

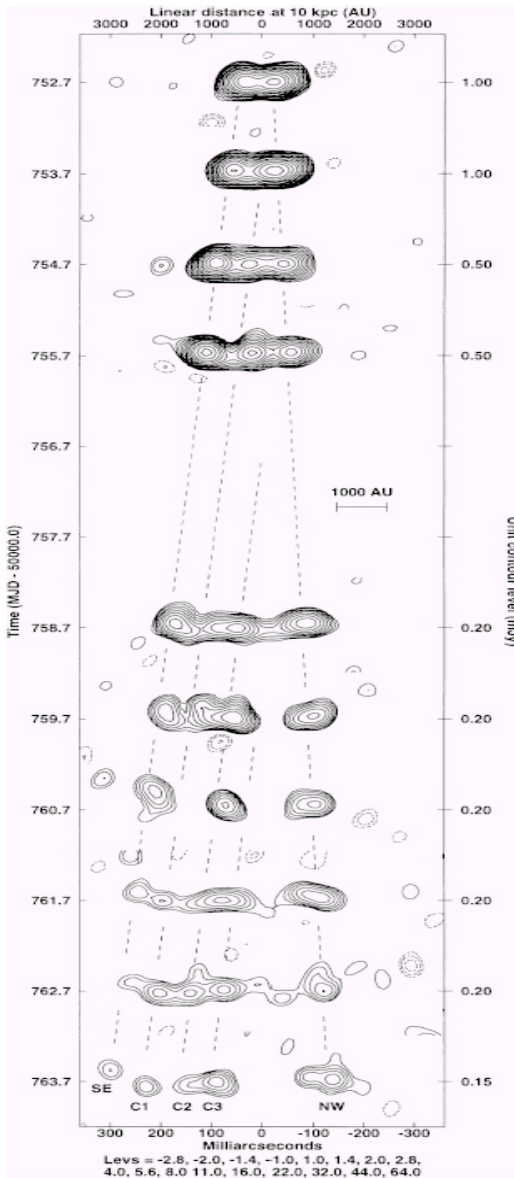
2004年 11月 8-9日 VERA User
Meeting (Mitaka/NAOJ)

