

# Observations of MASTER OT J030227.28+191754.5 (with full of preliminary results...) and future prospectives



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VSNET Collaboration

OISTER Collaboration

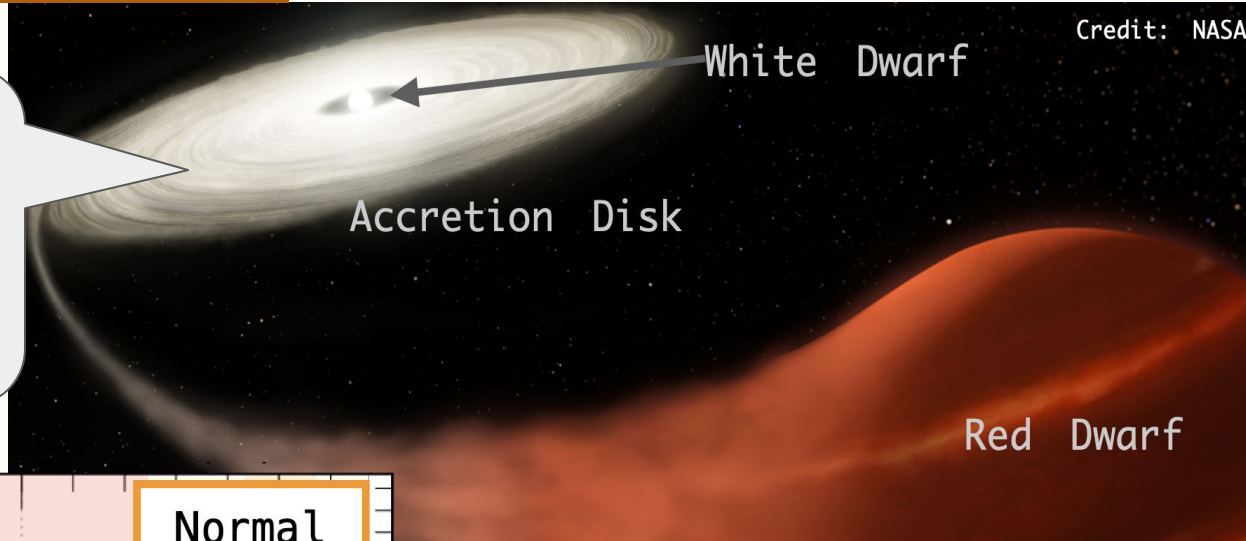
(Thanks to Yamanaka-san, Taguchi-san)

and more...

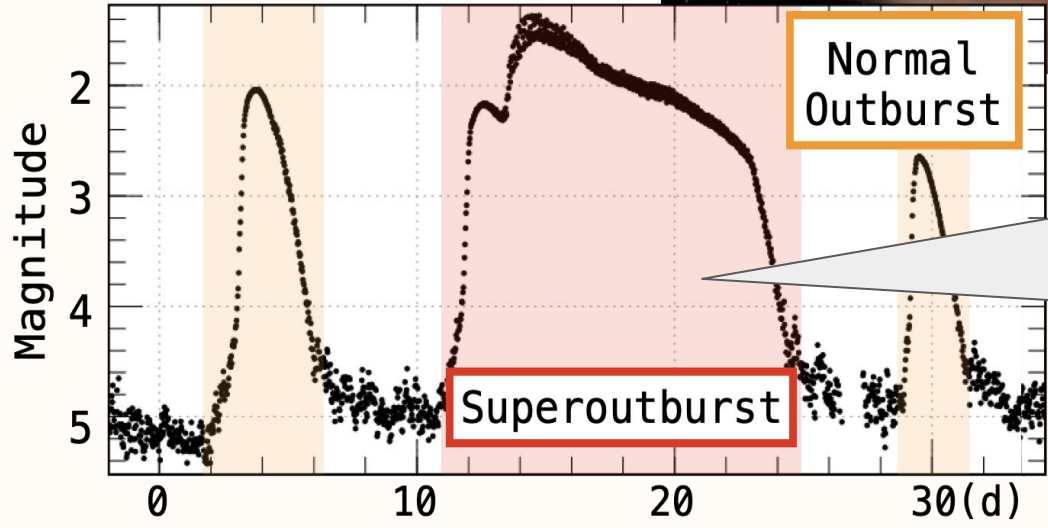
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# Dwarf Novae

