京都大学 3.8m せいめい望遠鏡による矮新星アウトバーストの初期分光観測

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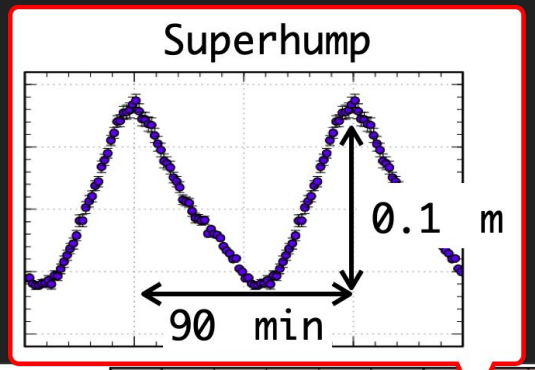
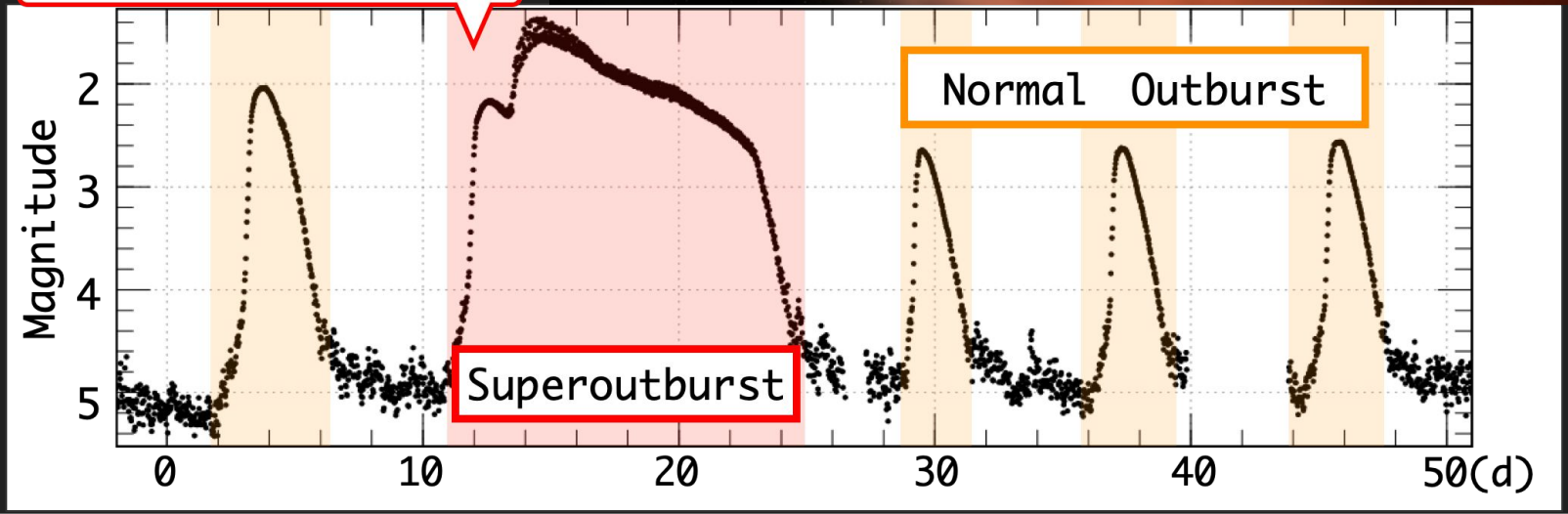
Dwarf Novae