Target of Opportunity (ToO) Observations for

Time-varying Flares and associated Relativistic Jets

in Microquasars

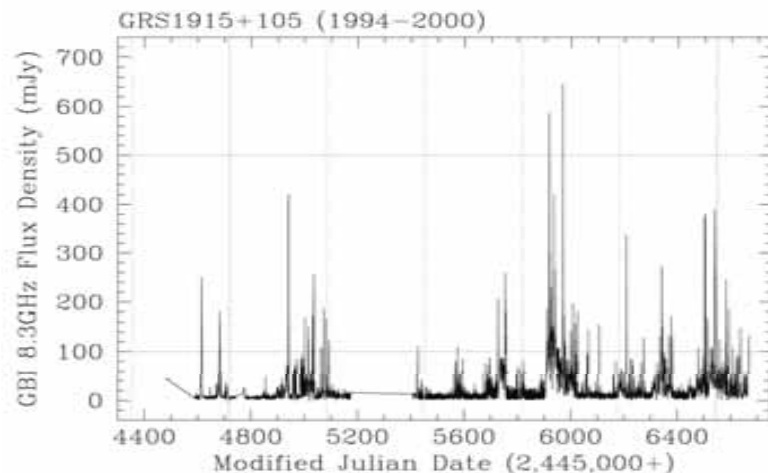
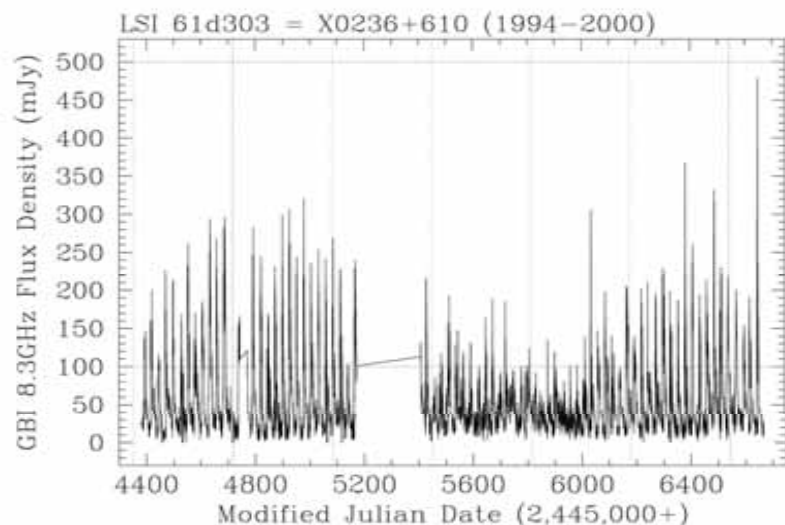
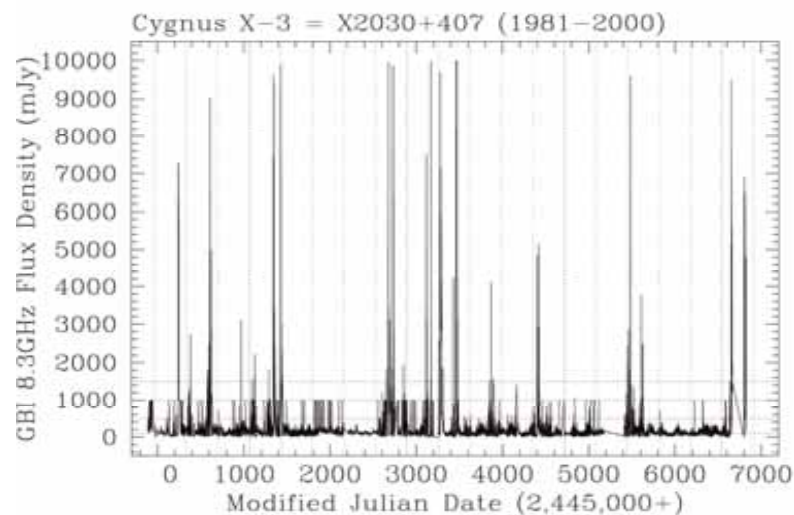
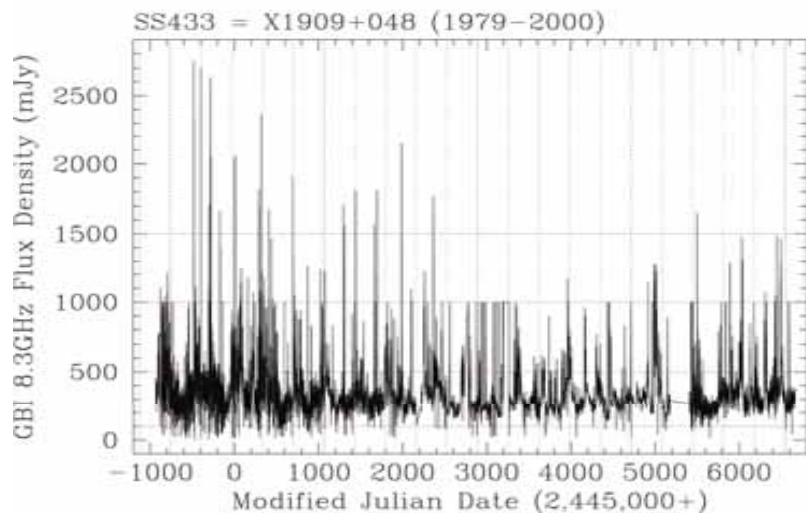
Soon-Wook Kim (忠南大, 韓國)



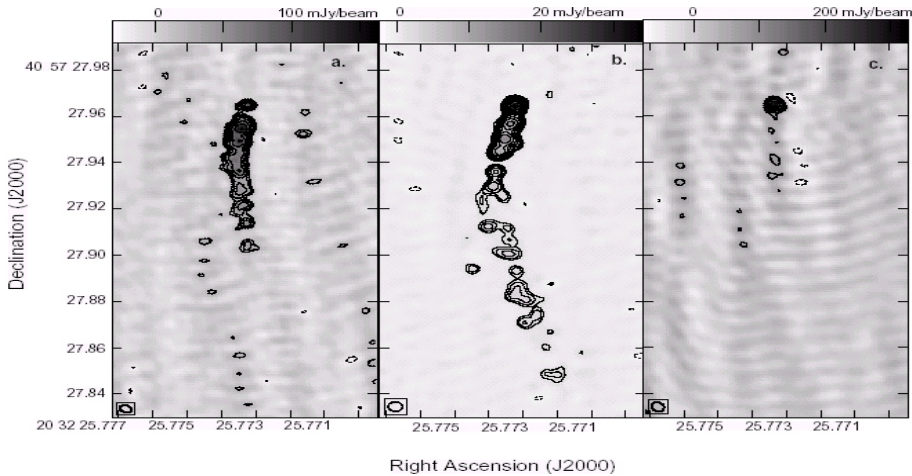
Superluminal Jets from the
best studied microquasar
GRS 1915+105 (~2 weeks)