Credit: NASA



White dwarf  
 +main sequence star binary  
w/ accretion disk  
 Porb: 80min~10hrs

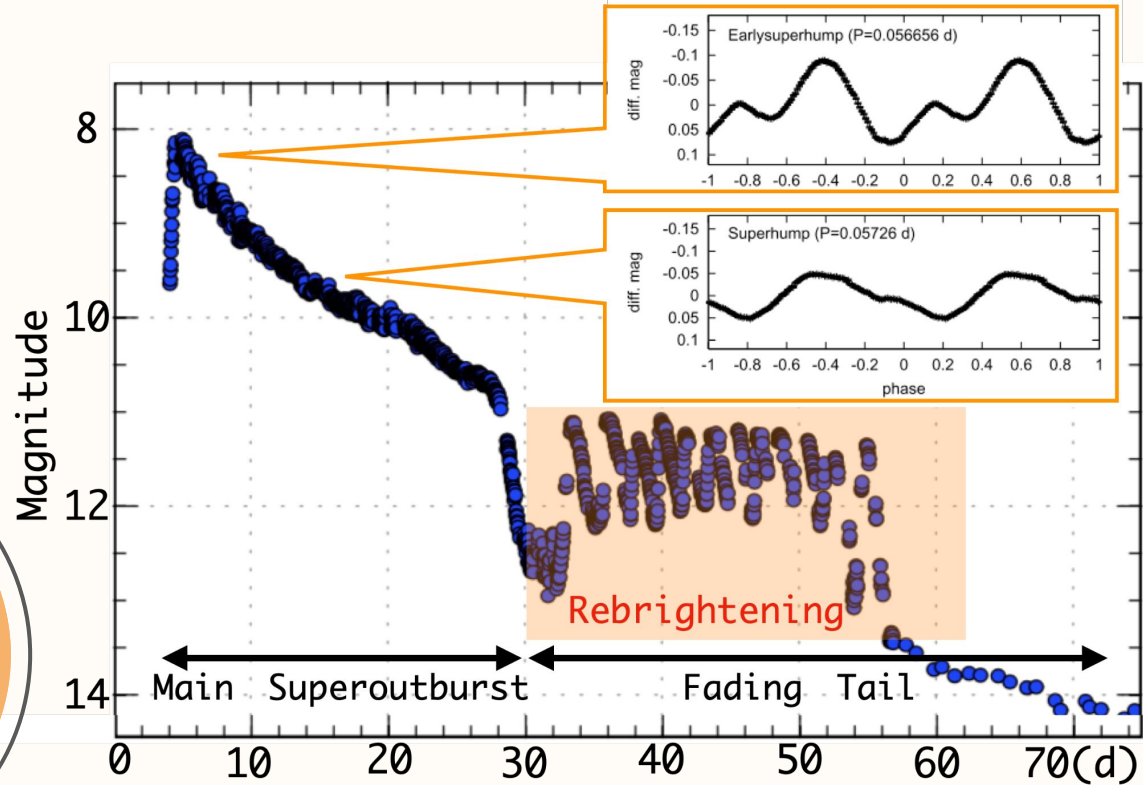
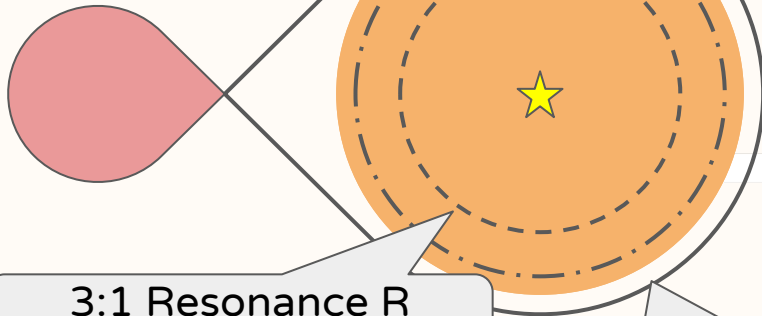


Outbursts triggered by thermal-tidal instabilities in accretion disk  
 Osaki1996  
 Amplitude: 1-9 mag  
 Duration: days~weeks

# WZ Sge-type DNe

- $P_{orb} \sim 80\text{min}$
- mass ratio  $< 0.1$
- only superoutburst
- large amplitude  $> 6\text{ mag}$
- outburst cycle  $> 10\text{ yrs}$

