

Probing the Very Early Stage of Radio Source Evolution in NGC 1275 with VERA

Hikaru Chida (Master Student)

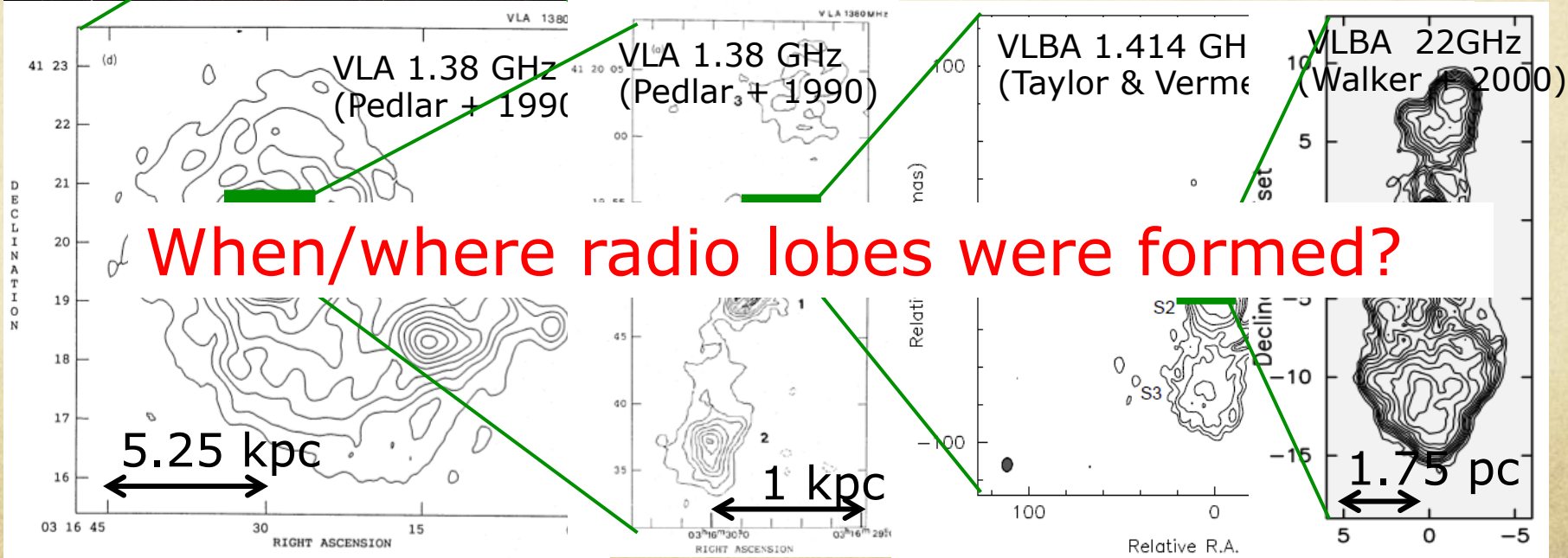
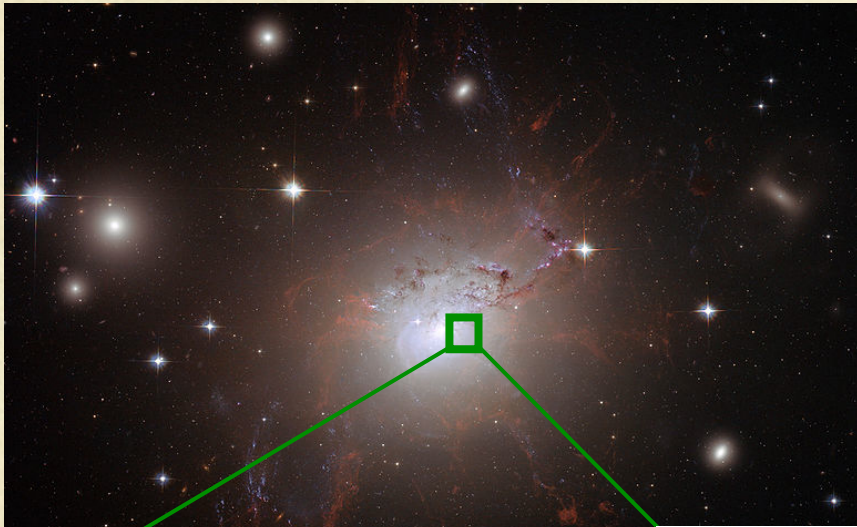
Tokai University / NAOJ