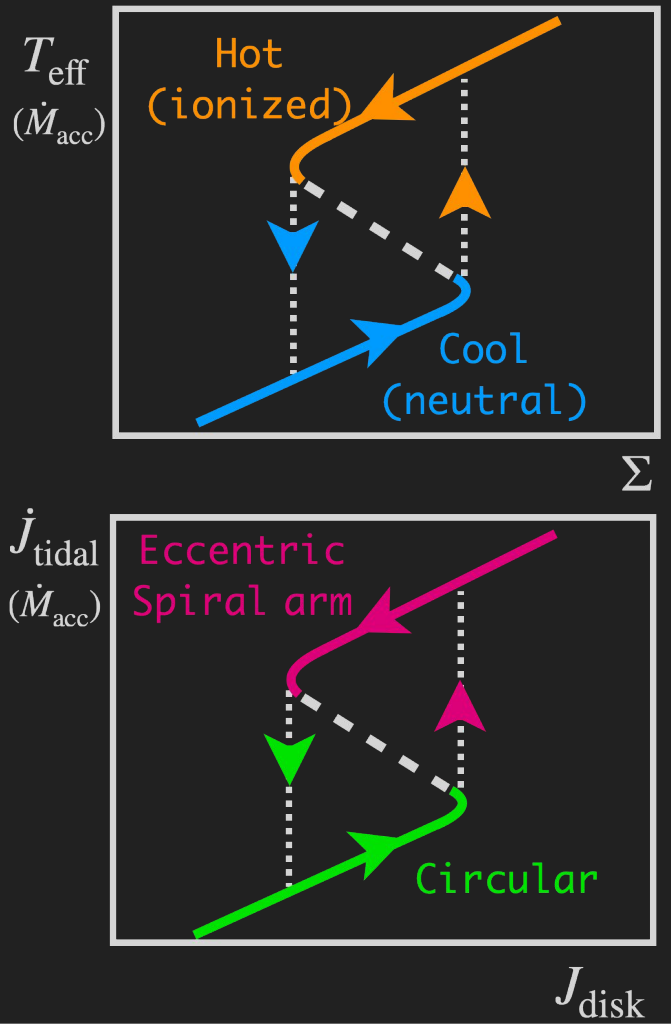
連星変光星研究会2020, 31st Jan., せいめい望遠鏡での矮新星アウトバースト分光観測

