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New water maser source near HW3d in the massive star-forming region Cepheus A

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Abstract. Cepheus A is the second nearest high mass star-forming region after Orion. It is characterized by the presence of several phenomena, such as a complex molecular outflow, and multiple radio continuum sources, known as HW sources. The radio continuum and water maser emission have been detected toward HW2, HW3b and HW3d regions, and all of them are considered harboring young stellar objects. In 2014, we performed KaVA observations and detected a new bright maser feature, ∼700 mas apart from HW3d, which has not been detected with previous VLBI observations. The relative proper motion of the new maser feature is faster than other regions. It can be a clue for a newly forming star. Alternatively, it may be caused by outflow shock from the star-forming regions such as HW3d or HW3c.

Keywords. masers − stars: formation − ISM: individual objects: Cepheus A − ISM: jets and outflows

1. Introduction

Cepheus A is the second nearest massive star forming region, located at a distance of 725 pc, after Orion (Moscadelli *et al.*2009). Several radio continuum sources such as HW2, HW3c and HW3d have been reported and water masers are detected in HW2, HW3b and HW3d (Torrelles *et al.*1998). The HW2 region is associated with a powerful radio thermal jet, and a complicated water maser structure perpendicular to the HW2 radio jet traces a circumstellar disk of ∼300 AU in radius (Curiel *et al.* 2006). On the other hand, HW3d is thought to harbor protostars, based on the spectral indices and bipolar outflow motion (Garay *et al.* 1996 and Chibueze *et al.* 2012). However, the origin of the thermal continuum outflow in HW3d is still unclear (Zapata *et al.* 2013).

2. New water maser source detected in 2014

We performed KaVA observations at 22 GHz in 2014 to investigate the time-evolving feature of the water maser distribution in Cepheus A. The maser features detected in HW2, HW3d and the new source nearby HW3diii are presented in Fig. 1. We compare the water maser distribution of HW2 observed in 2014 with the VLA observation in 1995 and the VLBA observations in 1996, 2001 and 2002 (Torrelles *et al.* 2011). It is hard to distinguish an appreciable change over 20 years, although no VLBI results have been reported since 2003.

In HW3d, we detected two maser-emitting regions and a new maser feature close to HW3diii. The brightest maser spots were detected in the new region, compared to other regions. The mean proper motion in the new region is the fastest among the values of mean proper motion estimated using the relative proper motion for maser spots detected in all regions including HW2 and HW3d.

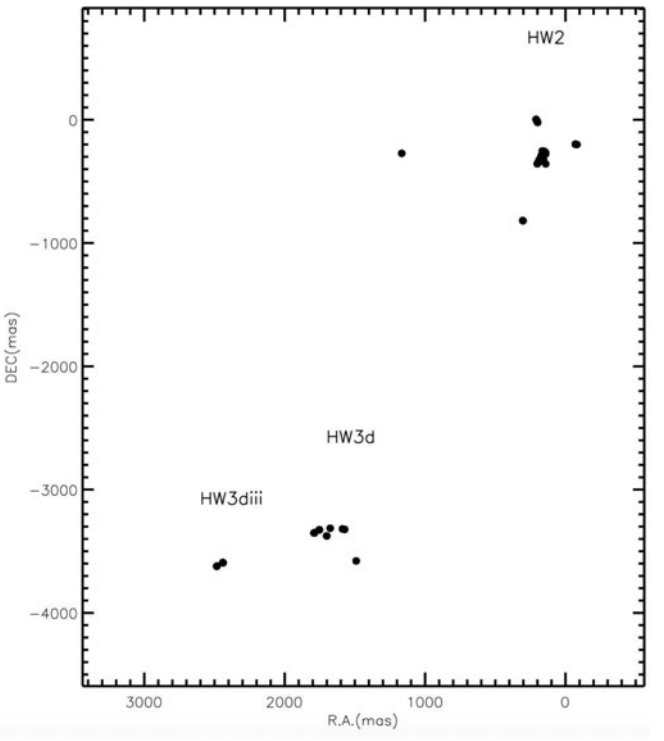

Figure 1. Water maser distribution of Cephues A in 2014 KaVA observations.

The new maser feature can be a signature of a newly forming star. Alternatively, it may be caused by outflow shock from the star-forming region HW3c, or from HW3d which is thought to be a star-forming region. Sudden brightening of water masers in Cep A was reported based on observations of the RT-22 radio telescope in 2012 (Tolmachev 2012). It can be speculated that the observed maser flare in 2012 is related to the new maser feature we detected in 2014. If it is the case, the new maser feature near HW3diii could be a new star-forming region, and is not formed by the outflow shock from other continuum sources such as HW3d or HW3c. Thirdly, it can be possible that the new maser feature is part of HW3diii.

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