Collaborators :

Hiroshi Nagai, Mareki Honma (NAOJ),
Kyoshi Nishijima (Tokai University), Motoki Kino (KASI),
Kazunori Akiyama (University of Tokyo/NAOJ),
GENJI Programme members

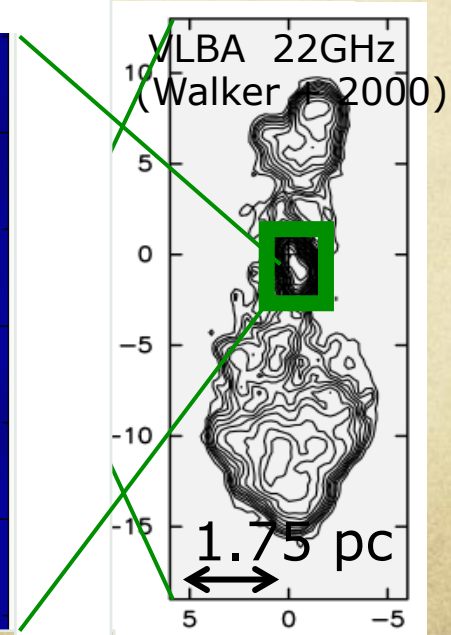
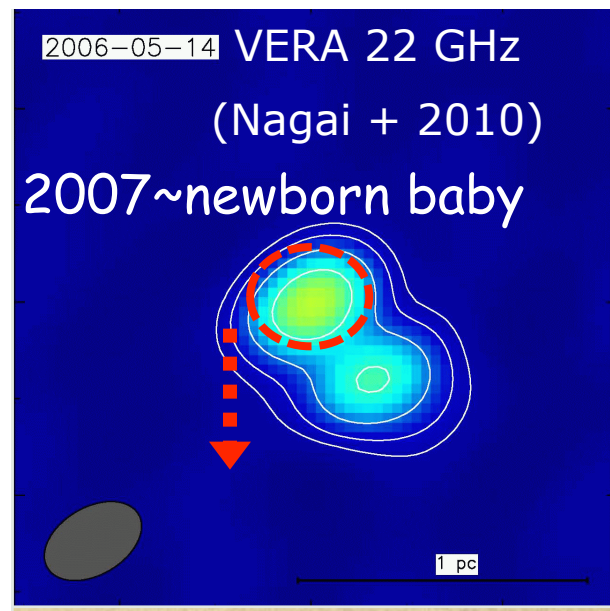
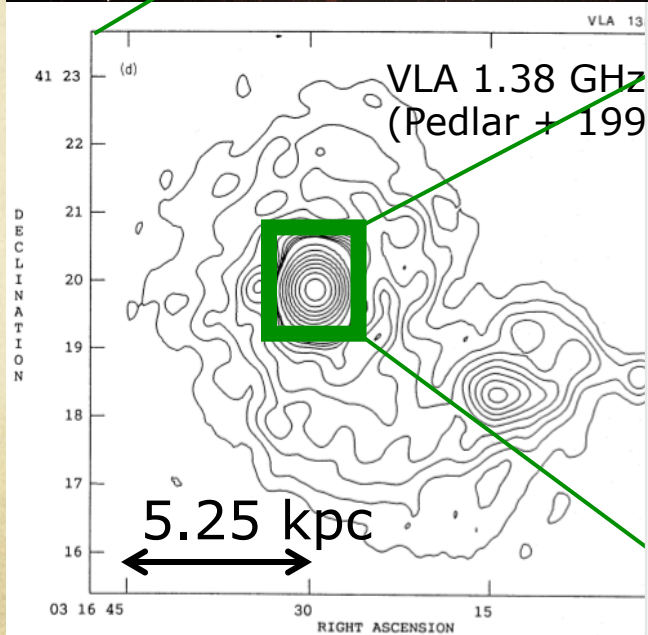
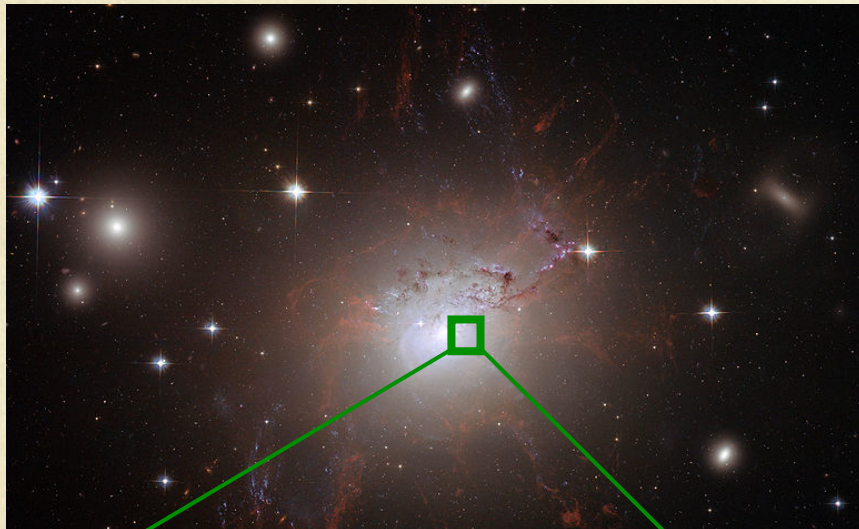
What is the radio galaxy NGC1275?