Outburst Mechanism

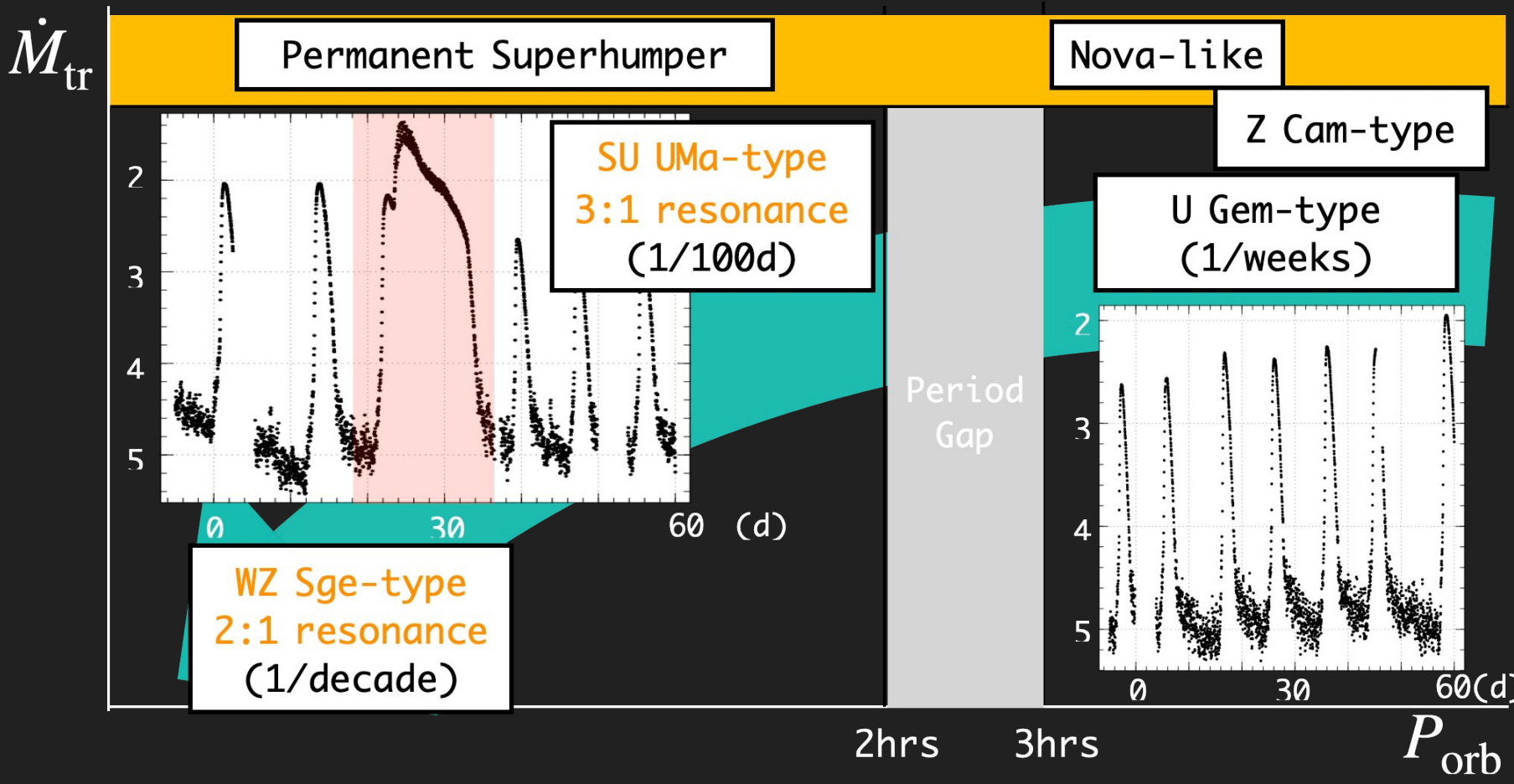
- Normal Outburst (Osaki 1974 etc.)
  : Thermal instability by ionization
- Superoutburst (Osaki 1989,2002)
  : Thermal - Tidal instability

  @ 3:1 resonance radius (q<0.25)
  → eccentric disk & superhump
  (Psh ~ few% longer t/ Porb)

  @ 2:1 resonance radius (q<0.1)
  → spiral arm & early superhump
  (Pesh ~ Porb, ampl. ~incl.)