ToO for Microquasars (BH/NS binaries) with VERA

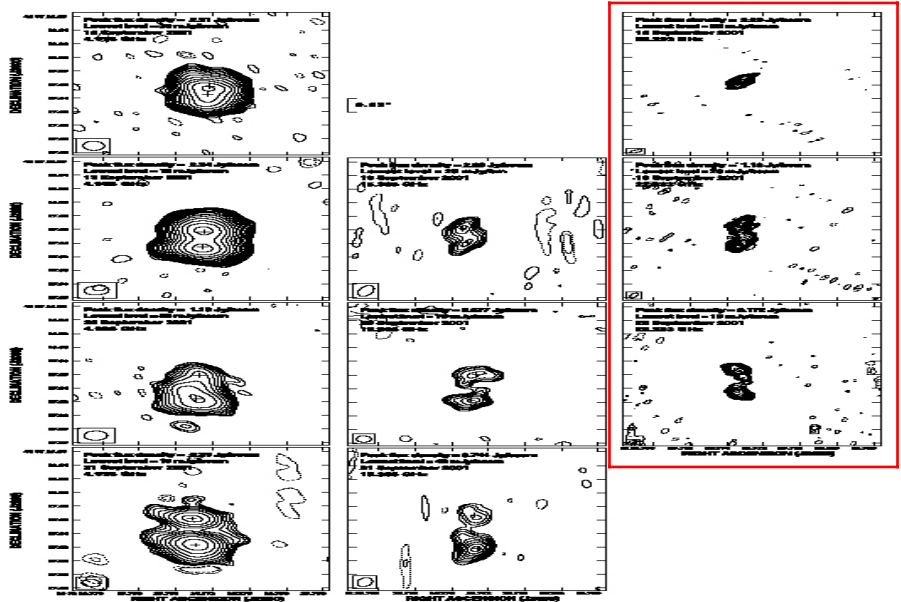
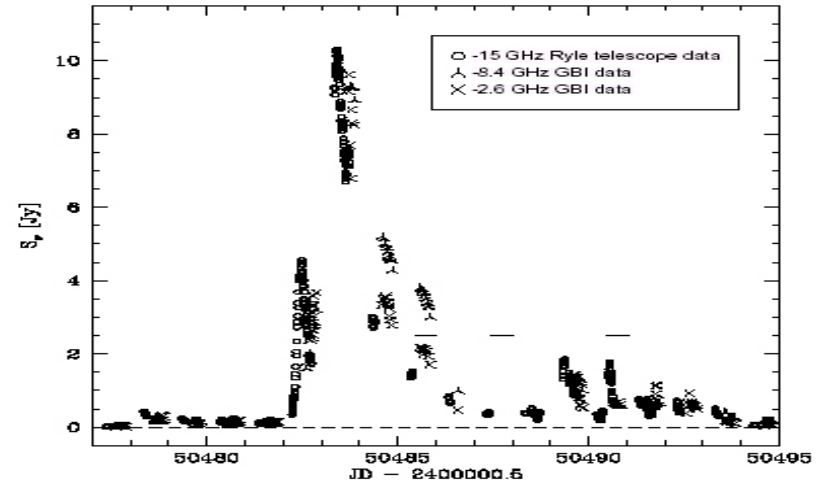
- (1) **Radio-Persistent** (cf. transients: flares of a few to a hundred years)
 - (2) **> a few $\times 10$ mJy or higher to detect**
- ⇒ A few bright, radio-persistents known