- Central giant elliptical galaxy of the Perseus cluster
- $z = 0.0176$
(1 mas = 0.35 pc = $1.1 \times 10^4 R_s$)



What is the radio galaxy NGC1275?

- The jet activities have been reactivated
- New component (C3) was detected on sub-pc scales (Nagai et al. 2010; Suzuki et al. 2011)

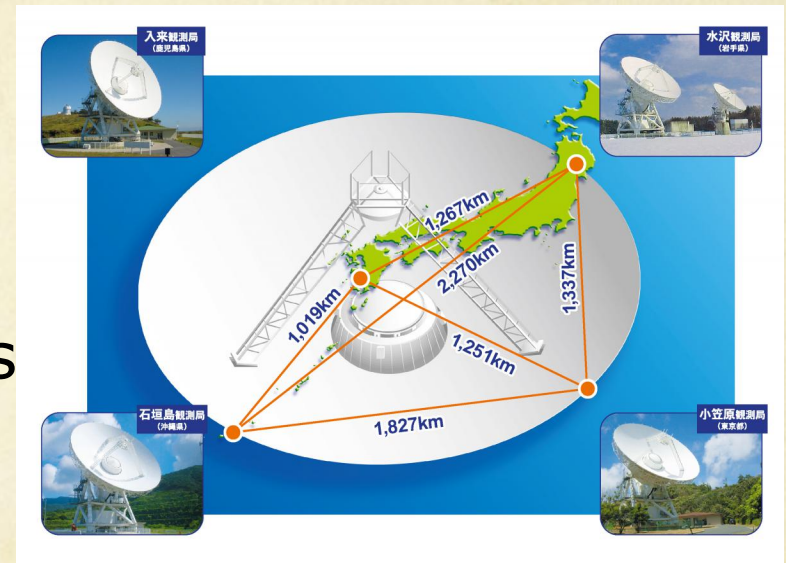


GENJI Programme

Gamma-ray **E**mitting **N**otable AGN Monitoring by **J**apanese VLBI

VLBI Monitor of γ -ray AGNs including NGC 1275
(Nagai et al. 2013)