Classification of Dwarf Novae



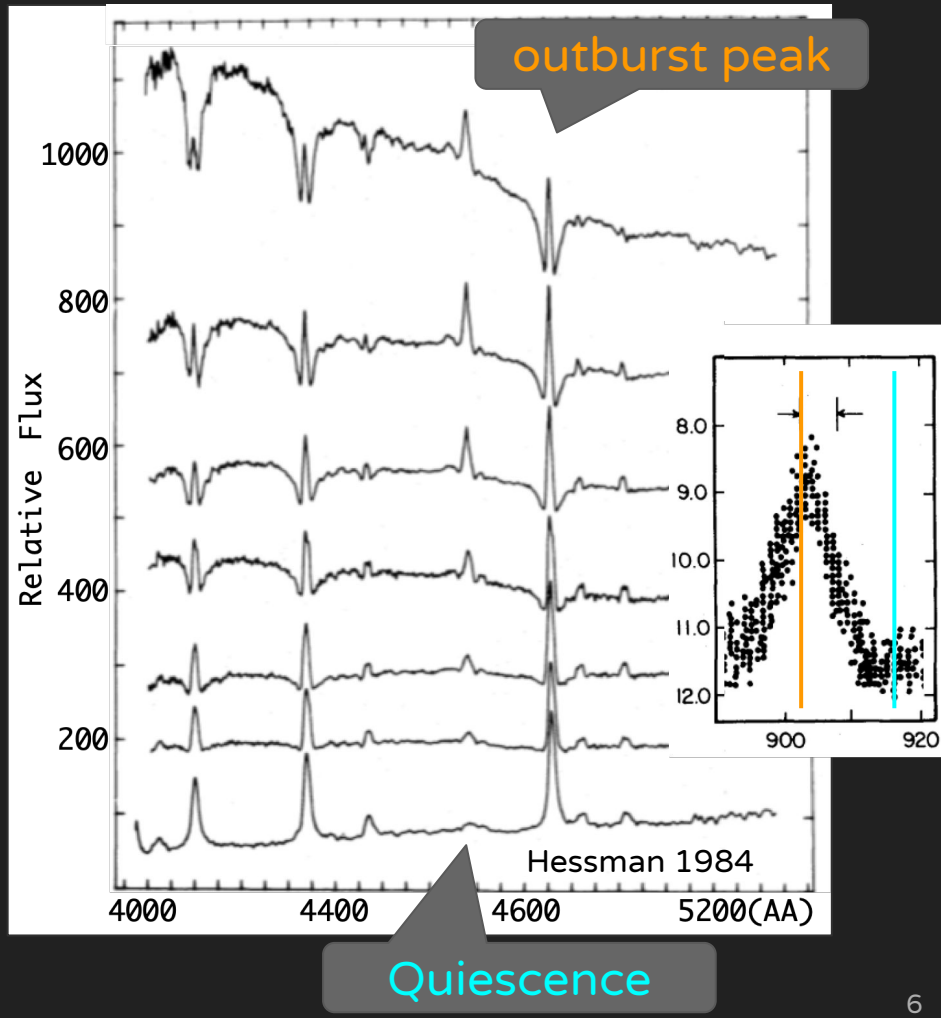
Spectra of Dwarf Novae

Multi-component spectra
- WD (X-ray ~ UV)
- accretion disk (UV ~ optical)
- secondary (optical ~ IR)

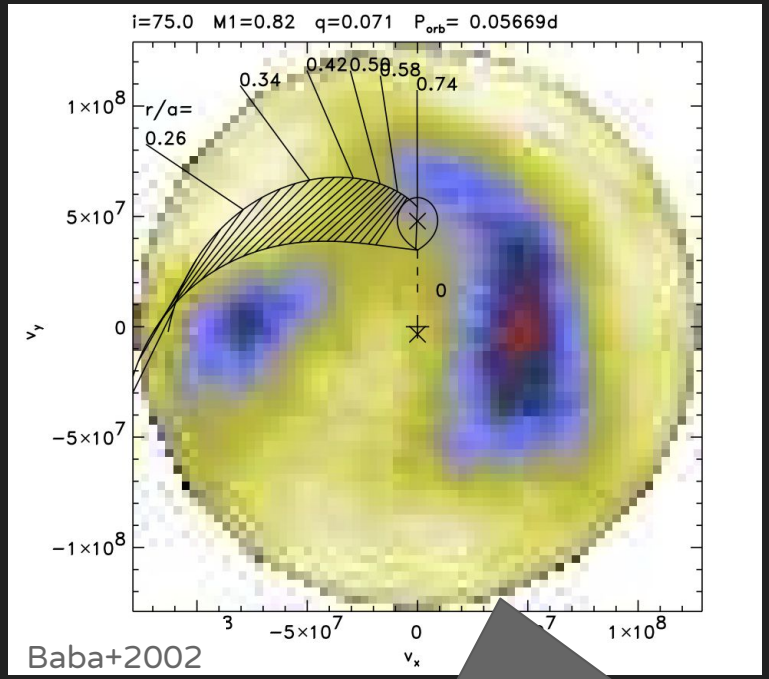
Quiescence
- broad emission lines
- small & optically thin disk

Outburst
- narrower absorption line
- extended, hot & optically thick disk
- stronger emission in higher inclination

Stronger He II 4686Å in superoutburst?
in Z Cha (Honey+1984)



