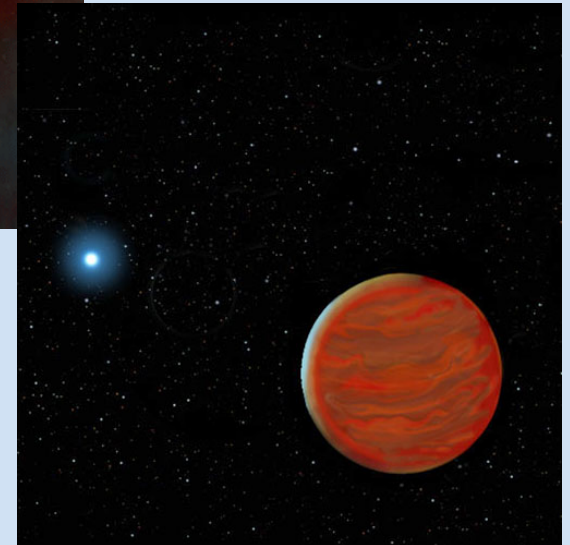
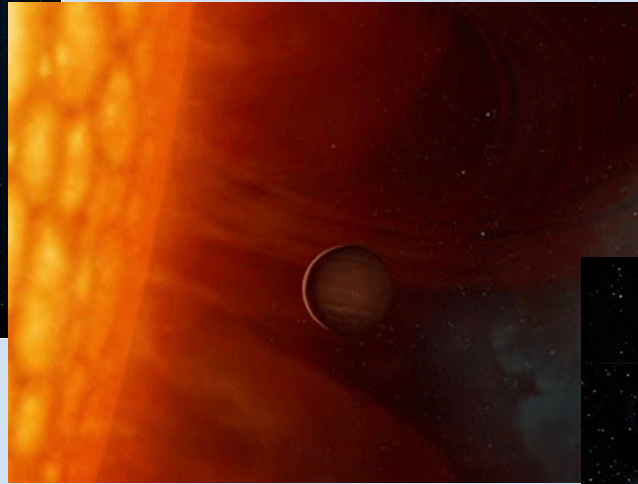
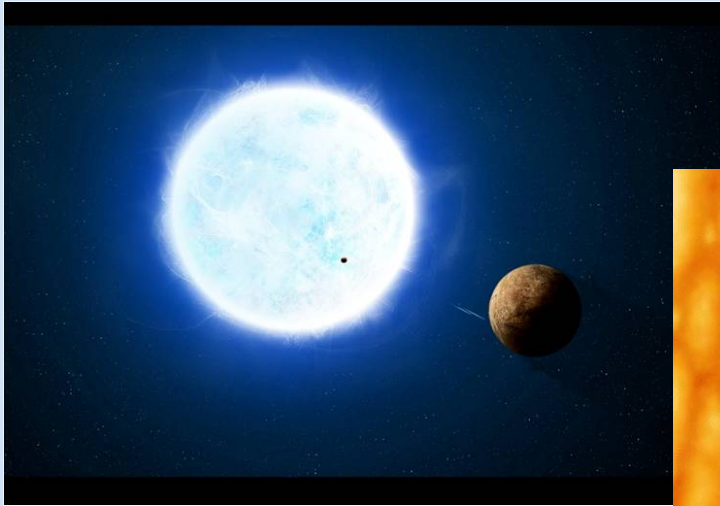


Observations of irradiated brown dwarfs

S.L. Casewell, M. Marley, J. Fortney, K.A. Lawrie,
P. Maxted, M.R. Burleigh, P. Rimmer, J. Barstow, P.
Steele