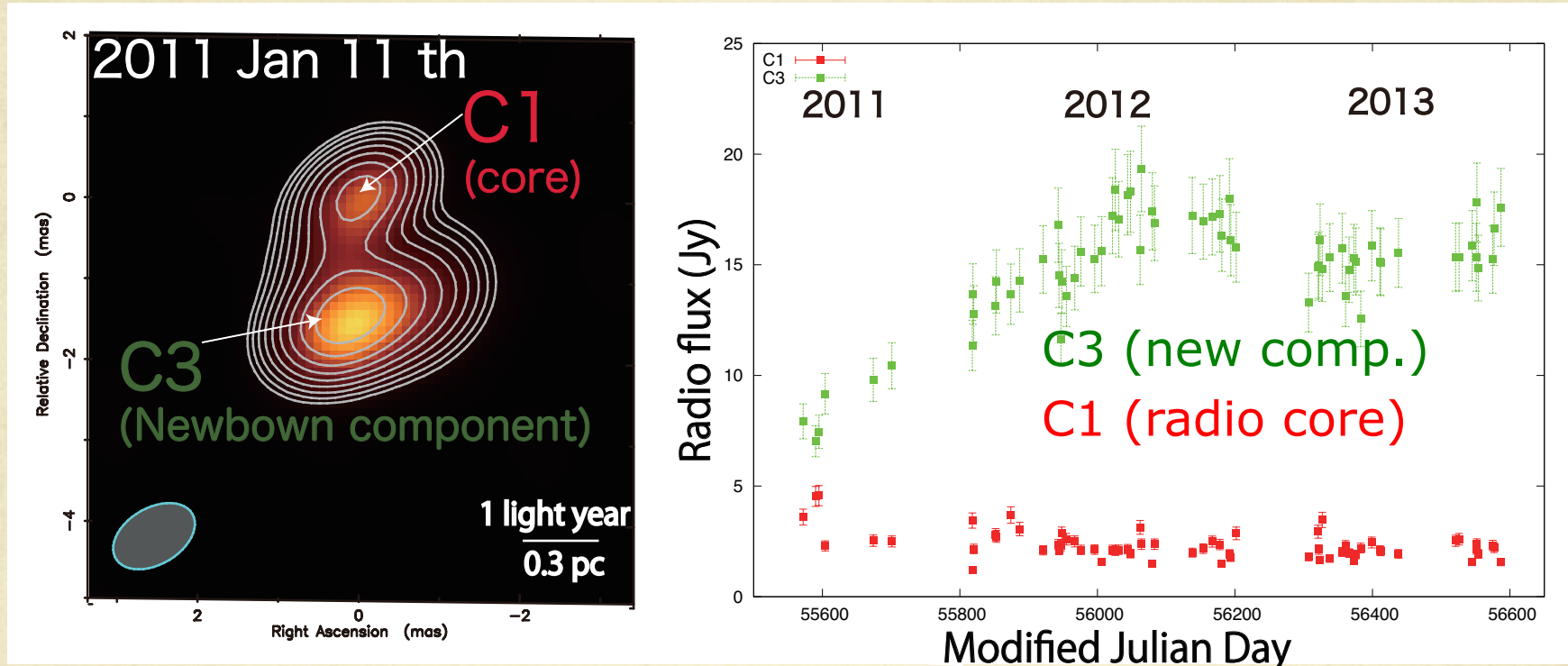
- Start from Nov. 2010
- Instruments : VERA
- Frequency : 22 GHz
- Typical Interval : 2 weeks



We report on observations from 2011 to 2013

Results (1)