ToO - Example: GBI/VLA-VLBA Observations for Cyg X-3

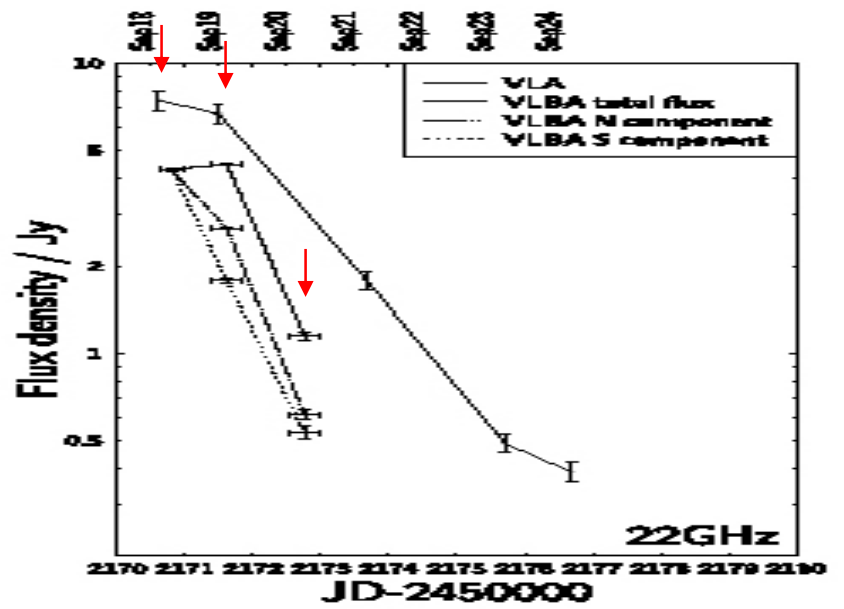


VLBA 1997 (15 GHz): 5 days → single jet



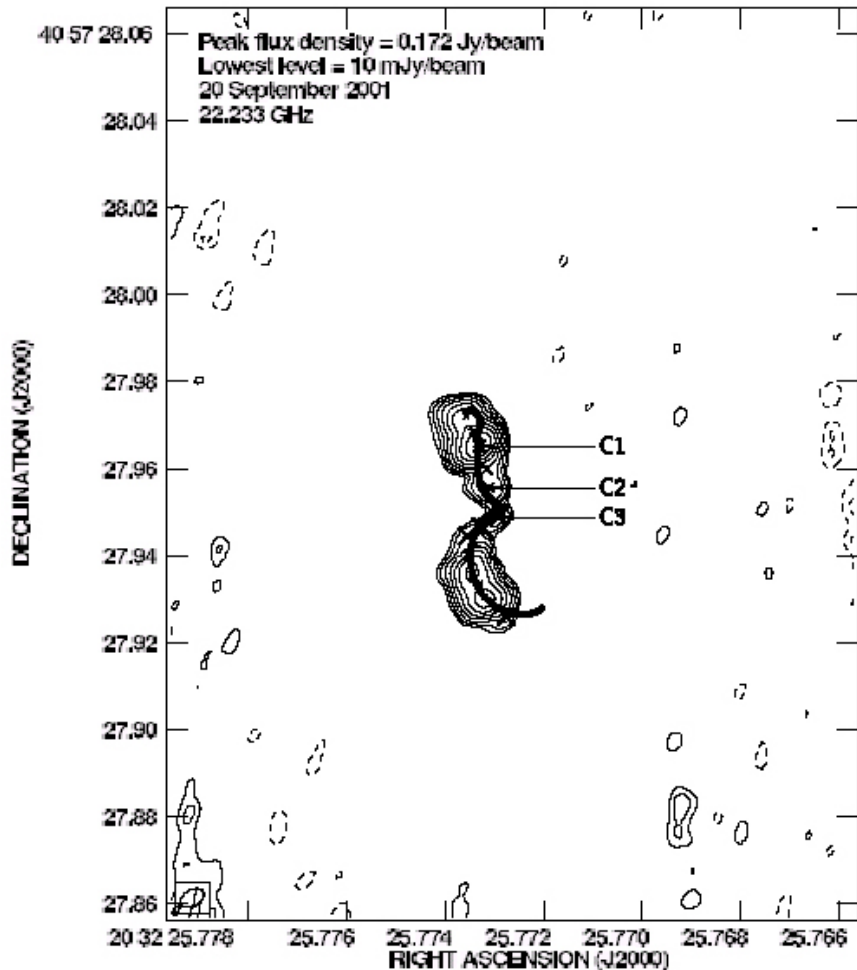
VLBA 2001 (4.9, 15 & 22 GHz): 3 days
→ double jets

GBI(2.5/8.4 GHz)-VLBA 1997 (15 GHz)