Evolution





Systems

GD1400

WD+L6

$0.67M_{\text{sun}} + 60 M_{\text{Jup}}$

$P=9.98$ hours

WD $T_{\text{eff}}=11000\text{K}$

WD0137-349

WD+L6-L8

$0.4M_{\text{sun}} + 53 M_{\text{Jup}}$

$P=116$ Min

WD $T_{\text{eff}}= 16500 \text{ K}$

NLTT5306

WD+L4-L7

$0.44M_{\text{sun}} + 56$

M_{jup}

$P=101.88$ min

WD $T_{\text{eff}}=7756 \text{ K}$

WD0837+185

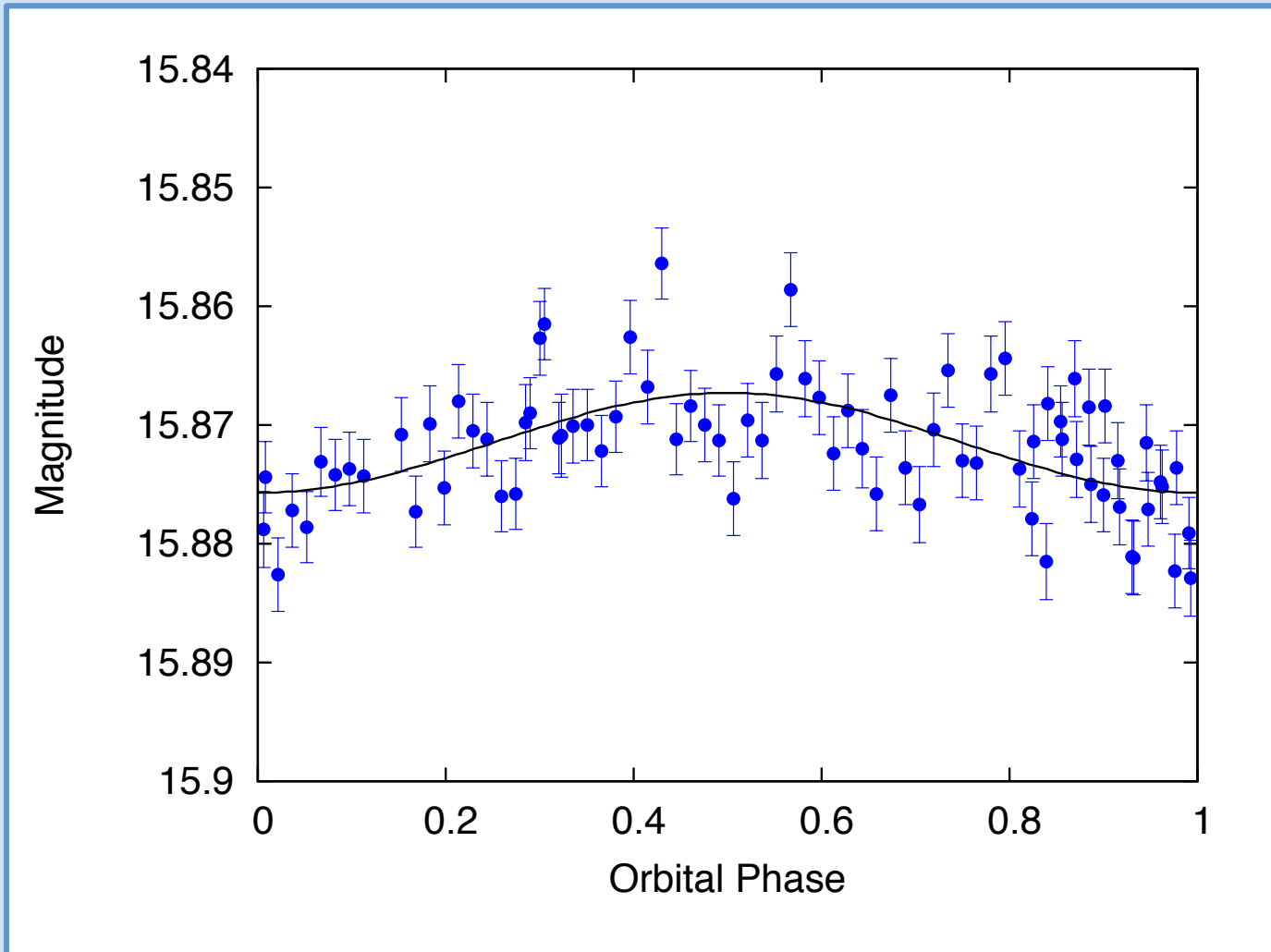
WD+>T8