Time variation in the radio flux of C3



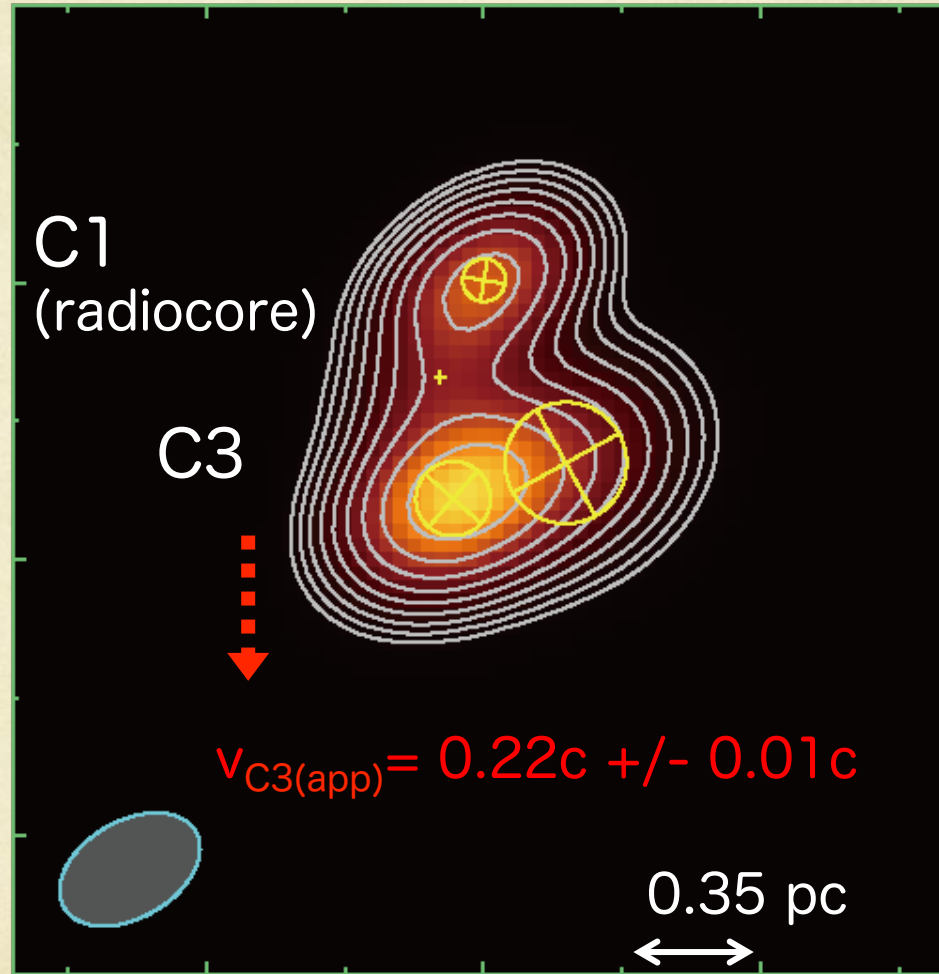
C1 flux is almost constant.

C3 flux was monotonically increased until 2011
relatively constant since 2012

Continuous injection of fresh electrons at C3 should be required. C3 is similar to that for hotspot.

Results (2)

