Flares of 2007 January and May in Cyg X-3 : Phase Referencing Results †

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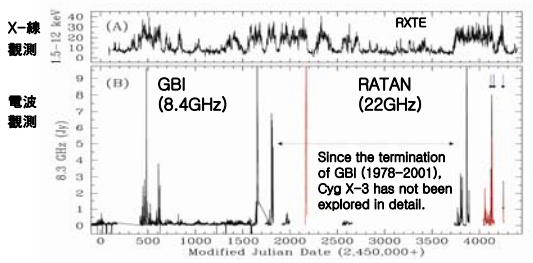
Abstract

We present VERA observations of a black hole microquasar candidate Cyg X-3 in the flaring states in 2007 January and May. In 2007 January, a structure is evident in the closure phase, although VERA could not detect any signature of jet activity in the image. On the other hand, in 2007 May flare, the closure phase around zero is indicative of no peculiar structure, as also displayed by images. Since the radio flare is dramatically changed in Cyg X-3 during flares, there were epochs we could not detect with VERA due to very low flux density. Therefore we carried out phase referencing by adopting a water maser source W75N in another beam. After the phase referencing, we were able to detect the Ishgaki station. Further analysis with phasereferencing is in progress.

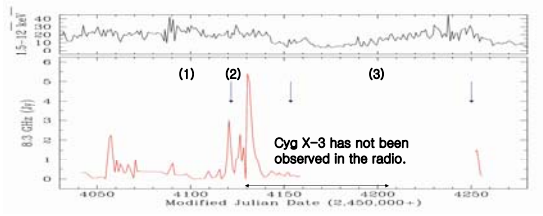
† Collaboration with Honma, Mareki (VERA觀測所) Kurayama, Tomoharu (韓國天文硏究院) Sasao, Tetsuo (亞州大學校, KVN)

Introduction: Long-Term X-ray & Radio Light Curve



Frequently flaring, black hole-Wolf-Rayet star binary Cyg X-3 has been monitored in X-rays (RXTE) and gamma-rays (SWIFT). The long-term radio monitoring with GBI was recently terminated. It has been also often monitored in the radio by RATAN.

2007 VERA Observation (22 GHz)



We observed Cyg X-3 with VERA three times in 2007:

(1) Jan 20: in the early-decay of a radio flare

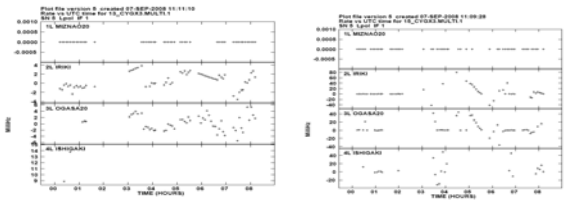
(2) Feb 21: during the late decay phase of a flaring states, or near quiescence

(3) May 29: during a high X-ray flux (and probably during a radio flaring state)

We detected Cyg X-3 in Jan and May with phase referencing.

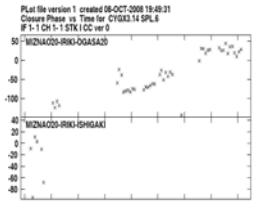
2007 January Flare: without & with phase referencing

Rate: Fringe results vs. Phase referencing



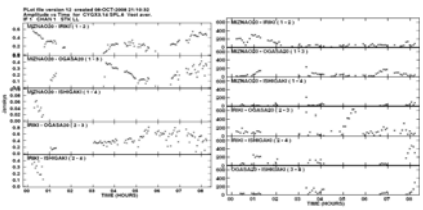
With phase referencing, we were able to detect Cyg X-3 at the Ishigaki.

Closure Phase for one-beam data



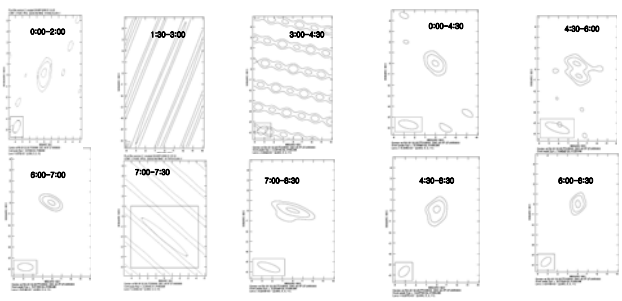
The signature of a structure is evident.

Visibility: Fringe result vs. phase referencing (solint:5min)



Visibility became improved with phase referencing. However, the amplitude became reduced; the reason is under investigation.

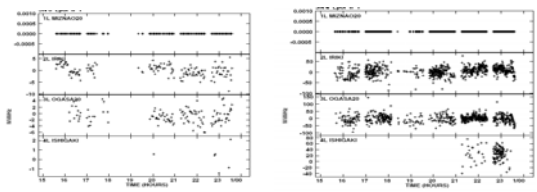
Image with phase referencing



We were not able to make image during 1:30-3:00UT due to the lack of data points. We cannot conclude whether there is a structure or not, over the whole observation.

2007 May Flare: without & with phase referencing

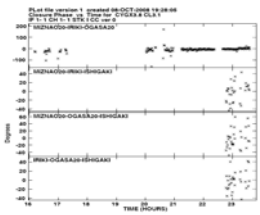
Rate: Fringe results vs. Phase referencing



With phase referencing, we were able to detect Cyg X-3 at the Ishigaki.

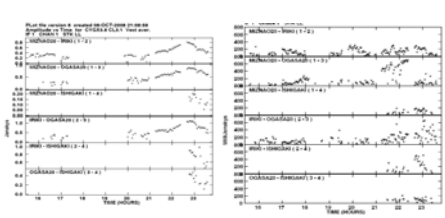
At the Iriki and Ogasawara, the number of data became appreciably increased.

Closure Phase for one-beam data



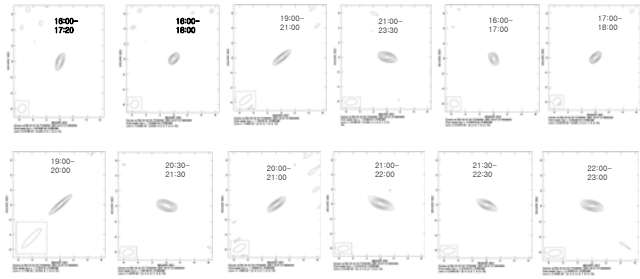
The closure phase of Mizusawa-Iriki-Ogasawara baseline is almost flat, or near zero.

Visibility: Fringe result vs. phase referencing (solint:5min)



Visibility became improved with phase referencing. However, the amplitude became reduced; the reason is under investigation, as in the case of the January observation.

Image with phase referencing



Although the flaring activity seems to be evident, we could not detect any signature of jet activity with VERA. Due to such stable structure all through the observation, we are able to justify the investigation of the variability analysis. Apparently, ~1-2 hour-long variability is plausible, although we are currently investigating the time scale of variability in detail.