$0.8M_{\text{sun}} + \sim 30M_{\text{Jup}}$

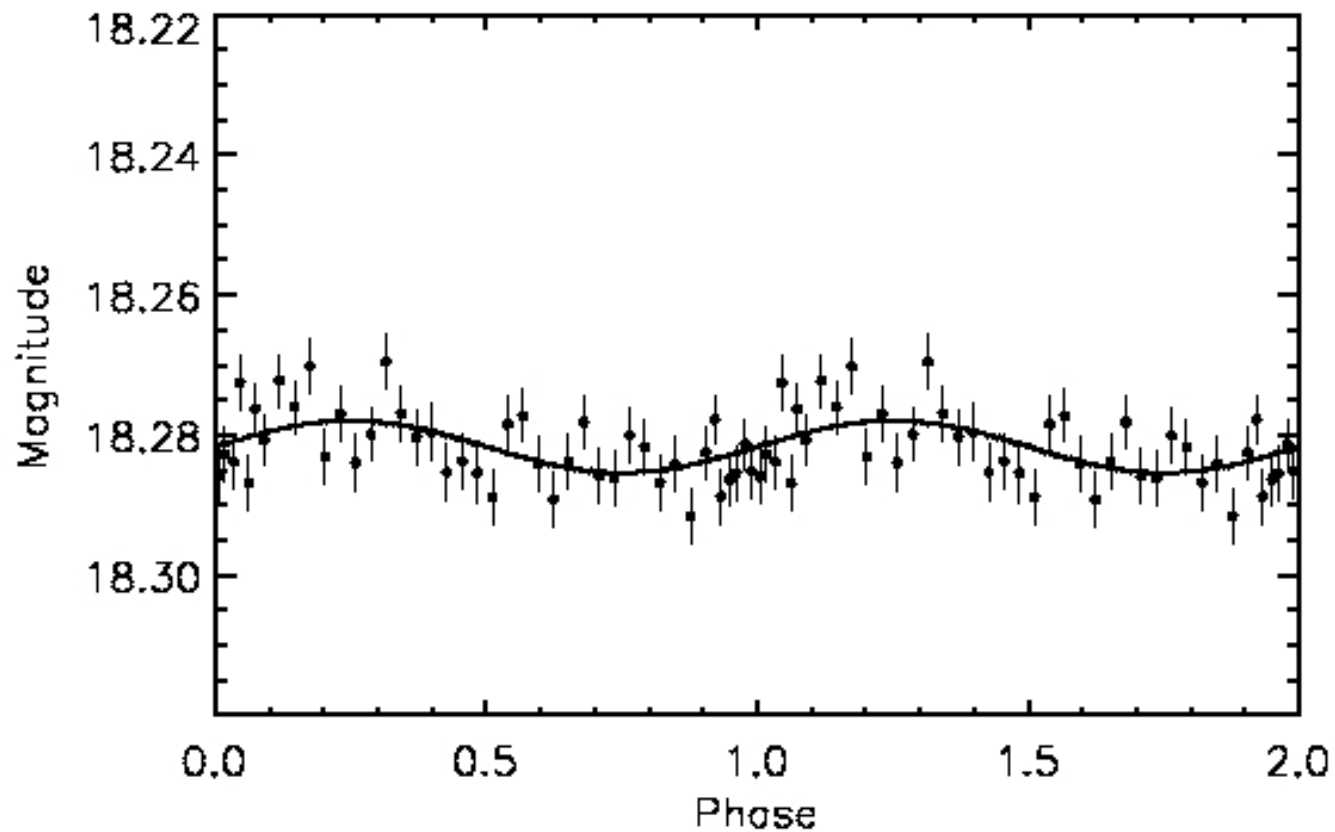
$P=4.2$ hours

WD $T_{\text{eff}}= 15000 \text{ K}$

Heating? NLTT5306

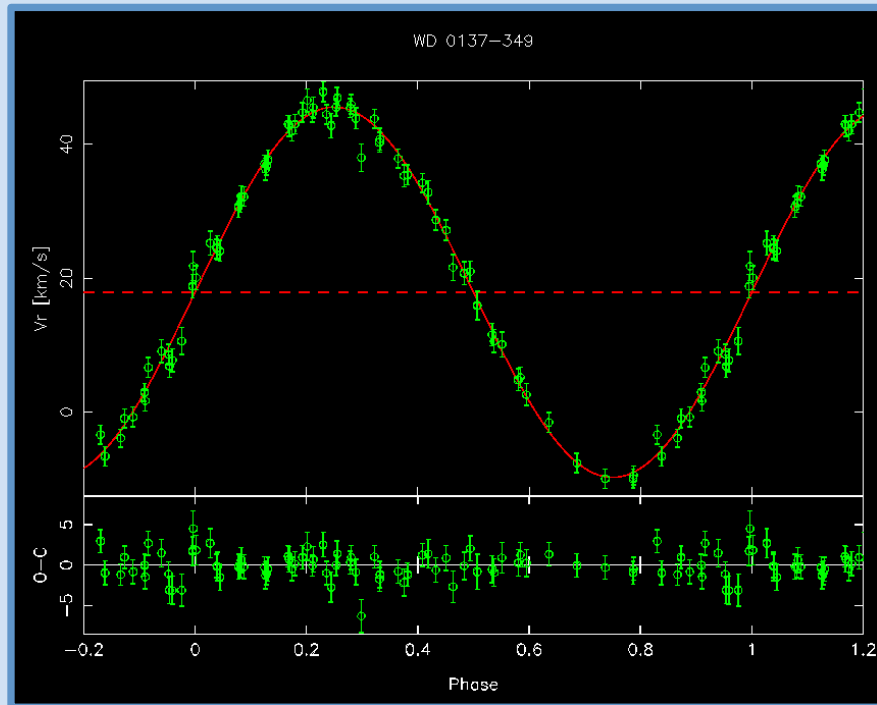


Heating? WD0837

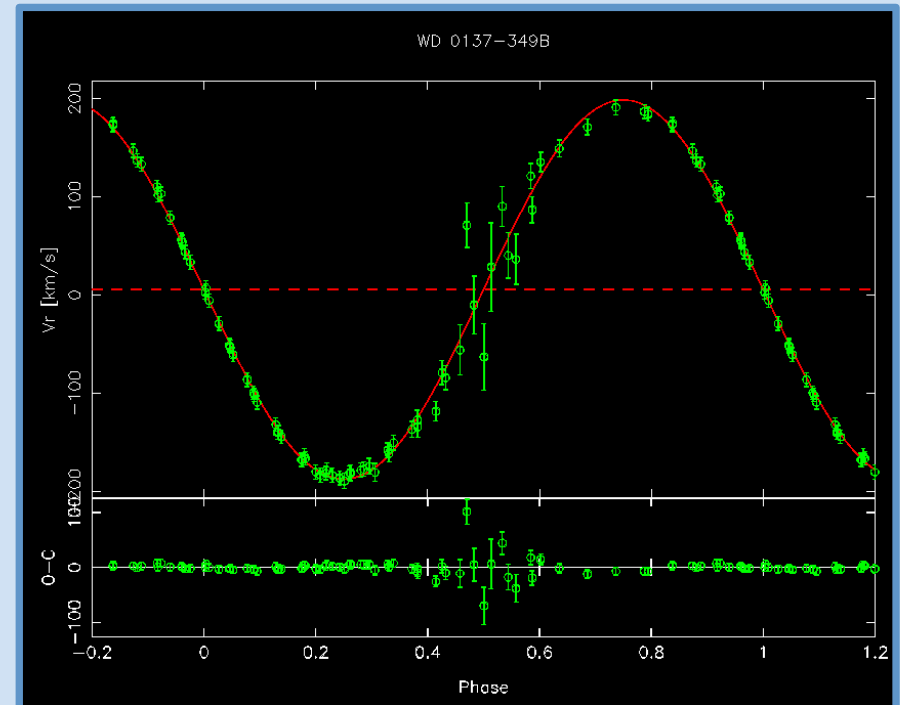


WD0137-349

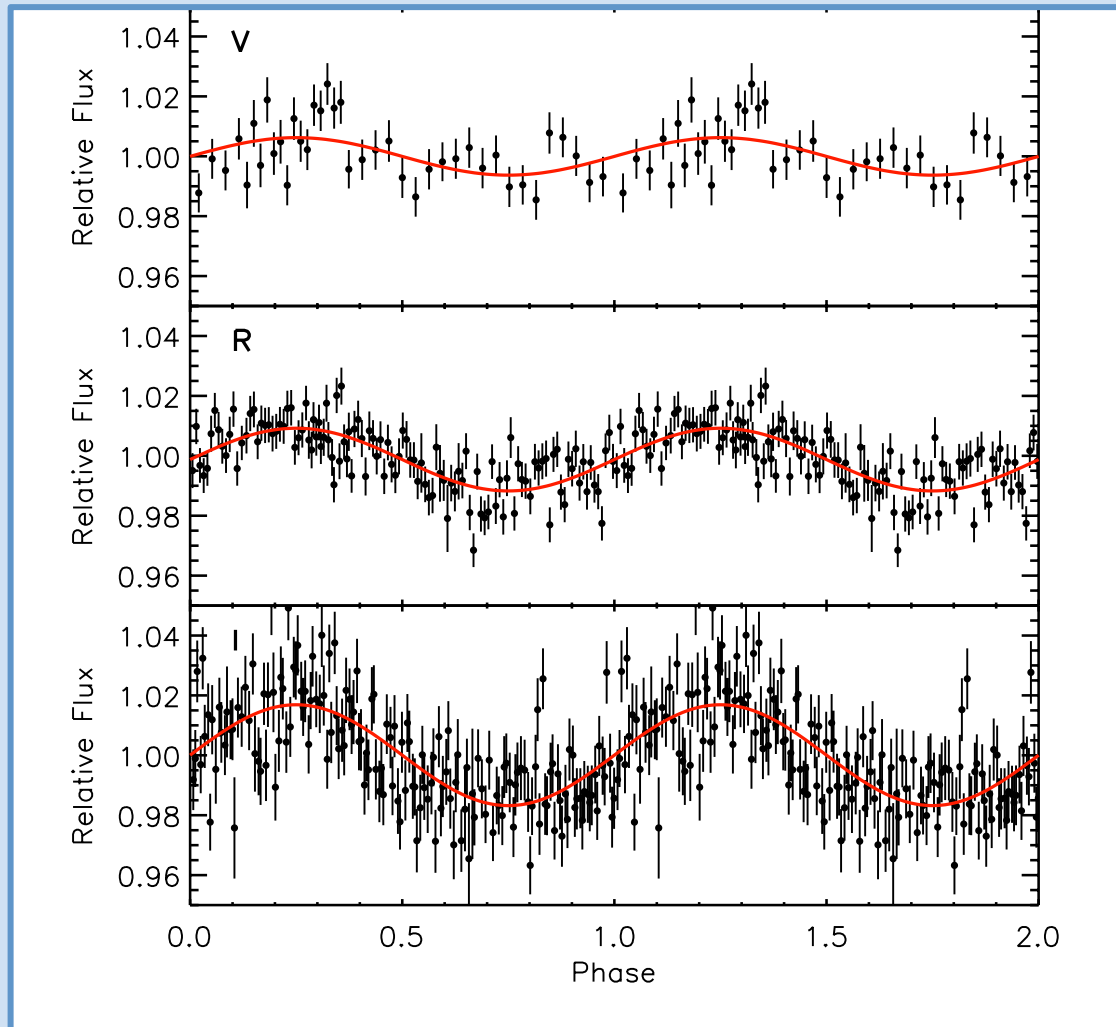
WD H Absorption lines



BD H emission feature

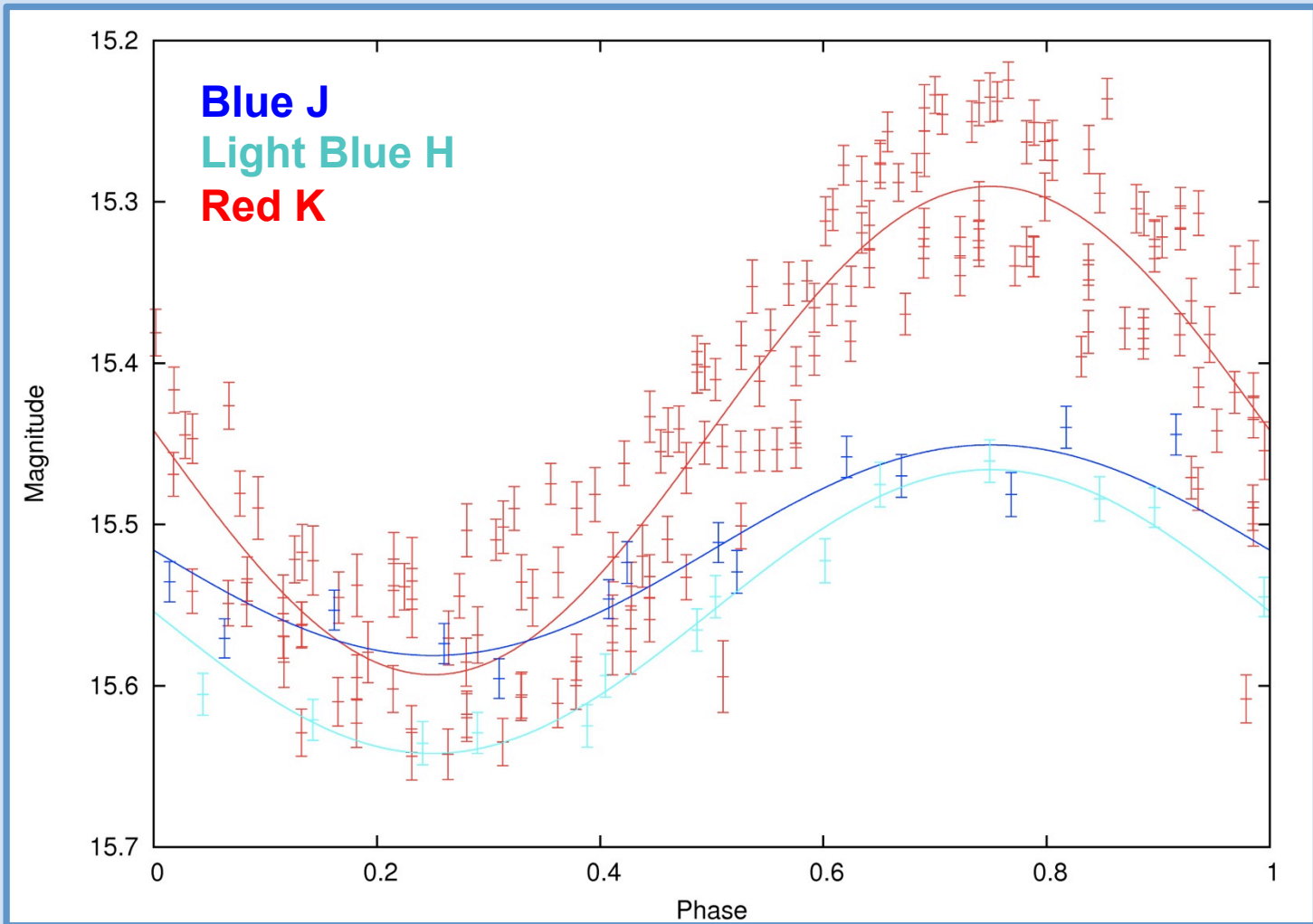


Heating?