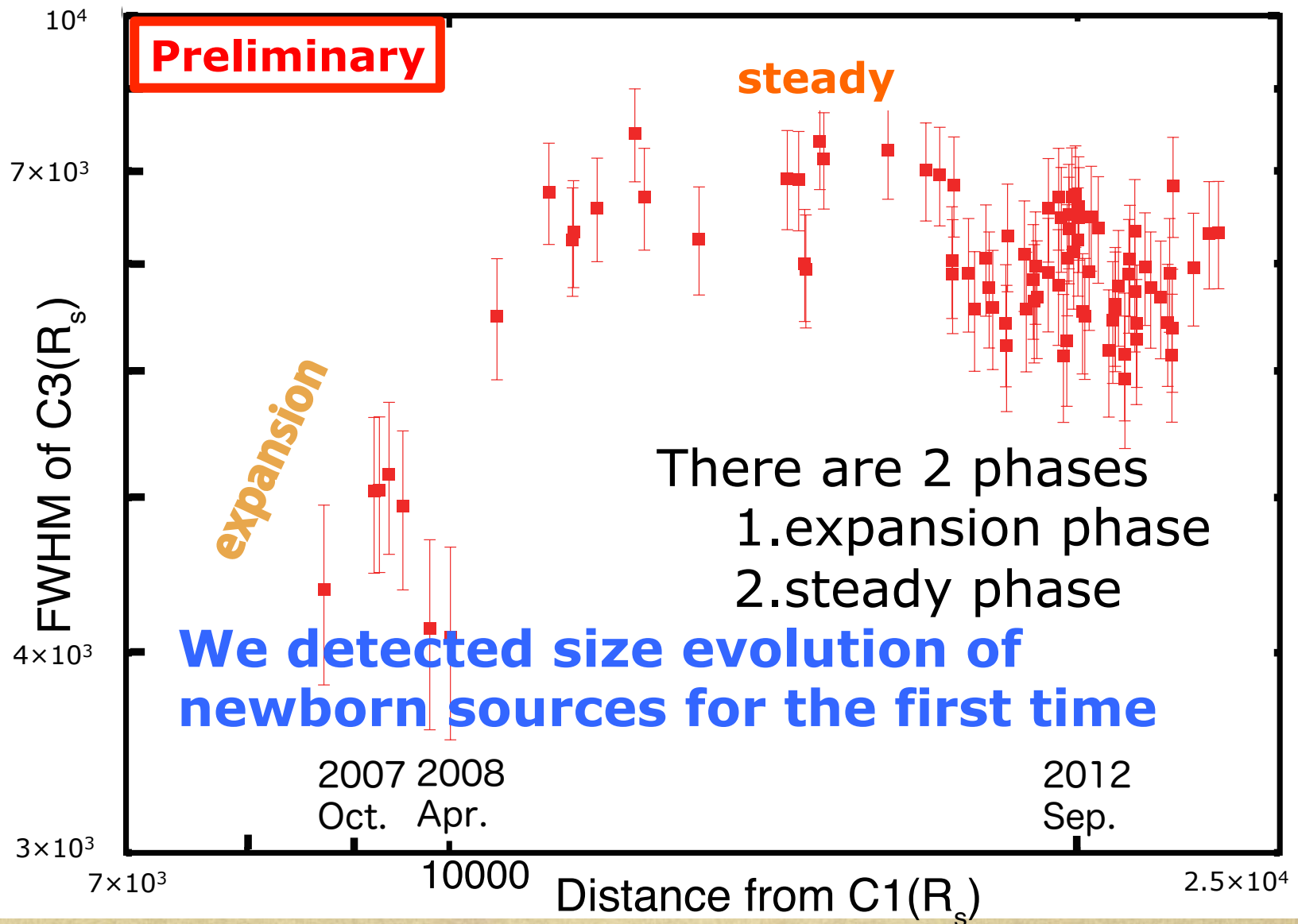
Motion of C3



Consistent with typical hotspot velocities of CSOs
(Compact Symmetric Objects)