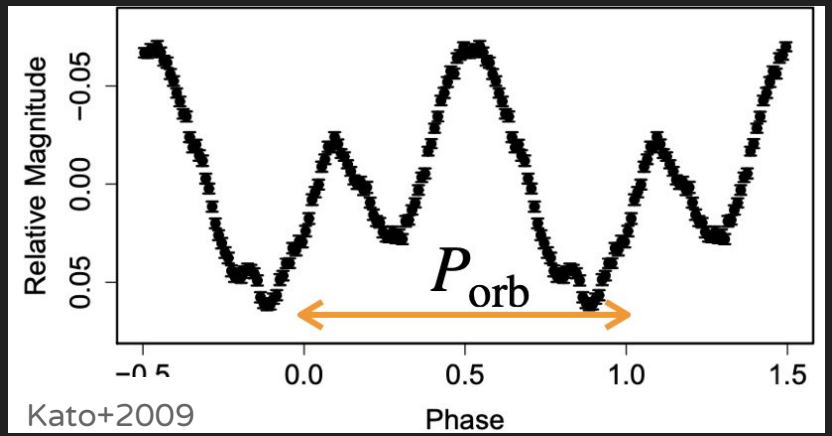
He II 4686Å Emission & Early Superhump



He II 4686Å doppler tomography
***disk inside(faster) is outside in figure

He II 4686Å emission mapping
→ Spiral structure just after the maxima
(Baba+2002, Kuulkers+2002)

Early superhumps
→ observed in first days of WZ Sge-type
→ double peak, period ~ Porb