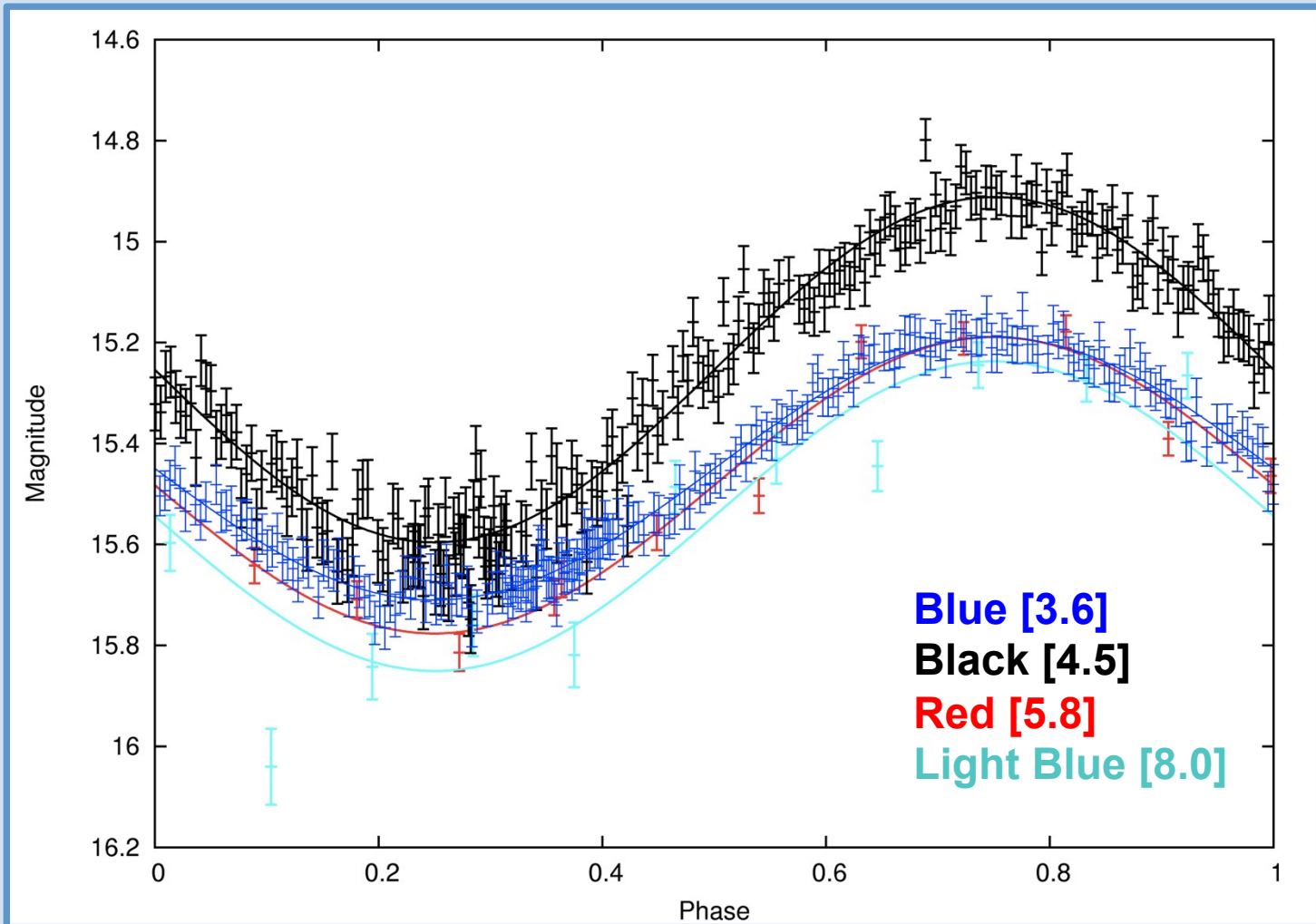


Irradiation



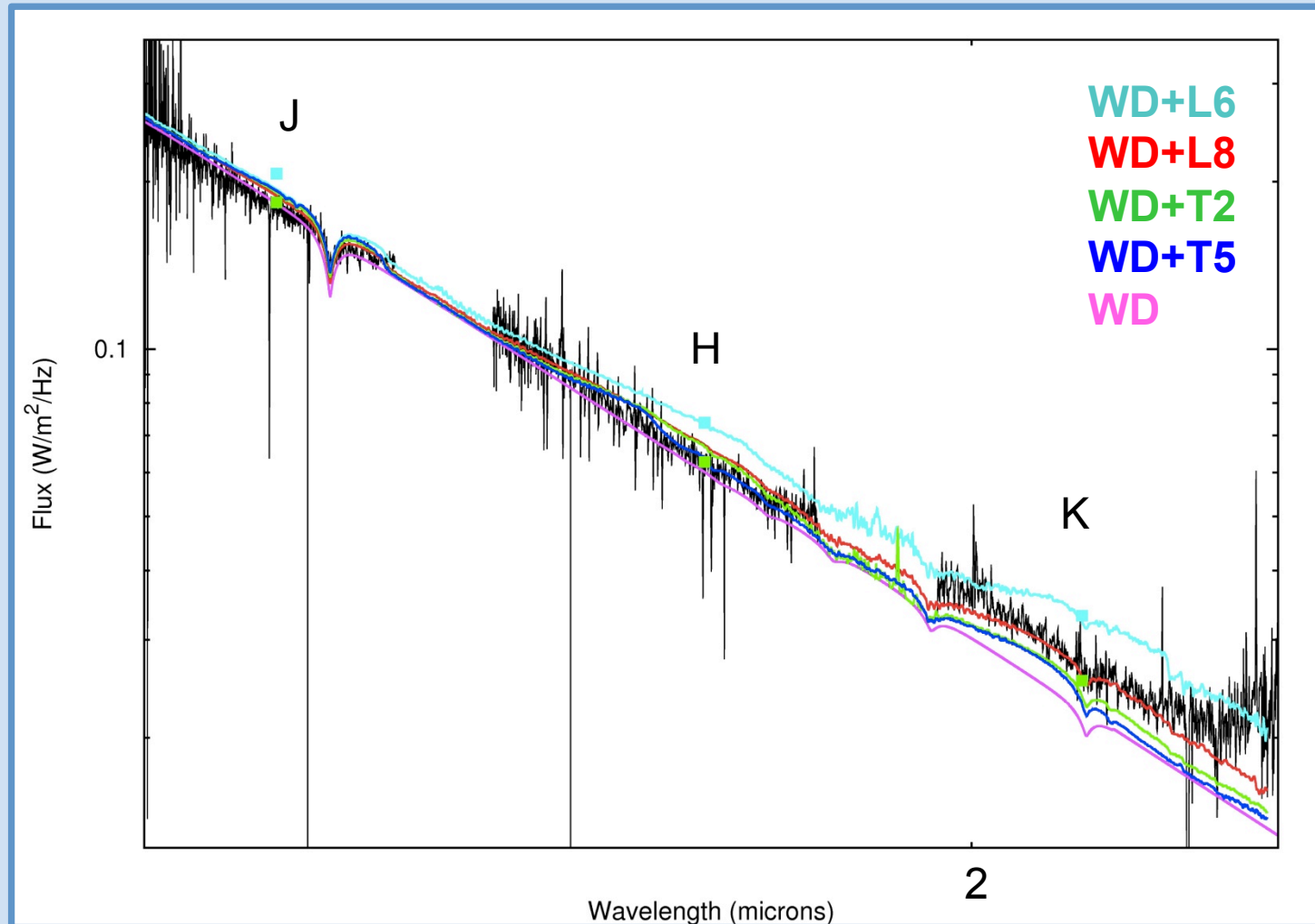


Irradiation

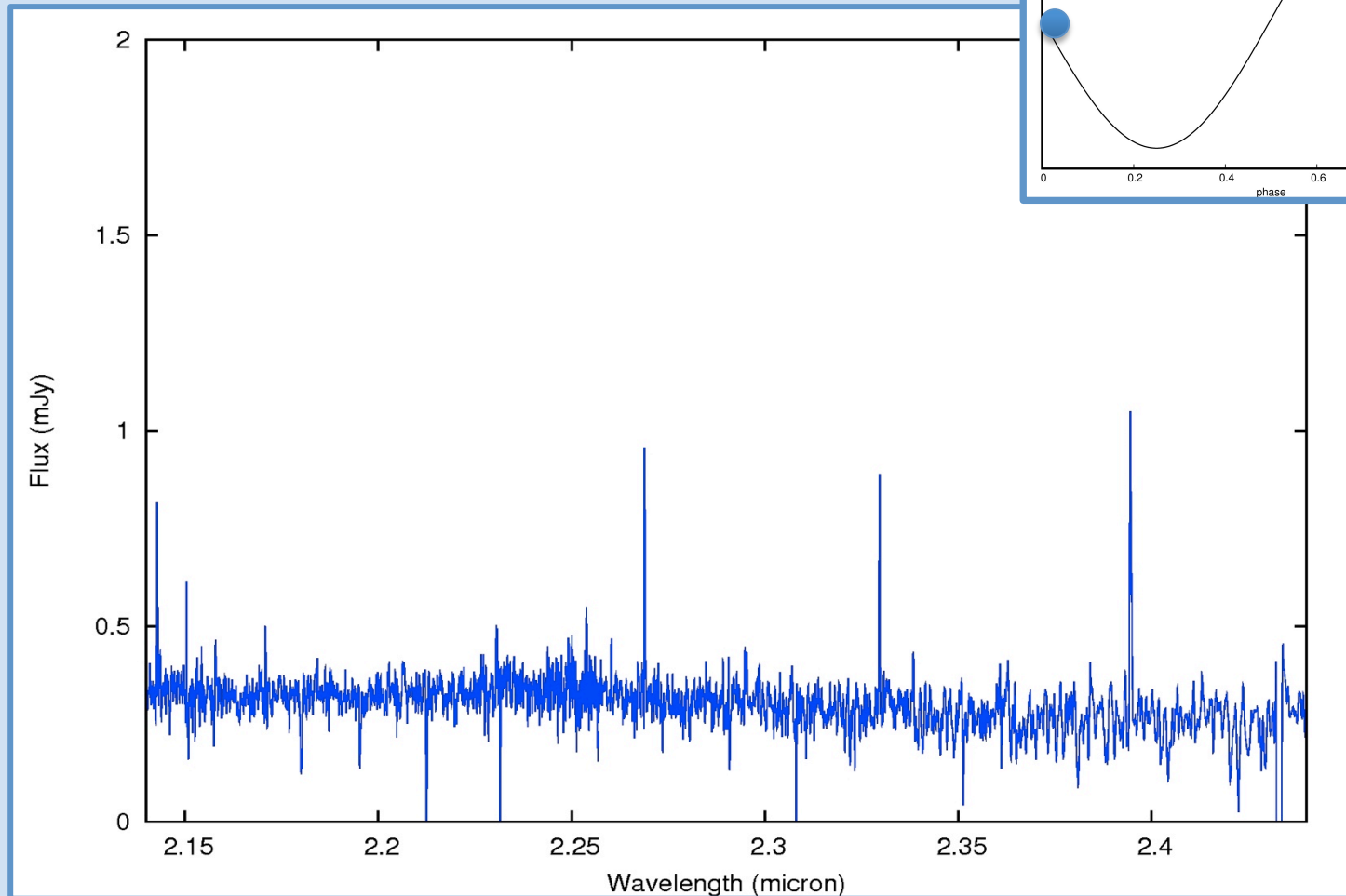




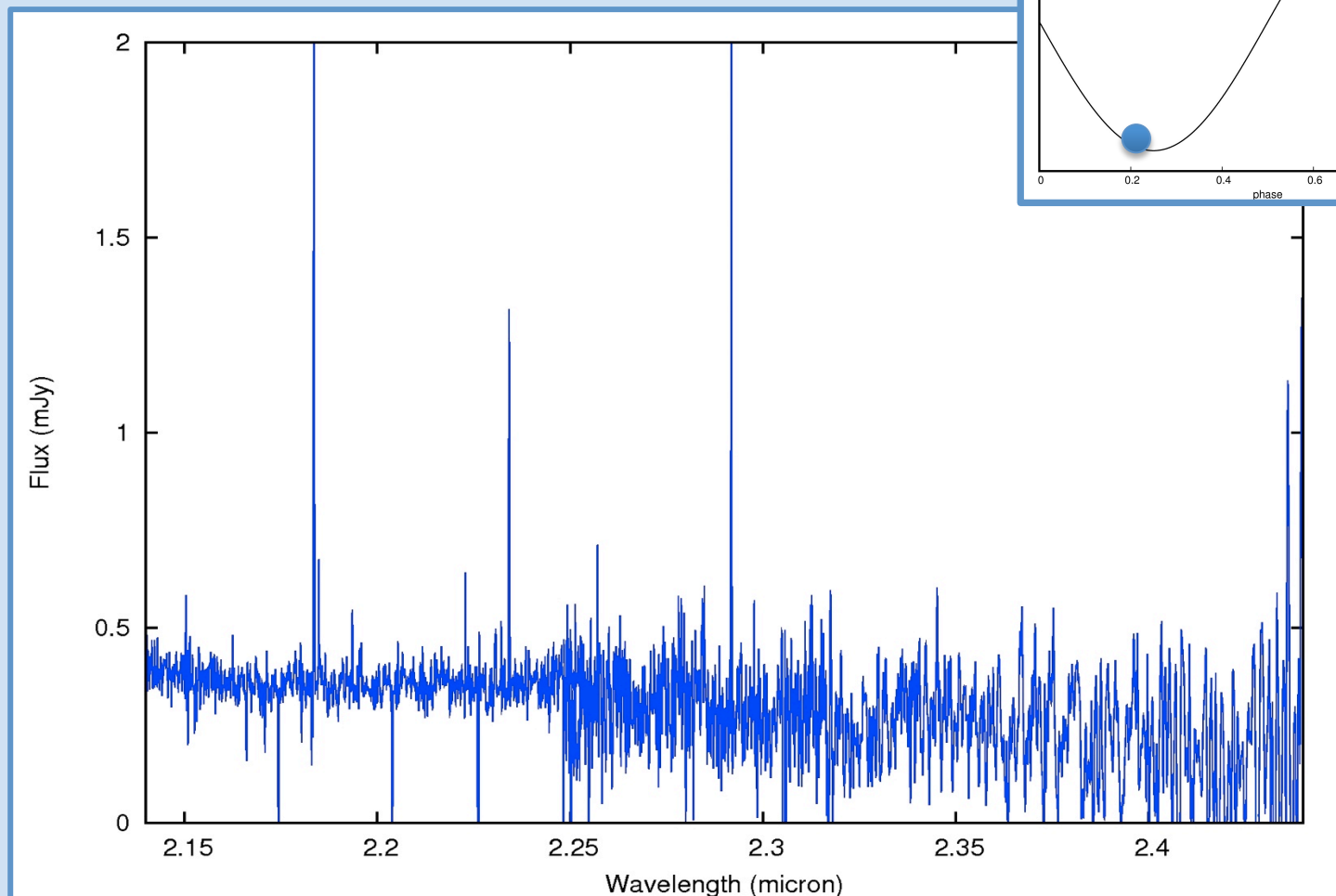
GNIRS spectrum



Orbit phase 0.05

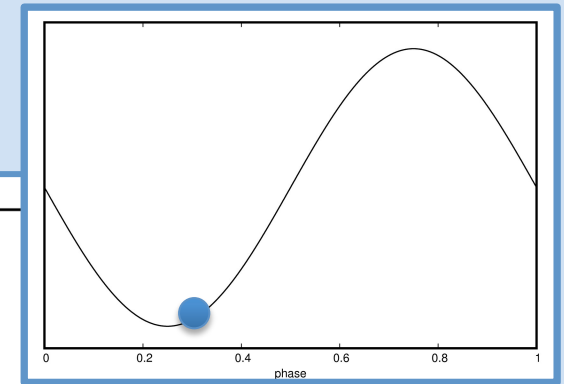
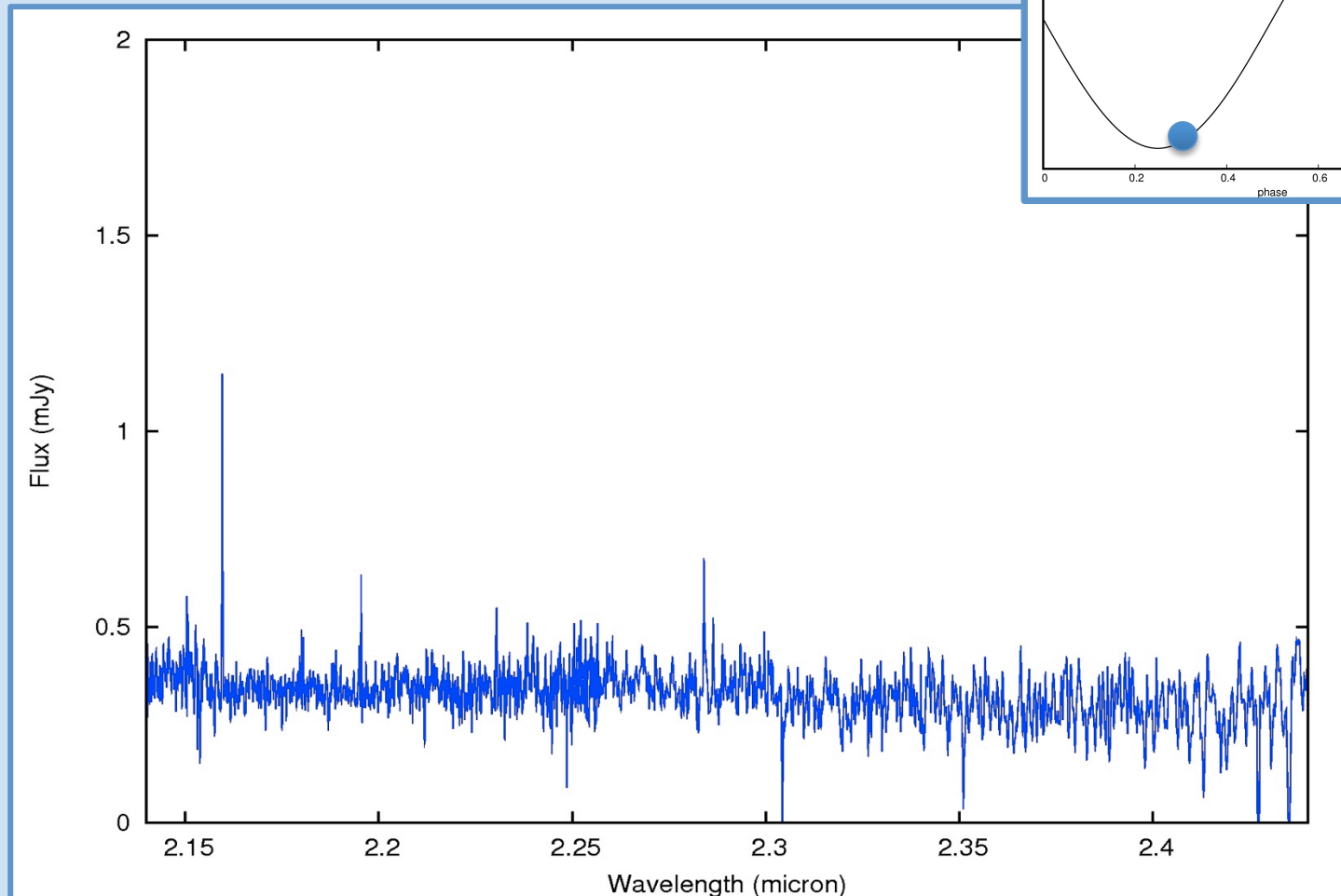