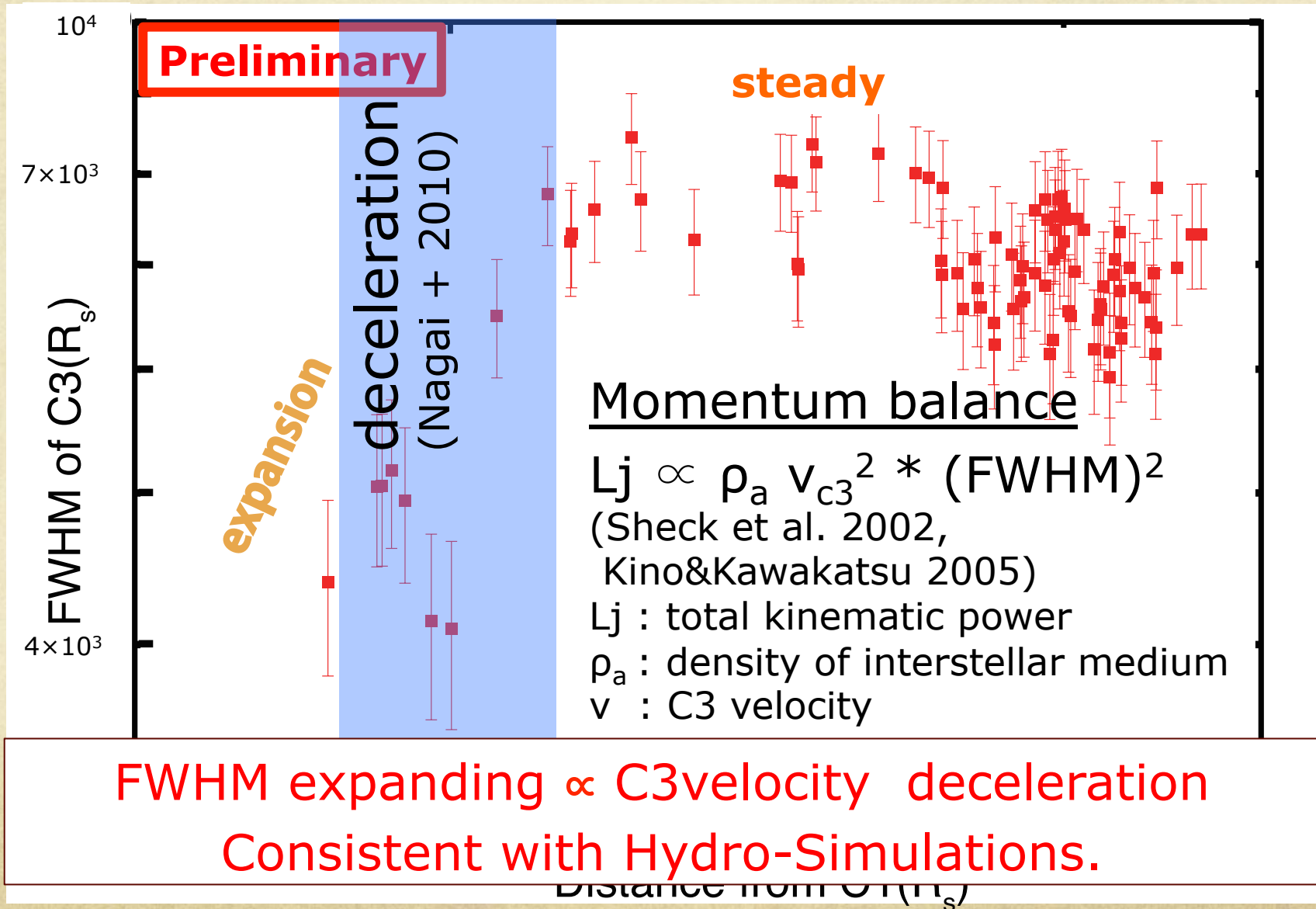
Results (3)

Size evolution of C3



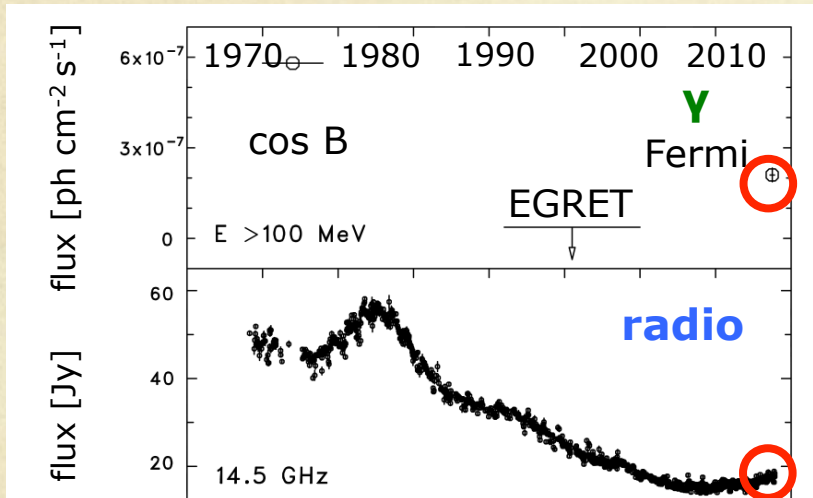
Discussion

What the nature of C3?