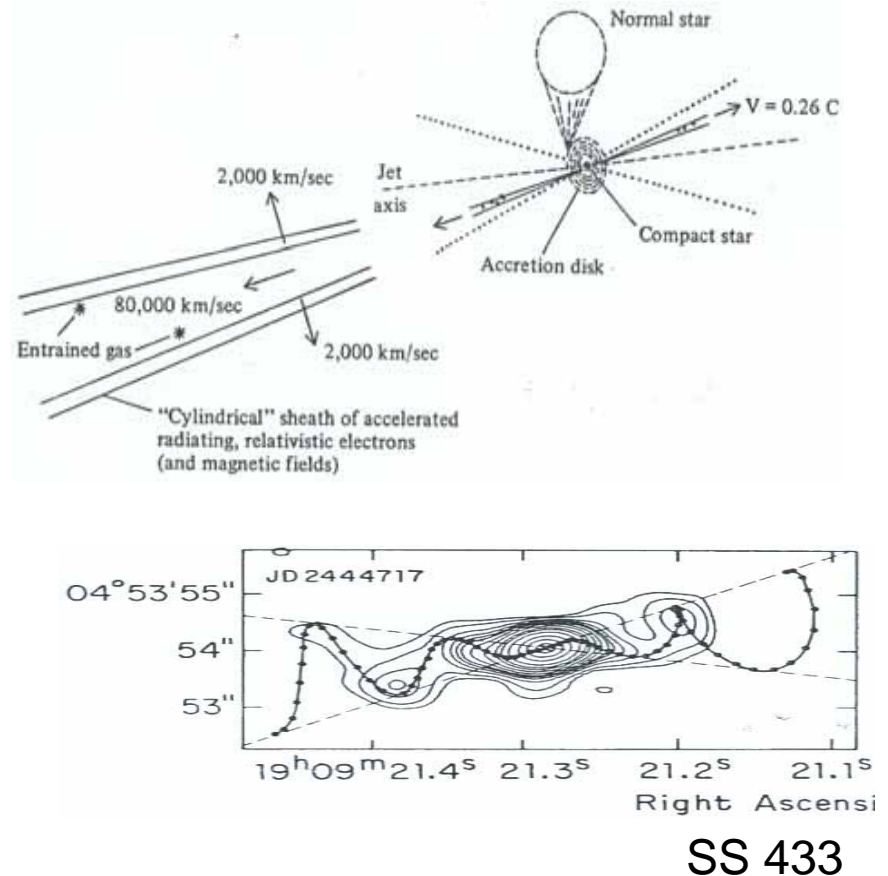


VLA-VLBA 2001 (4.9, 15 & 22 GHz)

Proper Motion for Spiral Jet due to Precession

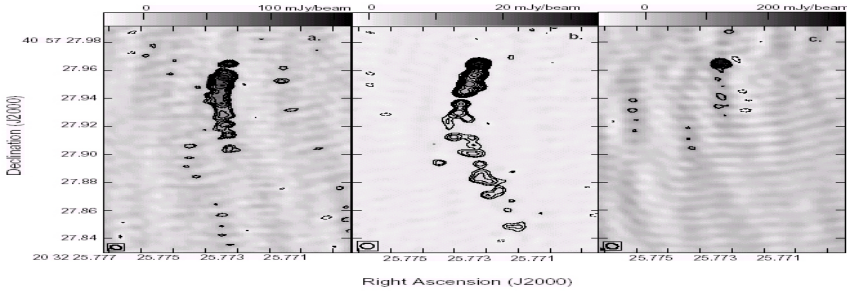


VLBA 22 GHz (3 days jet track)



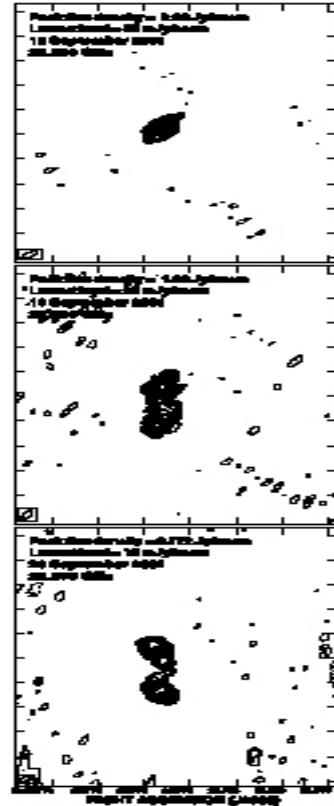
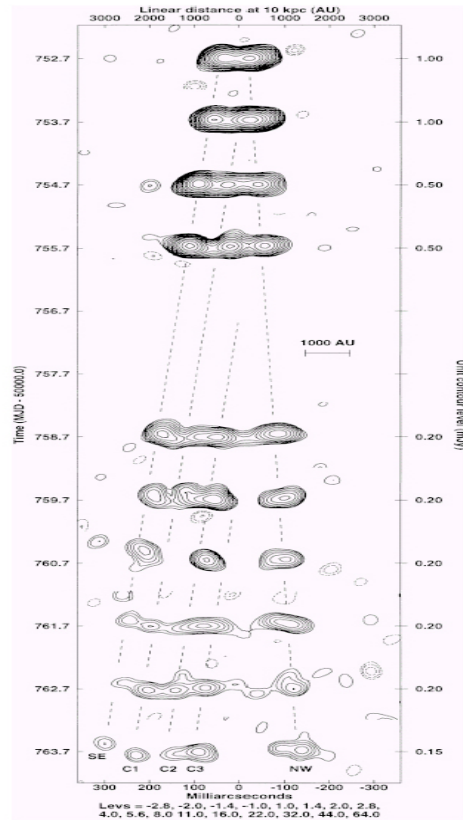
Time-dependent measurement of jet propagation with *high angular resolution* is very important to understand the nature of superluminal jet propagation and its relation to accretion disk !