Orbit phase 0.2



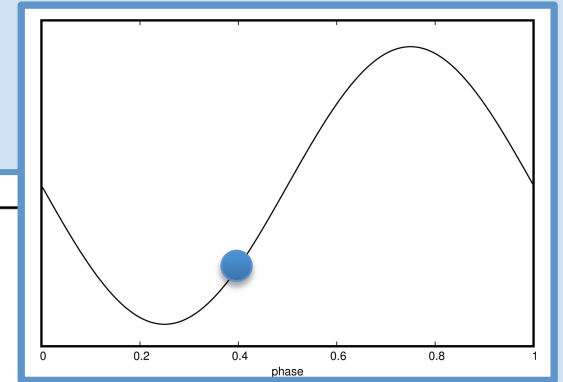
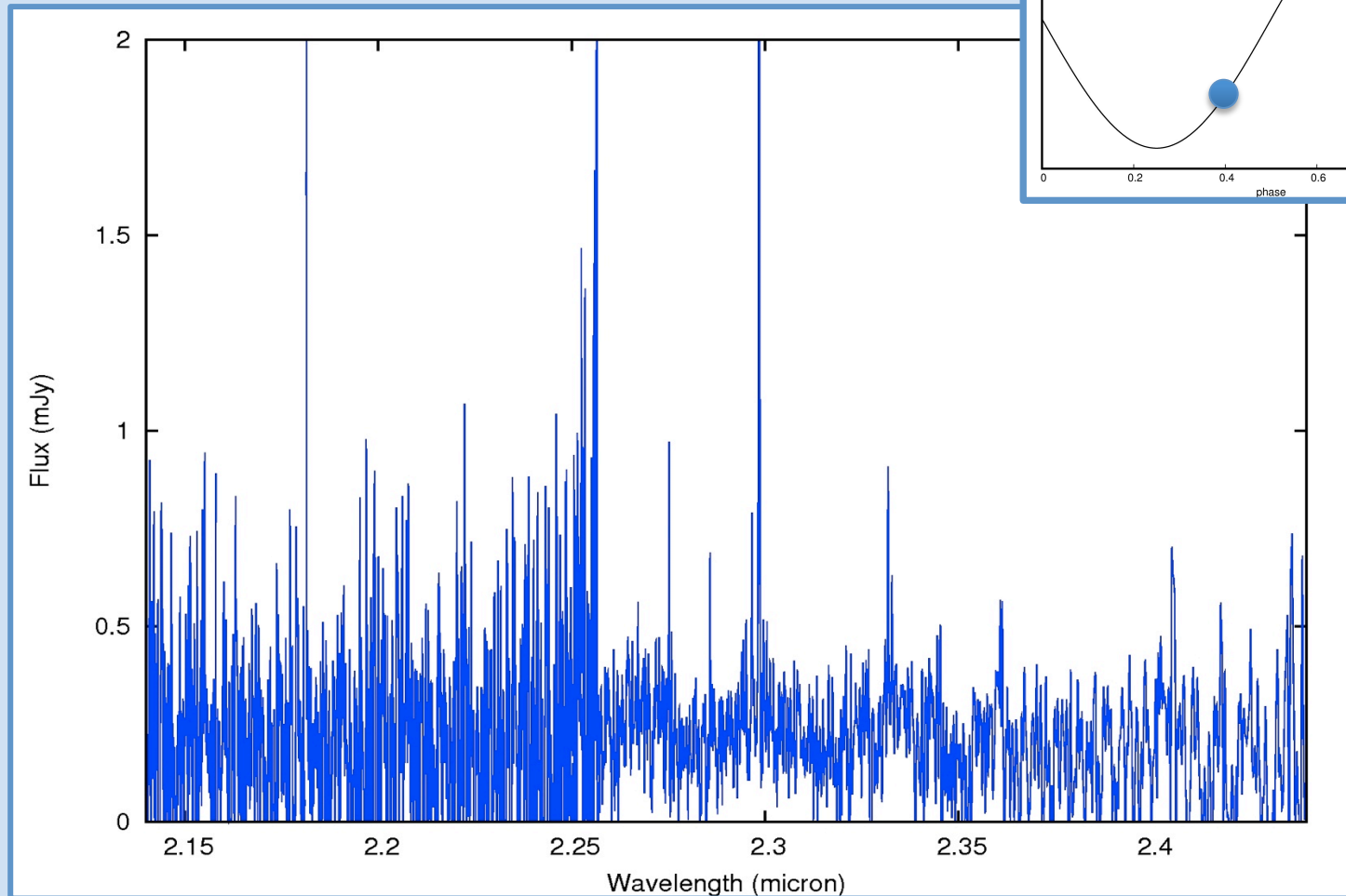