DN spectroscopy by 3.8 m telescope Seimei

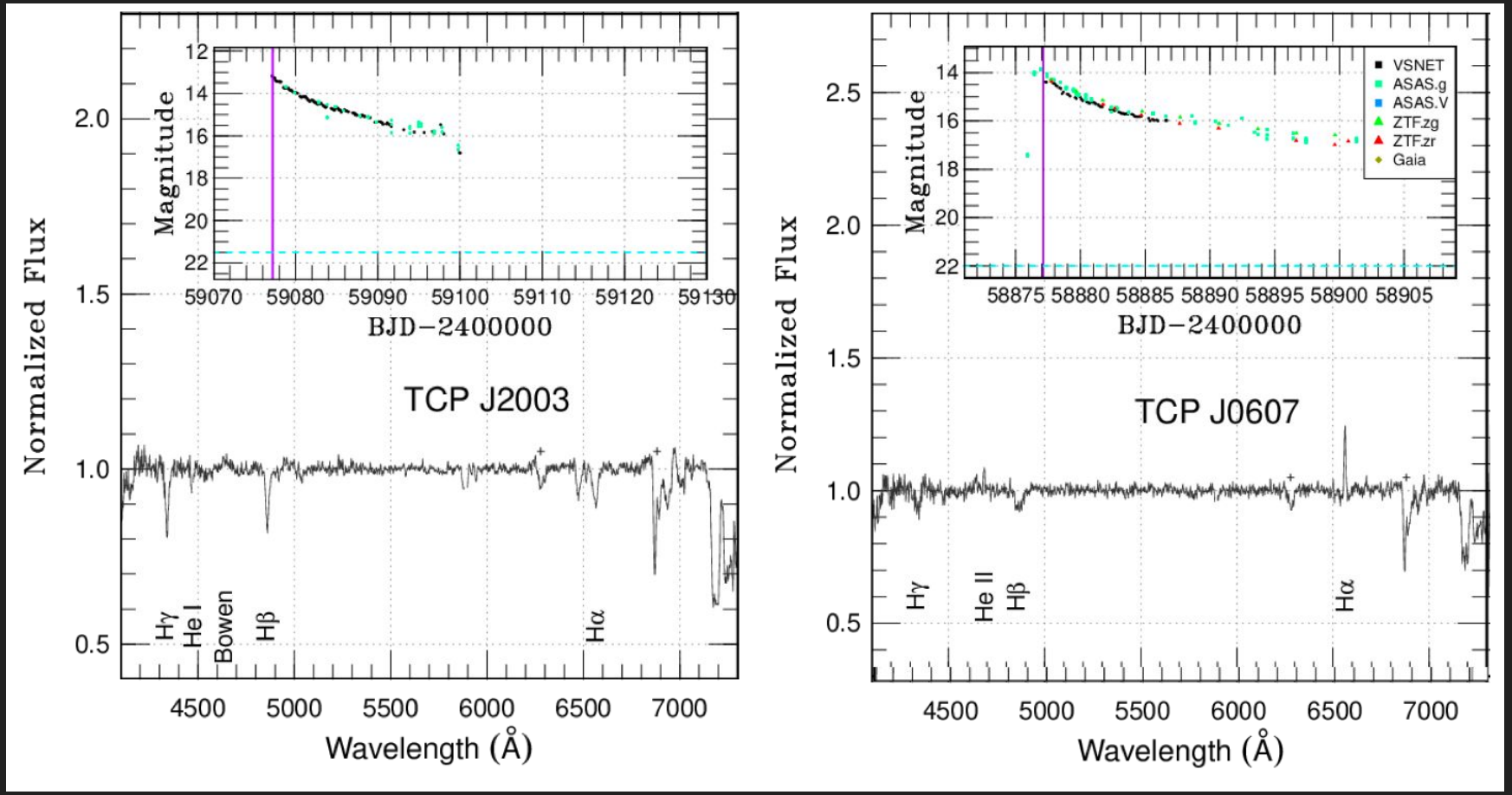
Observations

Seimei : 3.8 m segment mirror telescope @Okayama
KOOLS-IFU : fiber-fed integral field unit spectrograph
VPH-blue : 4200 - 8000 Å, R ~ 500