ToO: Quick & Efficient !

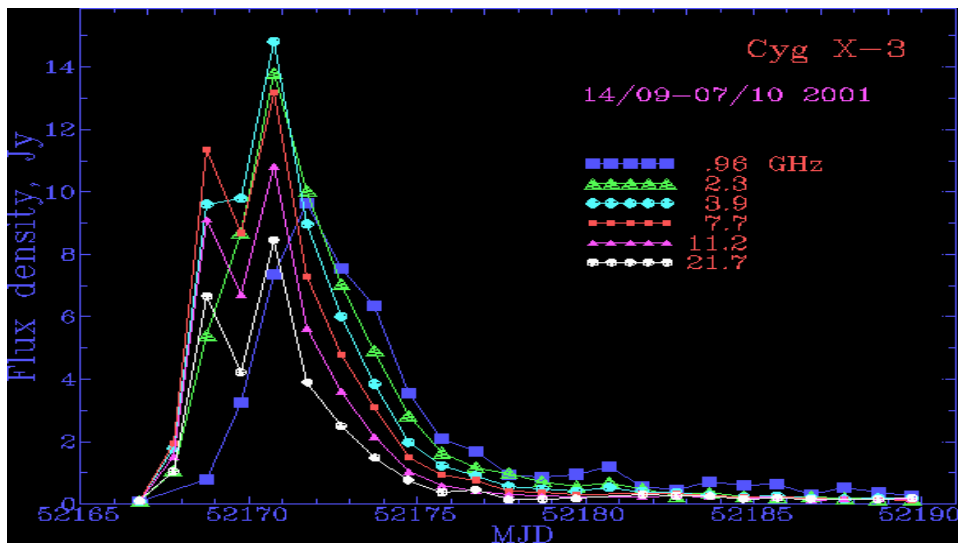


Cyg X-3 Decay (5 days)

- Extremely **energetic** & **efficient** (short time):
- from 10 mJy up to 20 Jy
- within a week or two !
- to observe the whole evolution of superluminal jets, from generation, propagation, & to decay !



Cyg X-3 Rise (3 days)



Superluminal Jets from the best studied microquasar GRS 1915+105 (~2 weeks)

How to initiate ToO ?

To know the initiation of a flare event,

Check IAUC, Astronomy Telegram, etc.

[but, not always available !]

(2) Check daily monitoring program (RXTE in X-rays)

[but, open to public every a week or two, while a typical event suddenly goes up within a day !]