Orbit phase 0.3

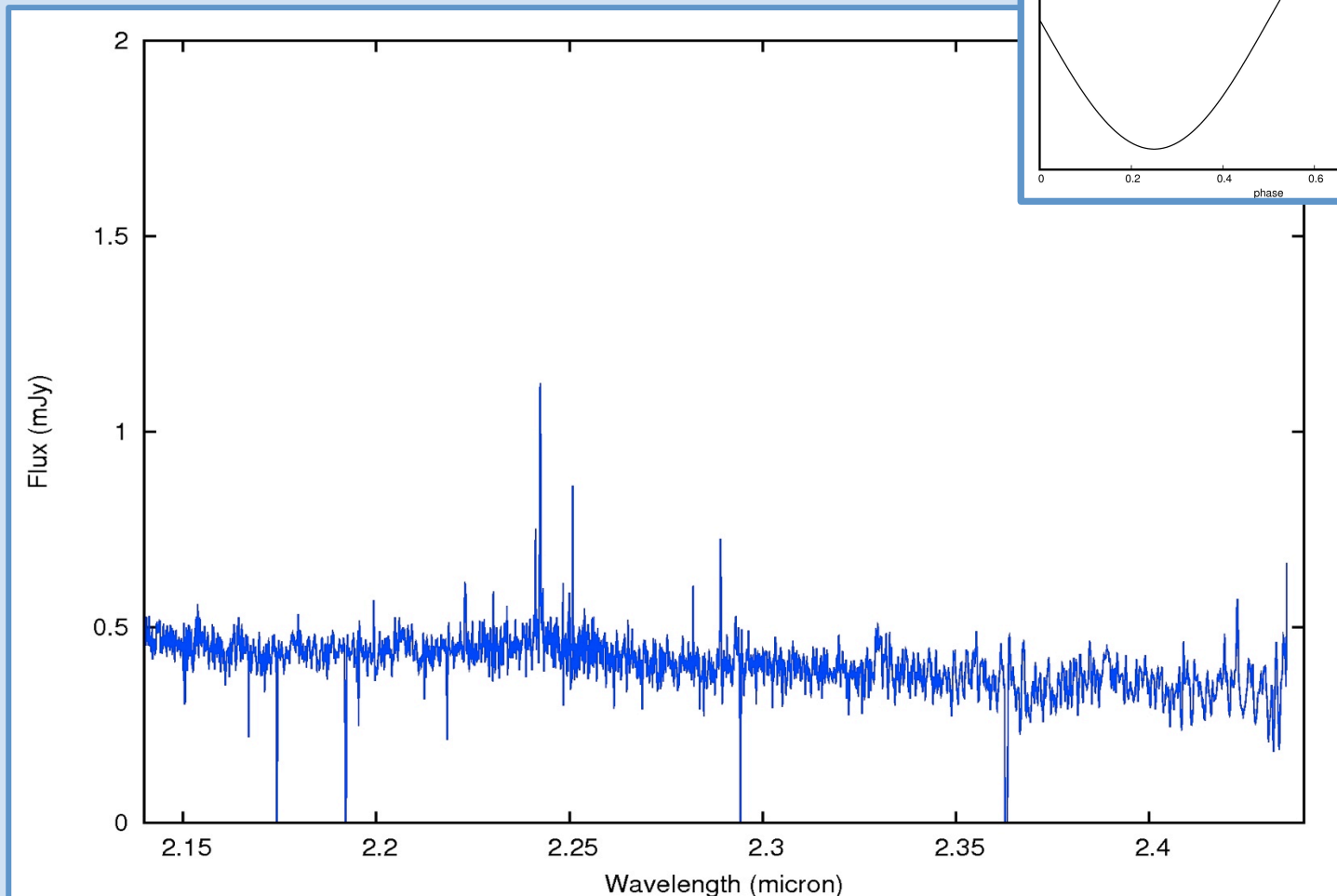




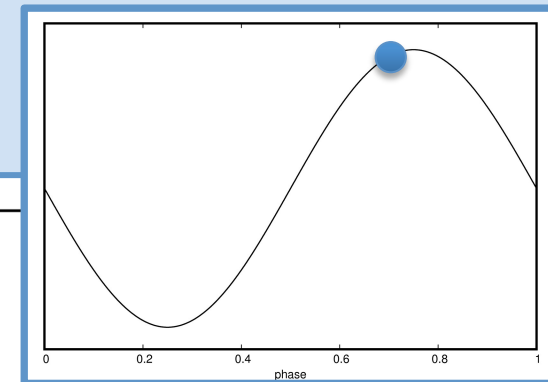
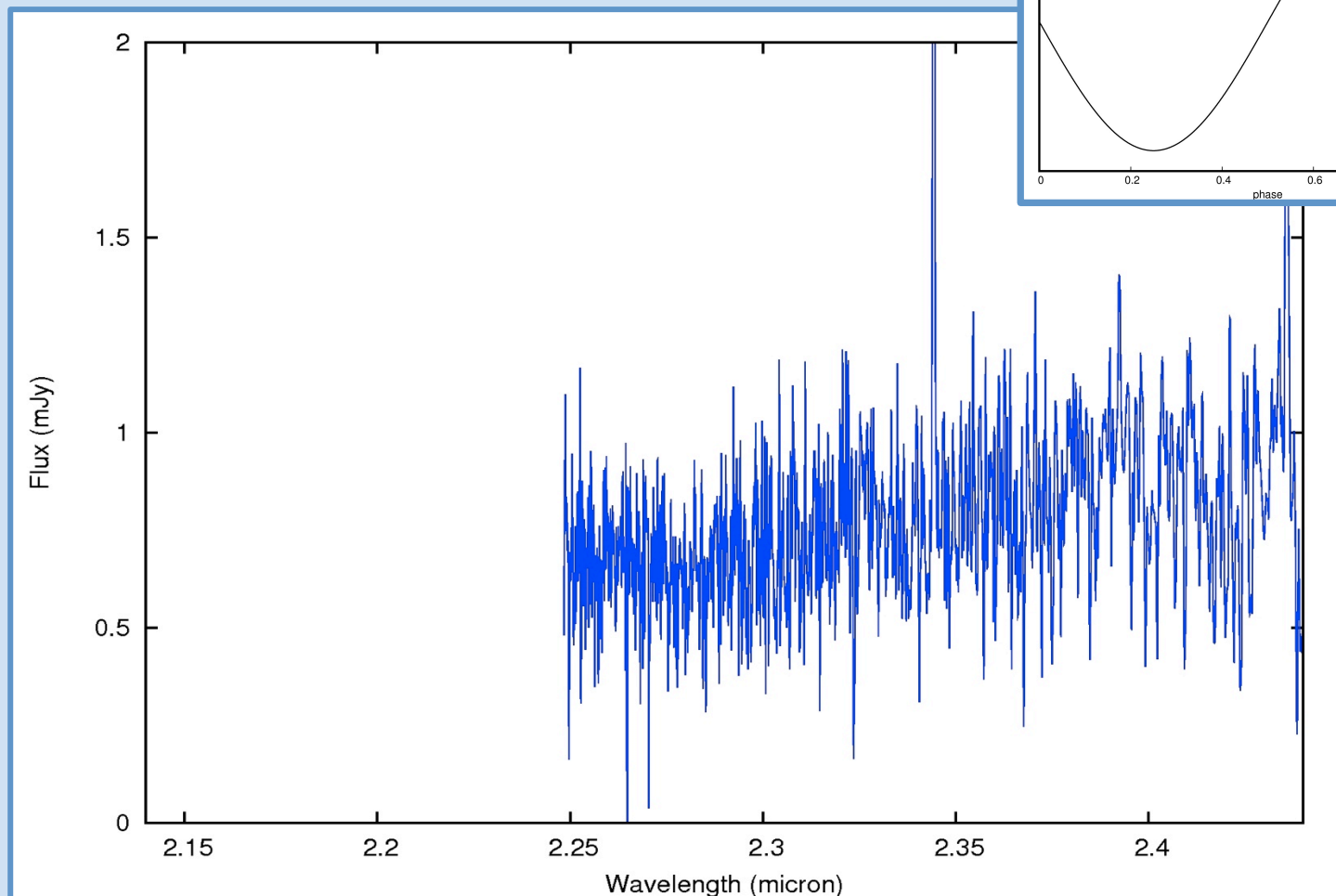
Orbit phase 0.4



Orbit phase 0.6

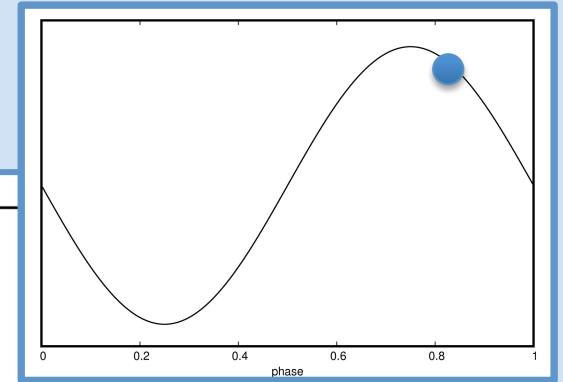
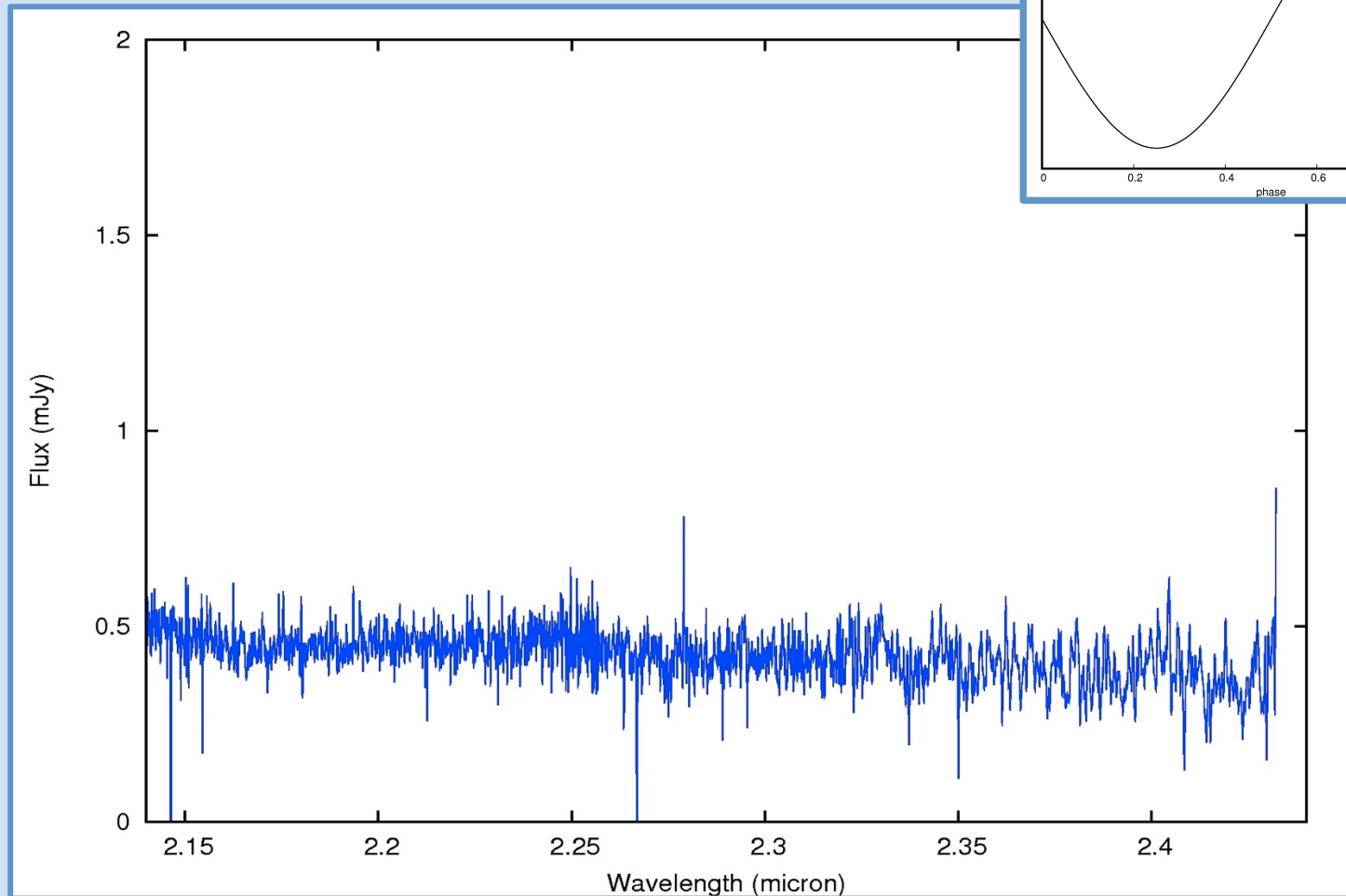