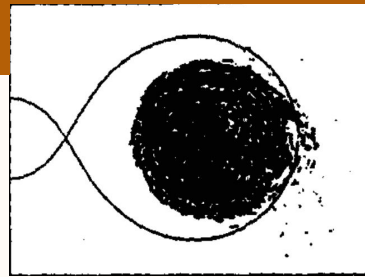
2:1 Resonance  
: early superhump



Ishioka+2002

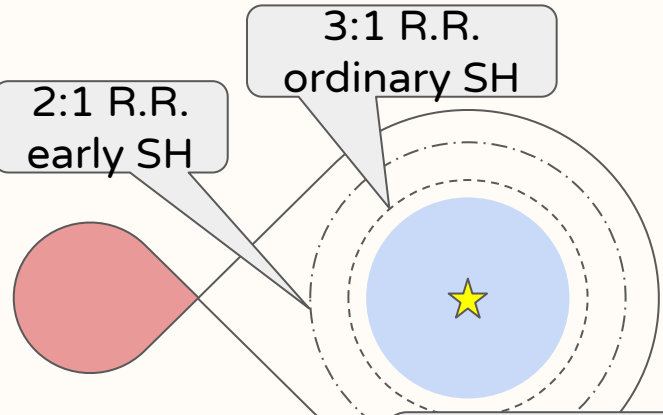
# Superhump evolution

In low mass ratio systems...  
 Disk reaches 3:1 resonance radius  
 → Eccentric disk  
 → Precession of non-axisymmetric disc  
 → (ordinary) superhumps !



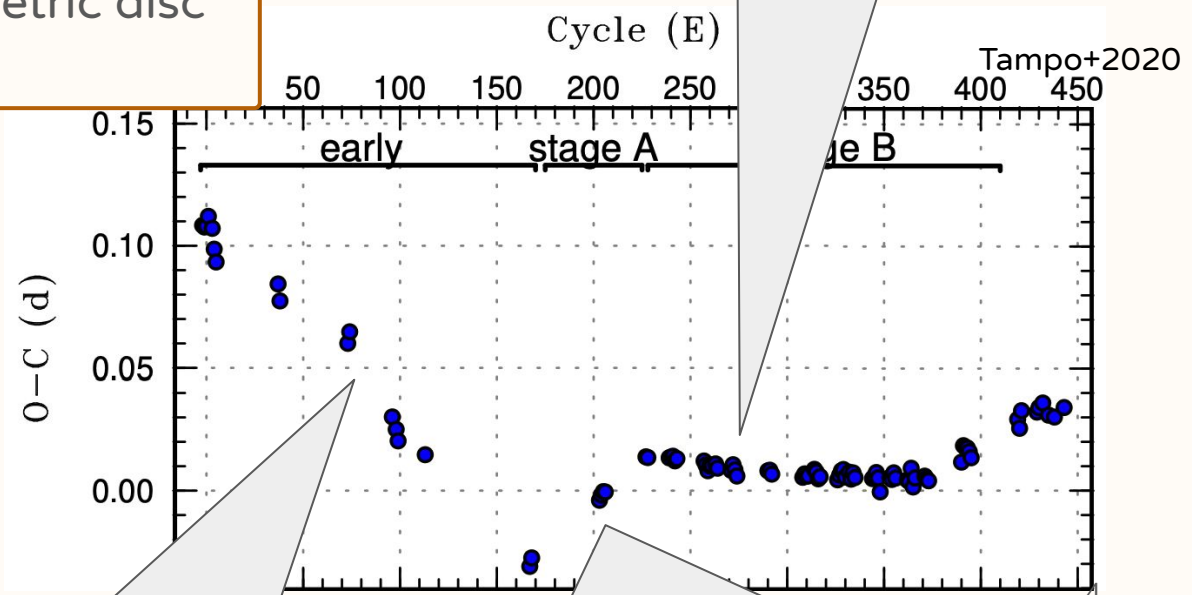
Hirose&Osaki1990

stage B:  
 eccentricity inward to disk  
 shorter SH period



early SH:  
 Before ordinary superhumps  
 equal to orbital period

Stage A :  
 growing SH @ 3:1 resonance radius  
 longer SH period



# Disk structure in Early SH

(Theoretical)

Vertical & asymmetric double arms in outer disk  
 cuz of **2:1 resonance b/w secondary and disk**