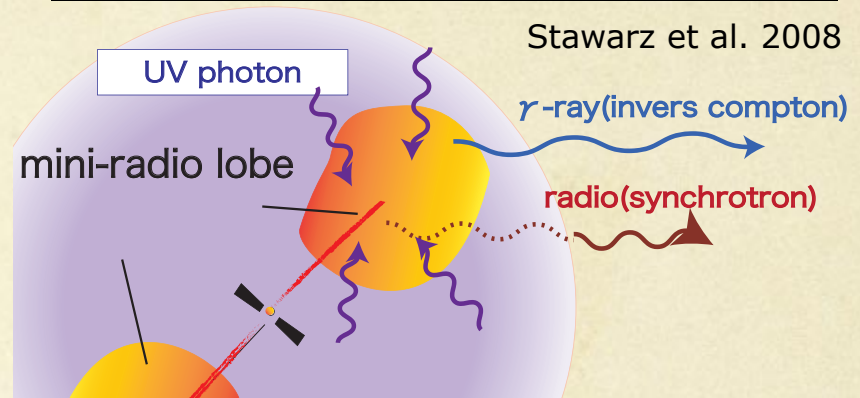
Future work

Possible origin of long-term trend

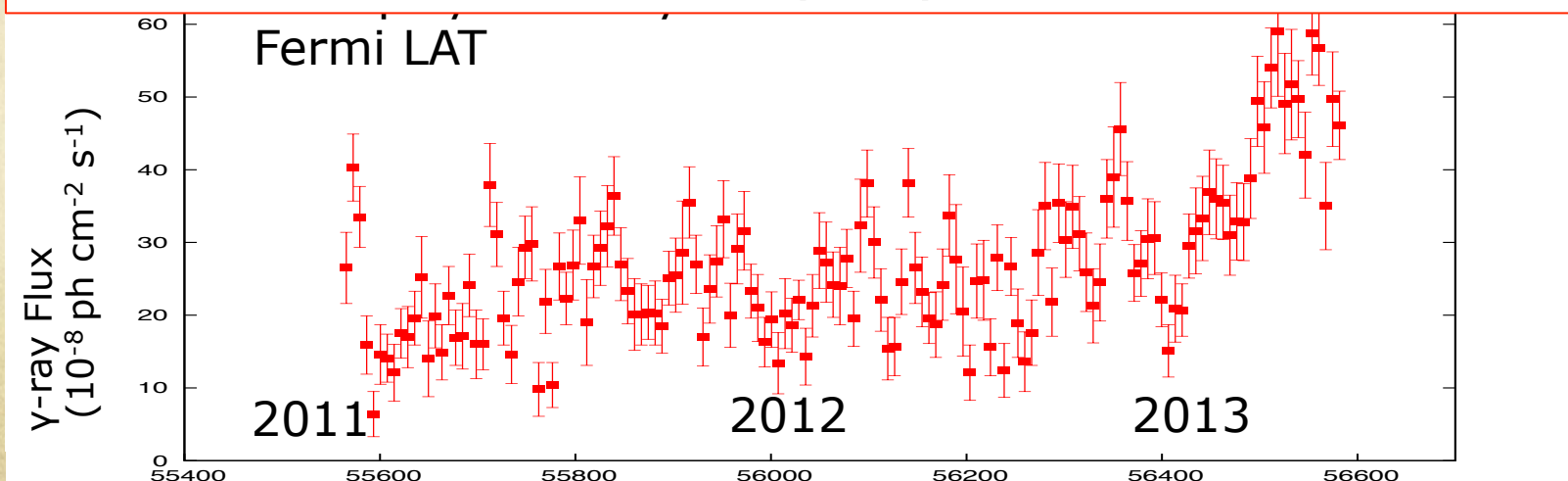


Radiation from mini-radio lobe

Stawarz et al. 2008



Future work: We want to approach the relationship between radio lobe and γ -ray.



Summary

- ✧ We studied nature of C3 (10 years old).
- ✧ We observed NGC 1275 from 2011 to 2013.
 - (1) Flux increases
C3 is hot-spot like component.
 - (2) Moved to the south with a velocity of $\sim 0.2c$
Consistent with hotspot velocities of CSOs
 - (3) Size evolution of C3 was detected.
Consistent with hydro-Simulations.

The hotspot and radio lobe can be formed at the immediate vicinity of the central SMBH in NGC 1275.

- ✧ γ -ray flux has been increasing from 2010 to 2013

In the future, we want to approach the relationship between mini radio lobe and γ -ray.

Thank you for the listening. Grazie mille!