Orbit phase 0.7



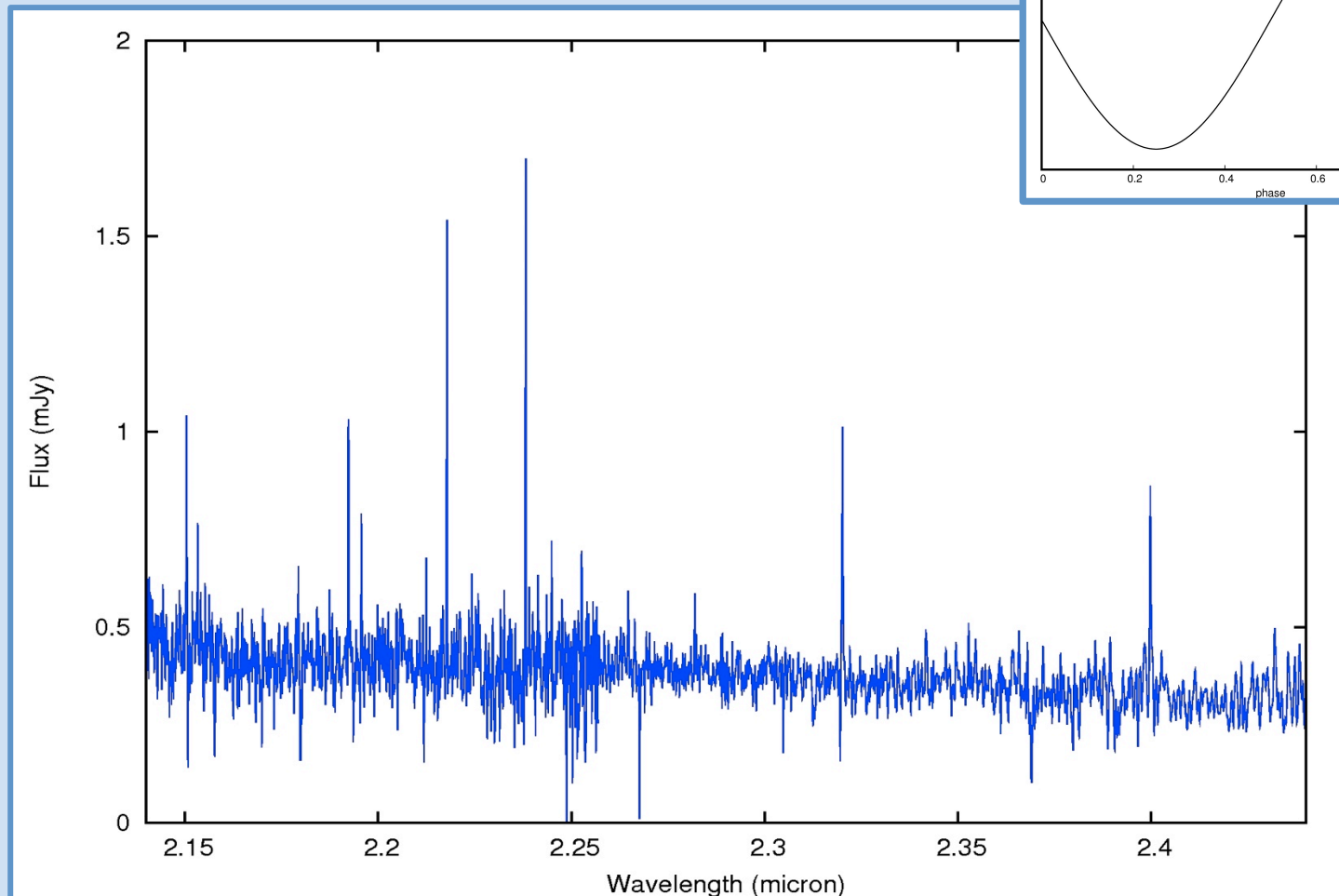


Orbit phase 0.8

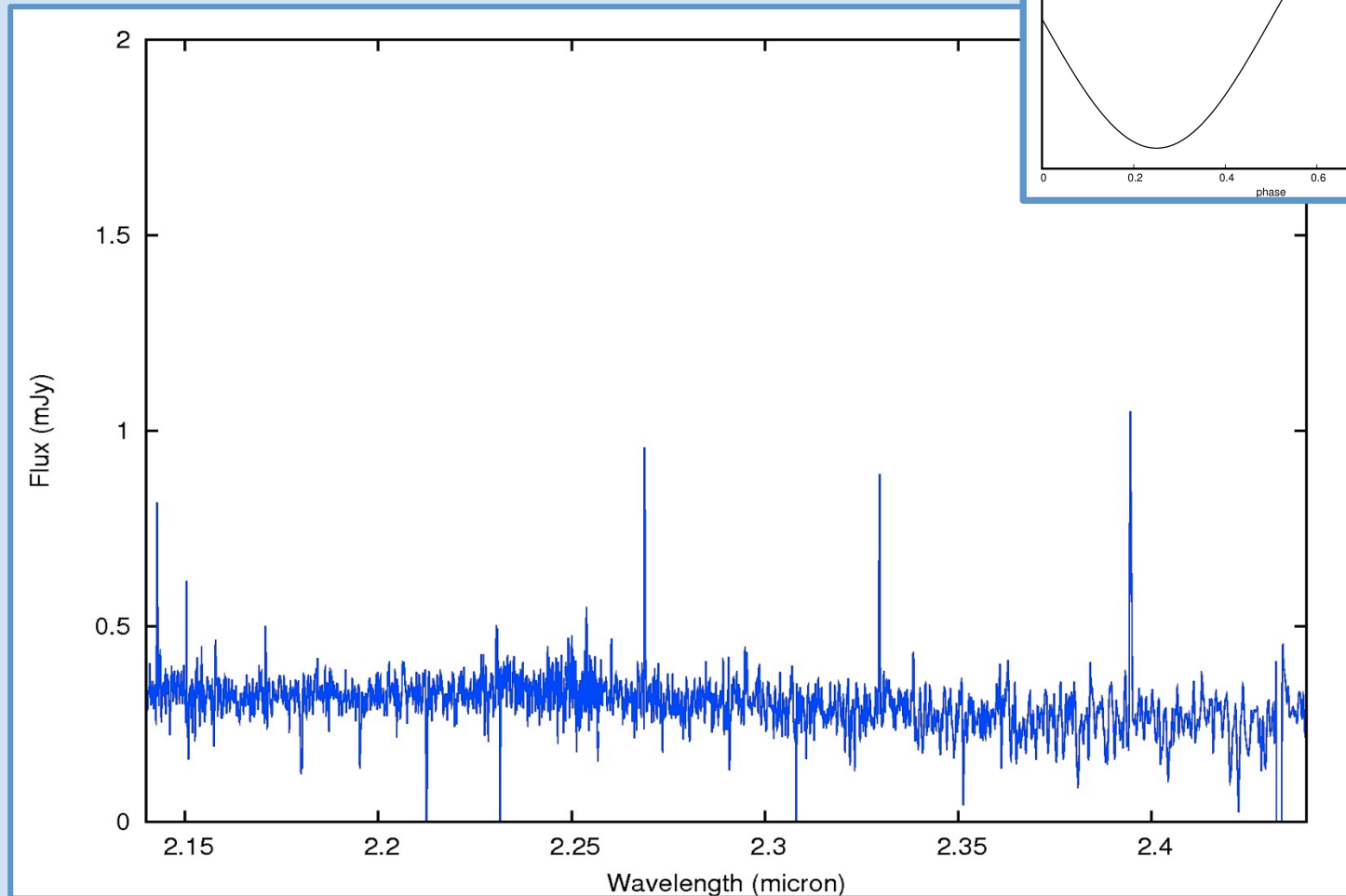




Orbit phase 0.9

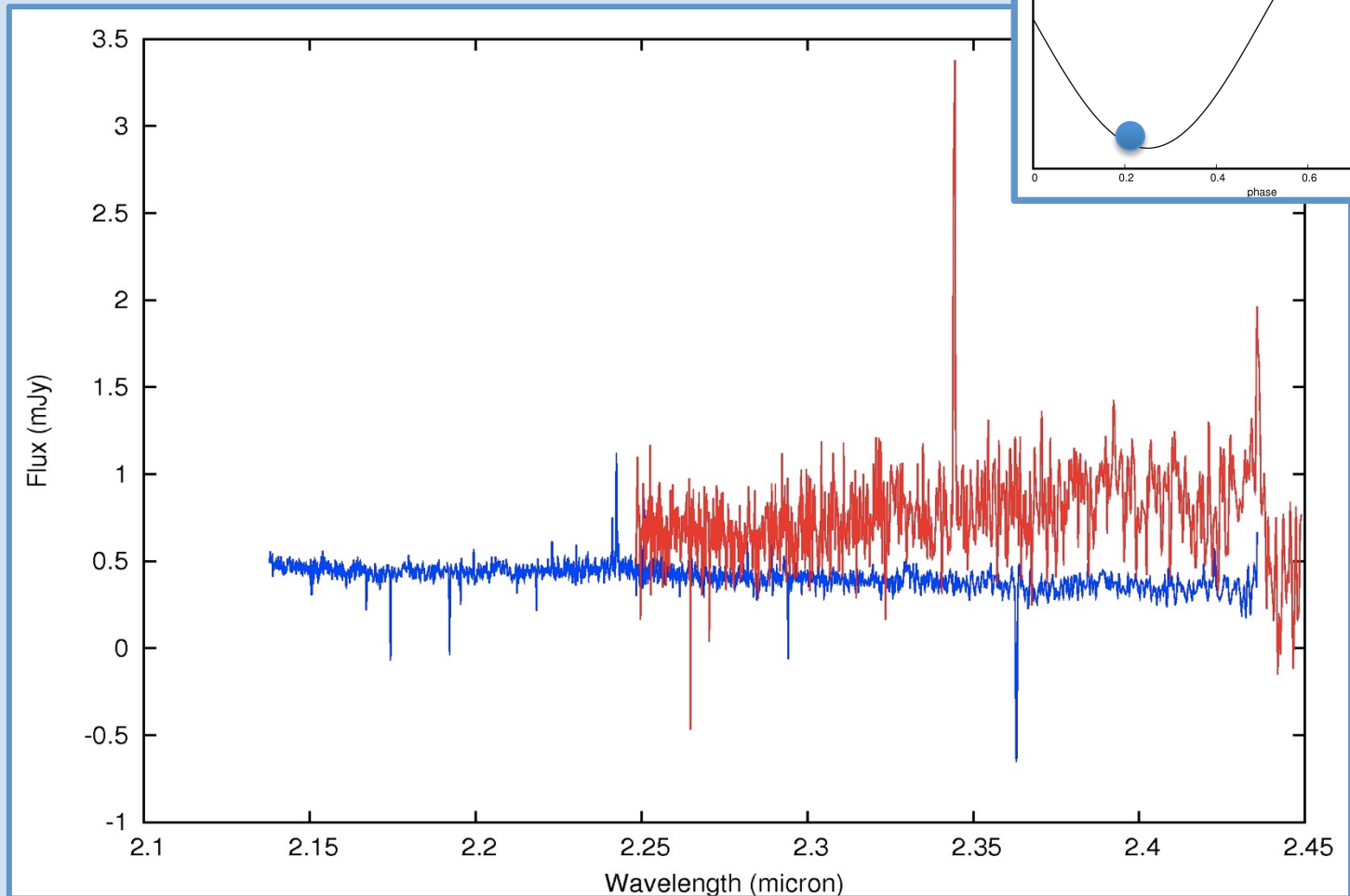


Orbit phase 0.05