Lin&Papaloizou1979

(Observational)

## 1. Doppler Tomography

Time-resolved spectroscopy

→ Velocity-line intensity map

: **non axisymmetric emission** from He II 4686  
 Baba+2002, Kuulkers+2002

## 2. Early Superhump mapping

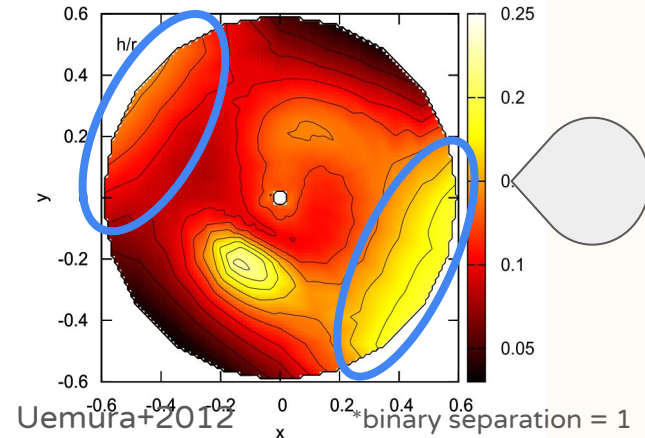
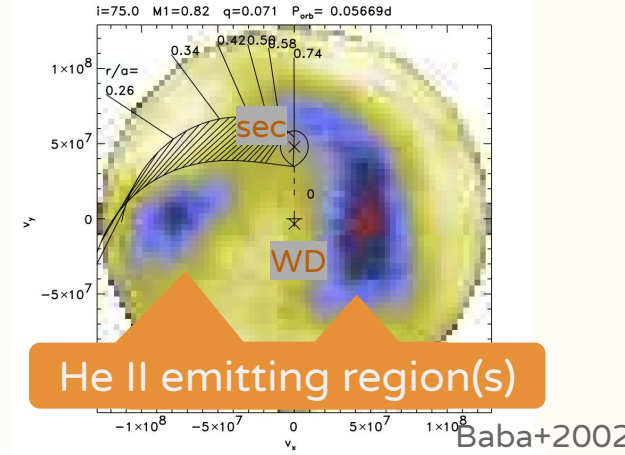
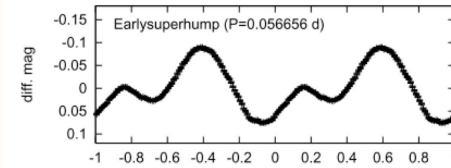
Multi-color photometry in Optical + IR

→ disk height map assuming self-occultation

: **two vertically-extended arms** in outer disk  
 Uemura+2012, Nakagawa+2013, Tampo+2022b