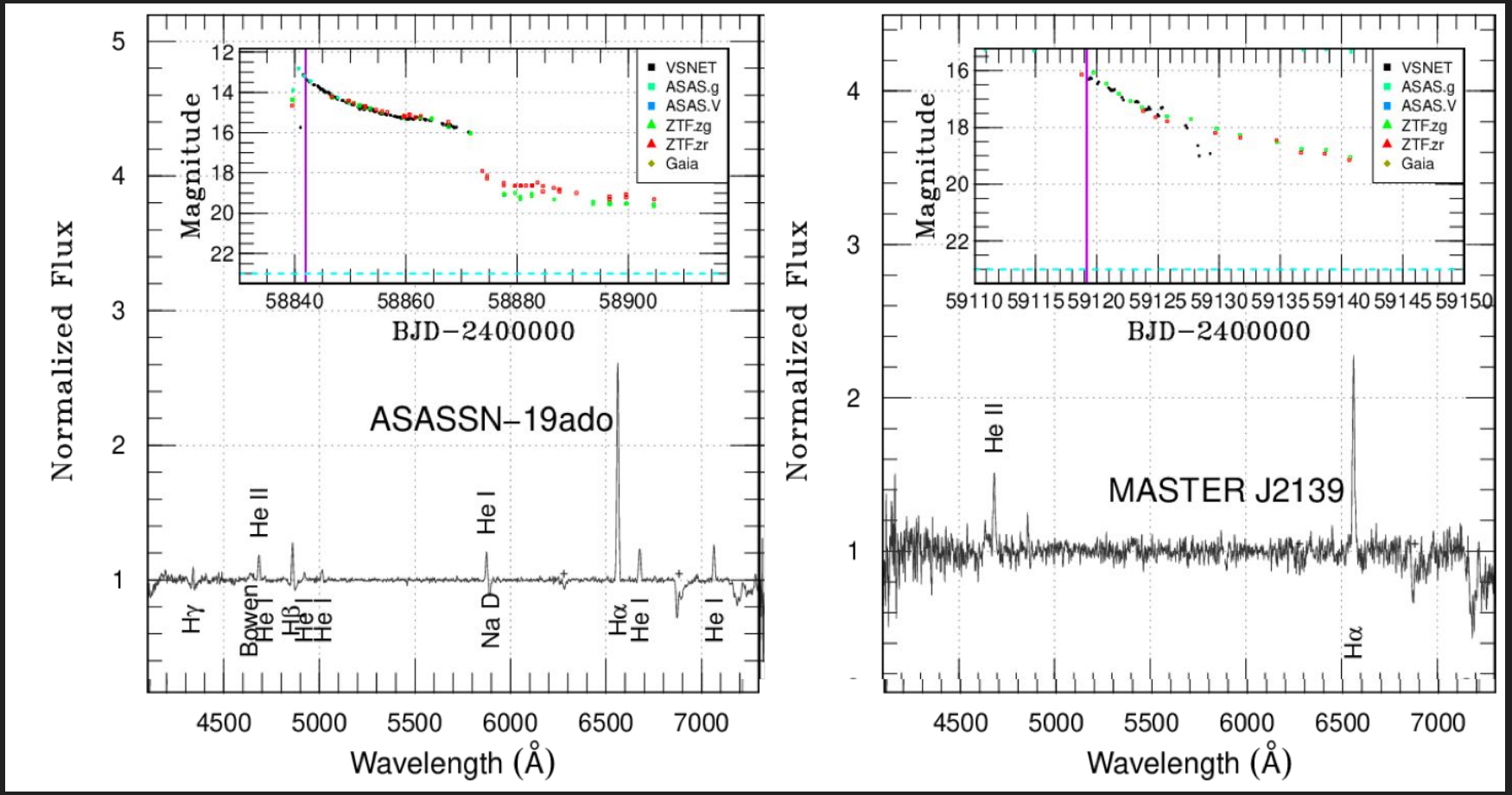
Statistics

✔ 17 dwarf nova outbursts observed (10 ATel)
✔ 11 WZ Sge-type DNe + 6 SU UMa-type DNe
✔ 11 newly discovered systems
✔ 6 objects less than 1 d from the peaks

Our Samples I: Early Spectroscopy



Our Samples II: He II 4686Å Emission



Discussion I. He II 4686Å Emission

This research
Kato+2015

		He II 4686Å Strength			
		nan	<0.3	>0.3	observed
early superhump amplitude (mag)	nan (low incl.)	A20kv	GW Lib		
	<0.03	EQ Lyn TCP J0059 TCP J2003	A19ado V592 Her		A14cl PNV J1729
	>0.03 (high incl.)		TCP J0607	MSTR J2139 WZ Sge V455 And	CRTS J0902 OT J1112 V572 And

Discussion II. Balmer Line (< 1 d from peak)

Kato+2015

	early SH amp. (~incl.)	Hα	Hβ	Hγ	reference
GW Lib	-----	emi+abs	abs	abs	Hiroi+2009
ASASSN-20kv	-----	abs	abs	abs	this research
ASASSN-14cl	0.02	abs	abs	abs	Teyssier2014
TCP J0059	0.02	abs	abs	abs	this research
TCP J2003	0.02	abs	abs	abs	this research
TCP J0607	0.05	emi	abs	abs	this research
WZ Sge	0.14	emi	abs	abs	Nogami&Iijima2004
MASTER J2139	0.15	emi	-	-	this research
V455 And	0.22	emi	emi	emi	Nogami+2009
CRTS J0902	0.35	emi	emi	emi	Djorgovski+2008

Summary & Future Work

✔️ 17 dwarf nova outbursts observed

✔️ 11 WZ Sge-type DNe + 6 SU UMa-type DNe

✔️ 11 newly discovered systems

✔️ 6 objects less than 1 d from the peaks

✔️ He II 4686Å strength ~ early superhump amplitude

✔️ early SH amplitude ~ inclination ~ Balmer emission/absorption

👀 Evolution of spectra across superoutbursts (based on stages)