by the primary at the speed of $\sim$300 km s^{-1}. It may lead to a spin-up of the rotation speed of the primary; in turn it leads to an appreciable

expansion in its dense atmosphere, which will eventually allows ionizing radiation from its core to permeate much easily.

Here, two concerns are that how long this trend may continue and what would happen at its end point? Nothing is certain, but the history suggests that an eruption may be a way to carry away any excessive angular momentum once it reaches a limit in critical rotational stability.

Easy to speculate; harder to prove.

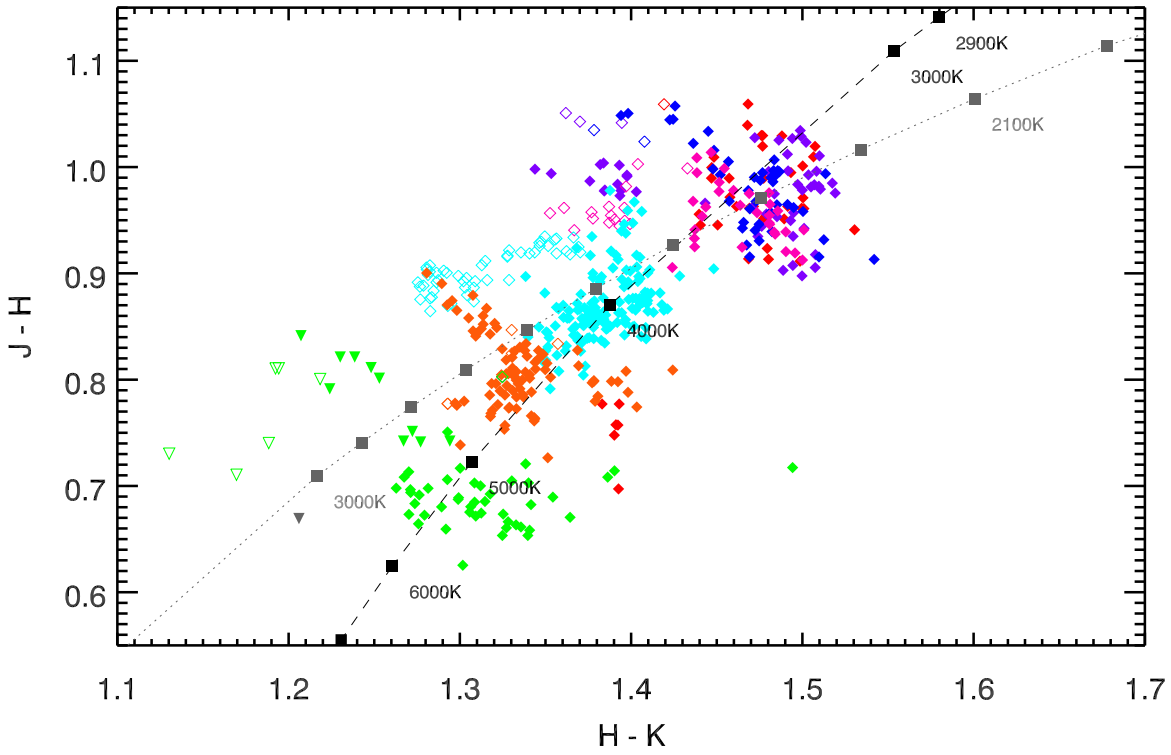

Figure 1. Historical Color-Color diagram of η Carinae in Near IR: data points are color-coded by 5.5yr phases. Note that the lone data point taken after the 2014.5 event shown here in gray (marked with reversed filled triangle) near H-K$\sim$1.2 and J-H$\sim$0.68. See [2] for more details.

Acknowledgments

We acknowledge Drs. Sugitani, Murata and many other observers to support this monitoring program. Ishibashi also acknowledges that this work was supported by JSPS KAKENHI Grant Number 26400227.

References

[1] Whitelock P A, Feast M W, Marang F and Breedt E 2004 *Mon. Not. R. Astron. Soc.* **352** 447–456
[2] Mehner A, Ishibashi K, Whitelock P, Nagayama T, Feast M, van Wyk F and de Wit W J 2014 *Astron. Astrophys.* **564** A14