⇒ **Double spiral structure in disk during early SHs**

: **Diversity? Needs high observation cost...**



# Disk wind in V455 And?

In Doppler map of He II 4686... Honeycutt+1986  
Matthews+2015  
Tampo+2022a

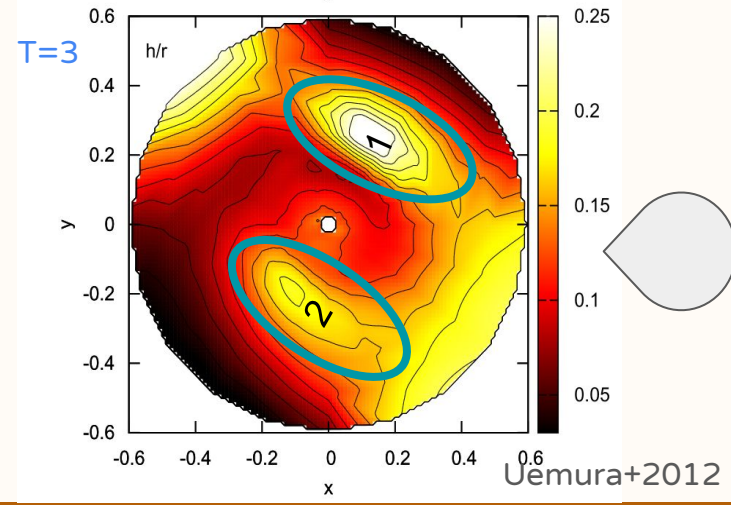
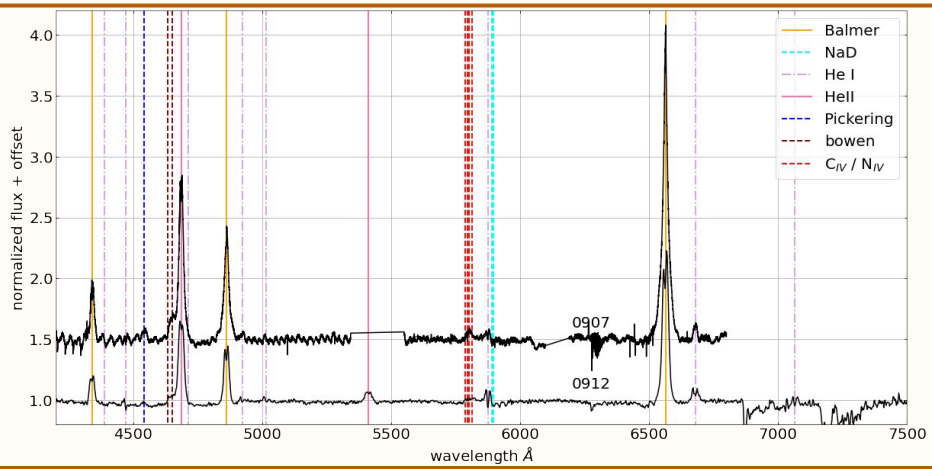
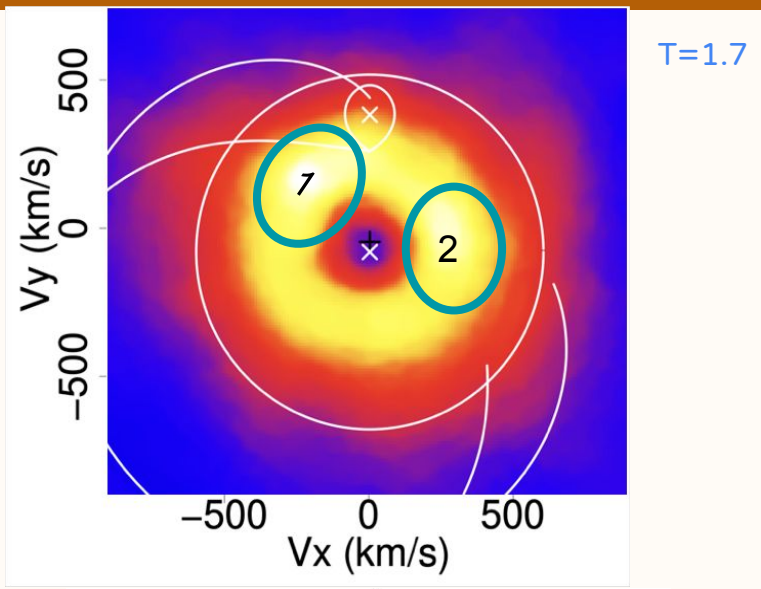
Ring-like structure w/  $\sim 200$  km/s

→  $R \sim 2 \times$  binary separation @ Kepler disk

→ NOT from disk but can be WIND?  
(Analogy w/ SW Sex-type CVs...)

2 superimposed flaring spots in Dop map  
: corresponding inner arm structure

⇒ Non-axisymmetric wind launch?