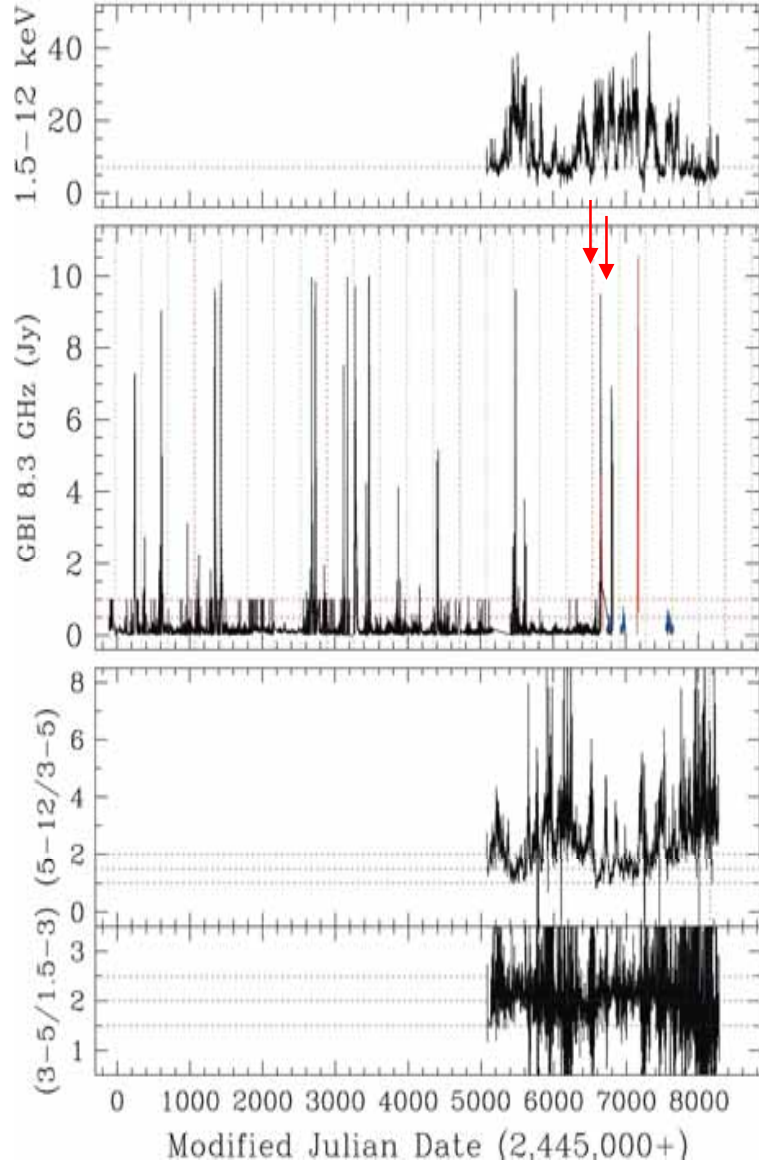
(3) Direct daily monitoring

[not currently available for VERA to do the radio monitoring;
most of radio-bright microquasars are not available in the optical !]

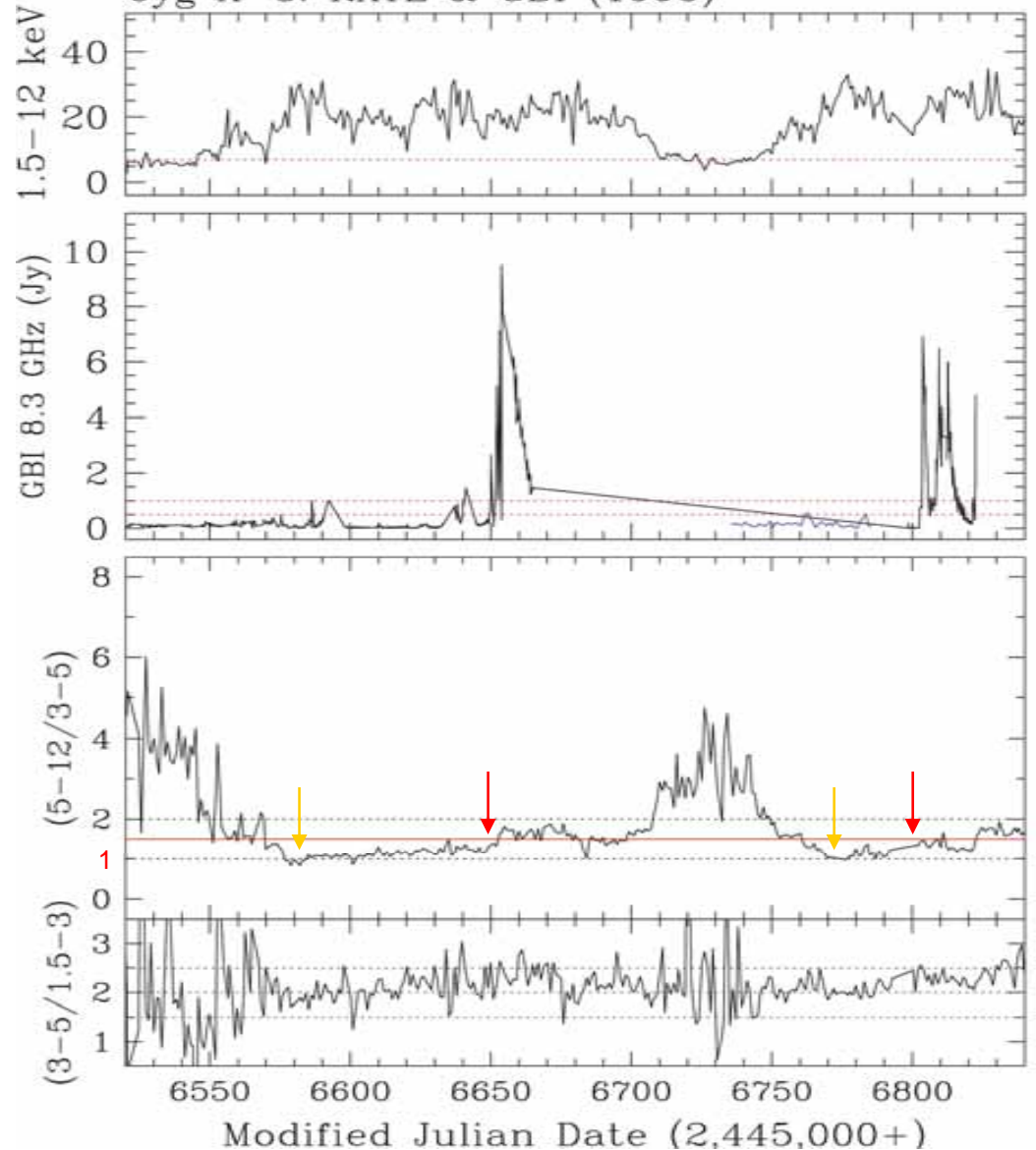
(4) Predict it theoretically or empirically ! (see below)