# Superhumps & O-C

## Early superhumps

- 0.05986(1) d & 0.03 mag
- ~ 400 cycles

## Stage A superhumps

- 0.06131(2) d
- ~ 100 cycles

## Stage B superhumps

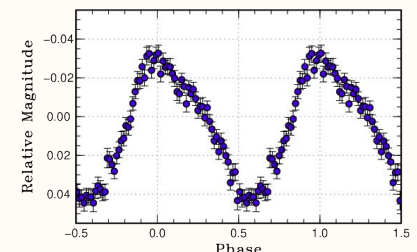
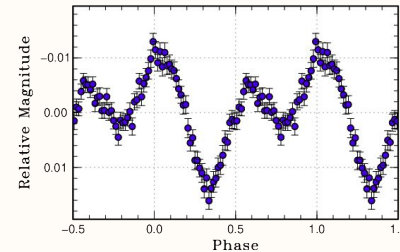
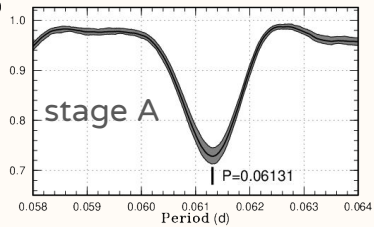
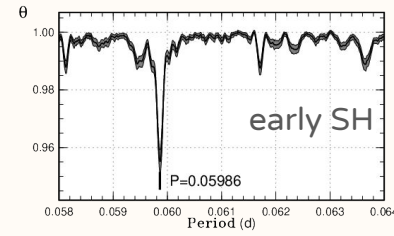
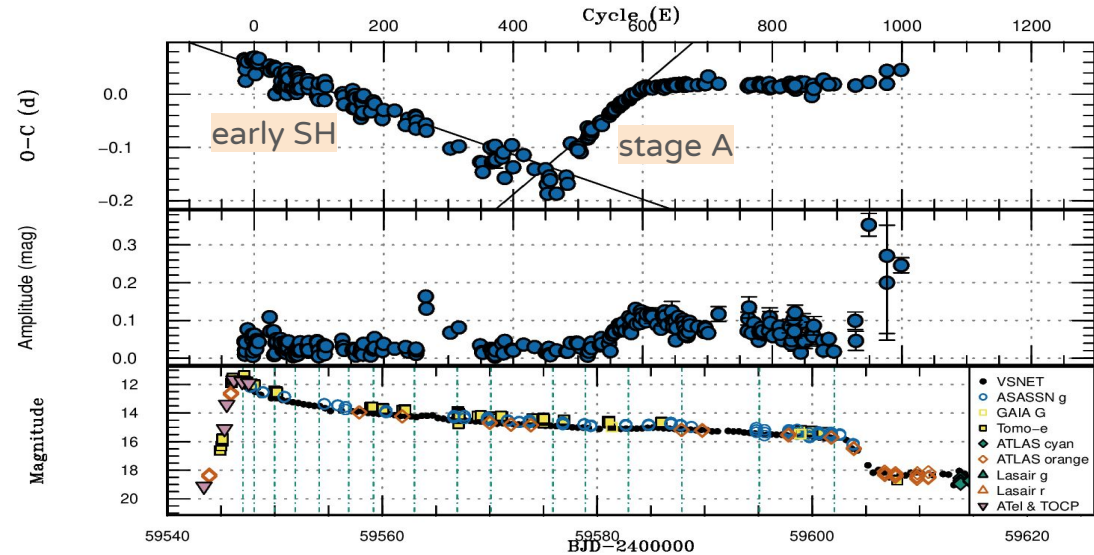
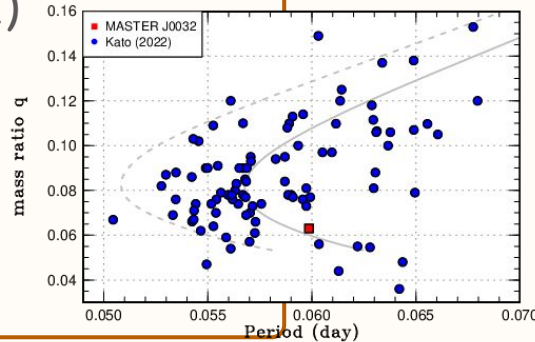
- 0.060286(6) d
- $\text{Pdot} \cdot 10^5 \sim -1.2(4)$

mass ratio = 0.063(1)

: period bounce

: standard evolution

consistent w/  
long stage A  
& low Pdot



# Early spectroscopy

Strong single-peak emission at peak

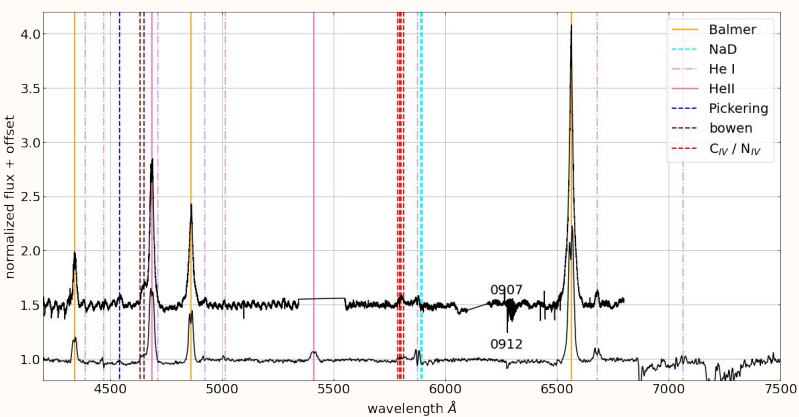
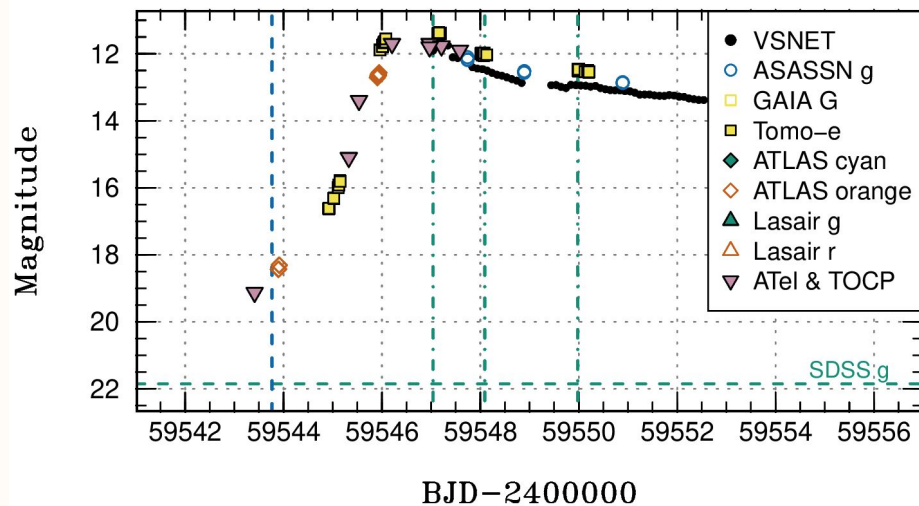
: Balmer, He II, Bowen, C IV / N IV

: He II 4686 > H $\beta$

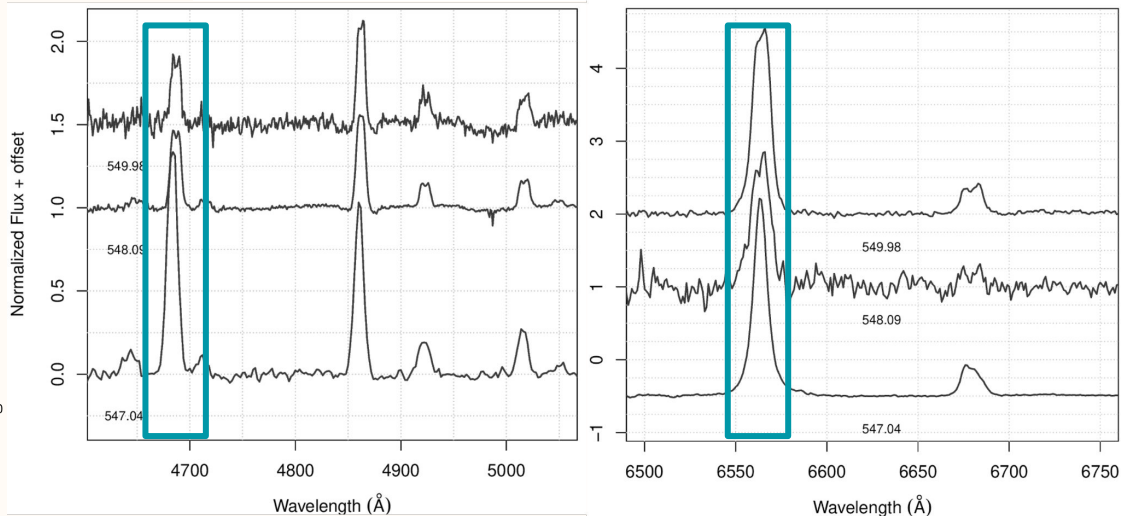
→ turn to normal DN spec one day after

⇒ analog of V455 And? only in peak?

(In V455 And, lasted for a few days)



c.f., V455 And, Tampo+2022a





# Summary

- We observed WZ Sge-type DN MASTER OT J030227.28+191754.5
- 10-mag amplitude and 60-days duration is tremendous in DNe
- According to orbital period and mass ratio,  
MASTER J0302 follows standard evolution of CVs
- Early SH mapping showed spiral arm structure in the disk
- Spectra at peak showed strong emissions from H $\alpha$  and He II
- Narrow line profiles indicates the disk wind as well as V455 And ?