ToO - Example for a Prediction for flares in Cyg X-3

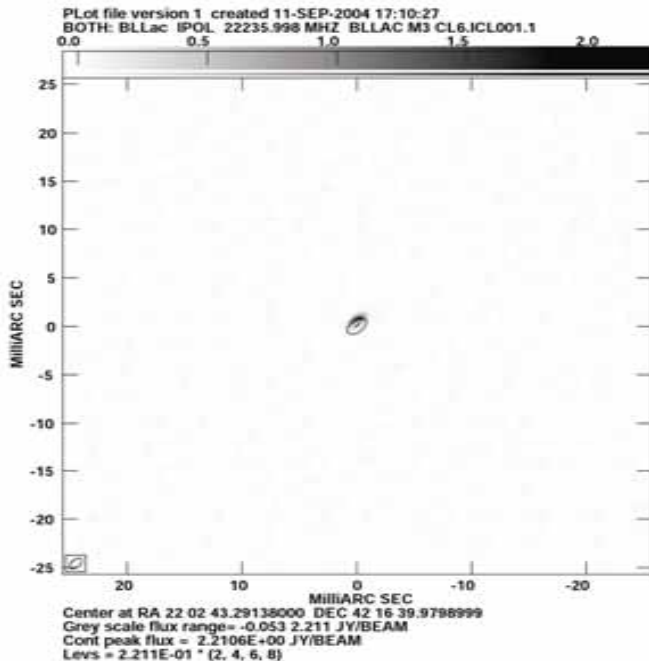
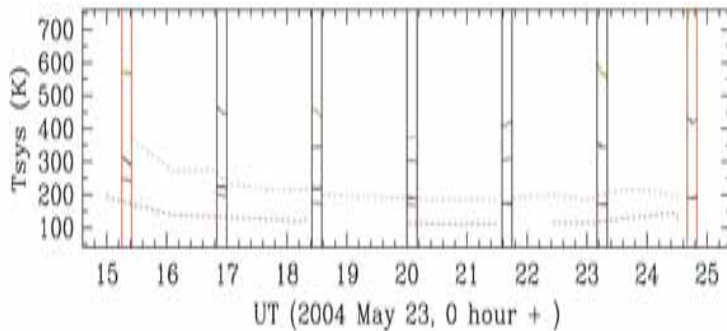
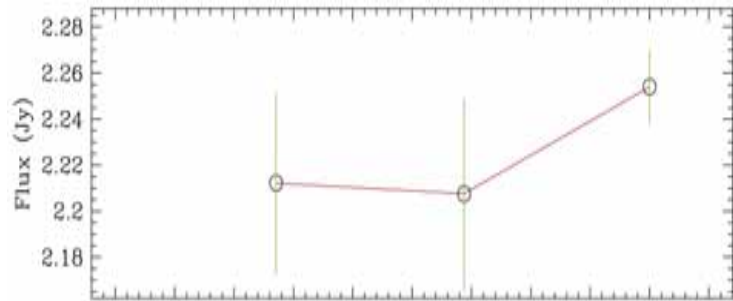
Cyg X-3: RXTE & GBI (1982–2006)



Cyg X-3: RXTE & GBI (1995)



VERA Observation of BL Lac



- To get a sure image with 2.2 Jy for BL Lac, with enough **UV coverage**, at least **two 10 min. snapshot observation during 90 min.** was required (to avoid the off-center image).
- Cyg X-3 has a **similar core size** (~mas or less), with a maximum jet image of a few $\times 10$ mas for a giant flare and a few mas for hour-scale flares.
- To detect a microquasar event (i.e., jet evolution) from Cyg X-3, at **2Jy or higher (up to 20 Jy)**, for example, **at least a few snapshots of 10-30 min. per day** is required for < 50 mas-scale event (for a giant flare) at 22 GHz to guarantee enough UV coverage.

Why Target of Opportunity for Microquasar Phenomena ?

- Understanding **accretion process** associated relativistic jets in BH/NS X-ray binaries
- Jet production at optically **thick to thin** transition
- **Companion's** stellar evolution: radio flux, jet speed & inferred mass transfer rate
- To understand these, measurement of **time-dependent** jet propagation, with high positional resolution (milli to micro arcsec) is extremely important !

END

以上

THANK YOU !