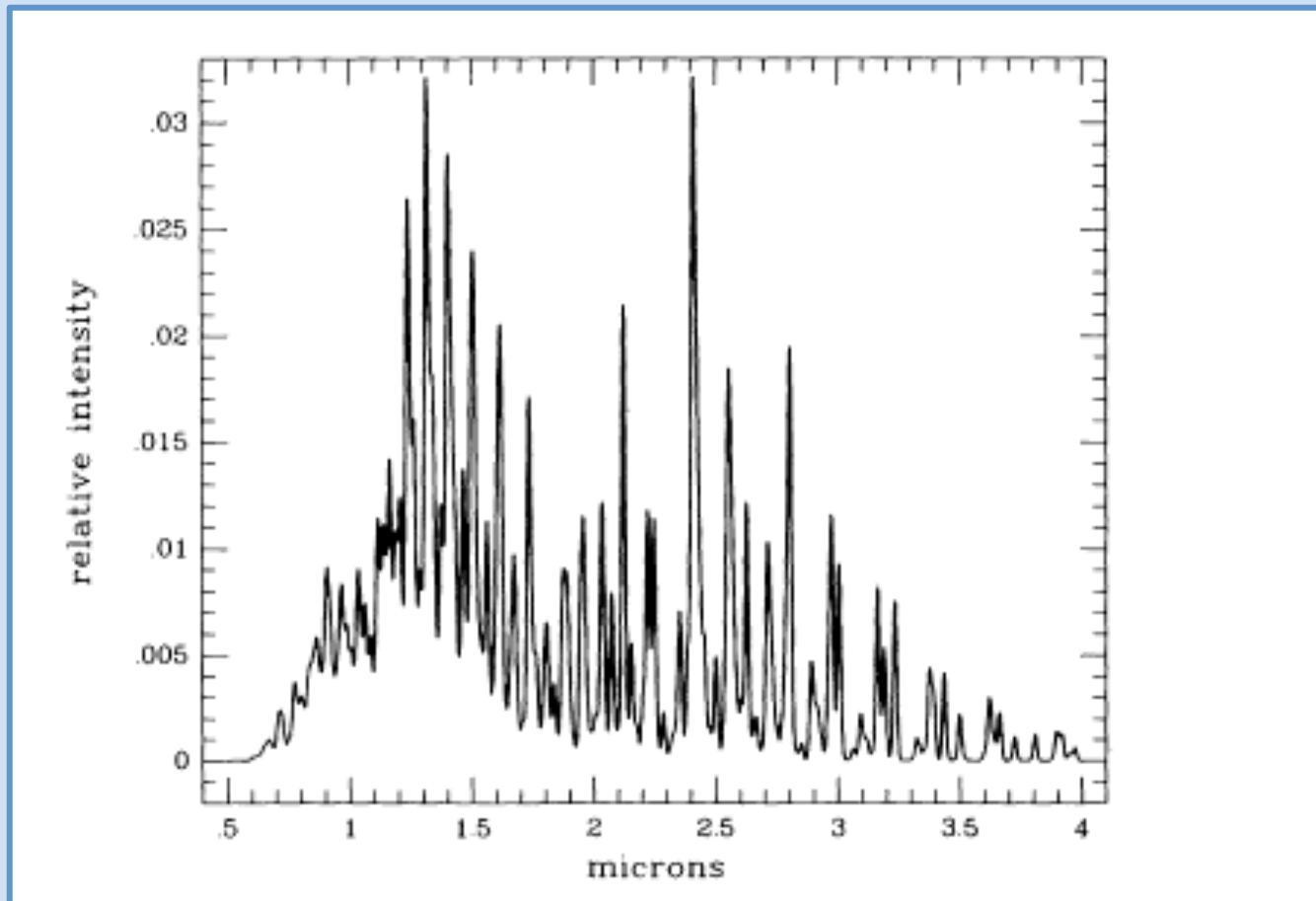


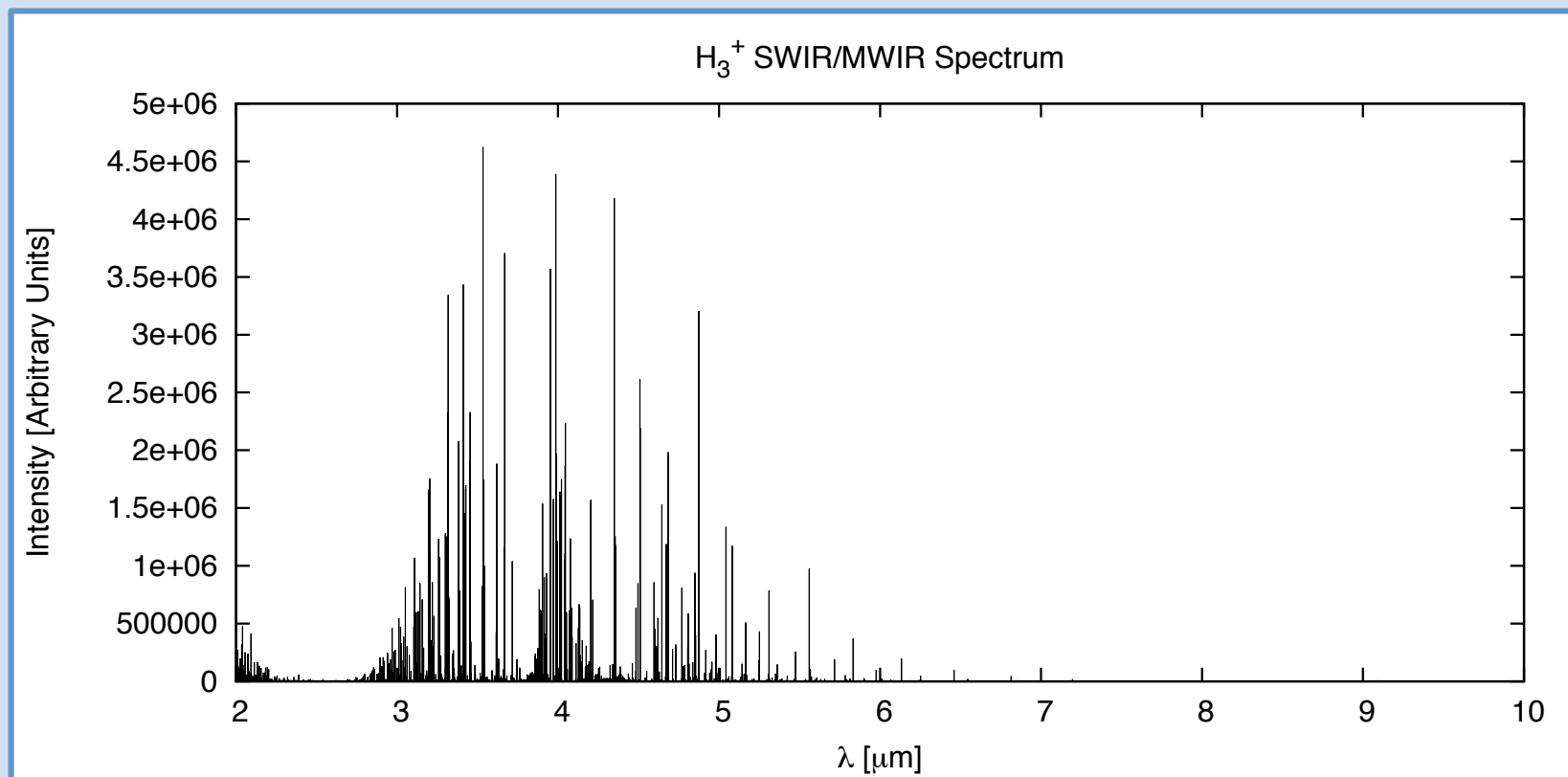
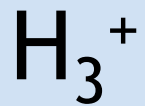


Spectral shape



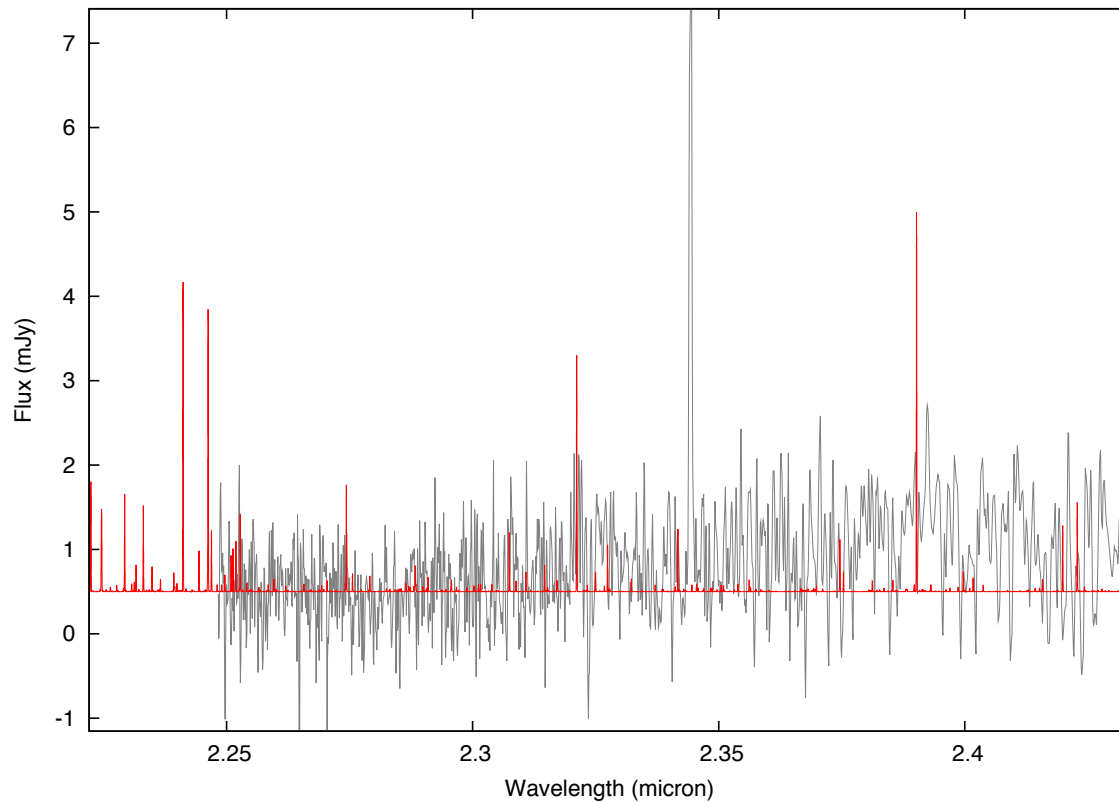
H₂ fluorescence





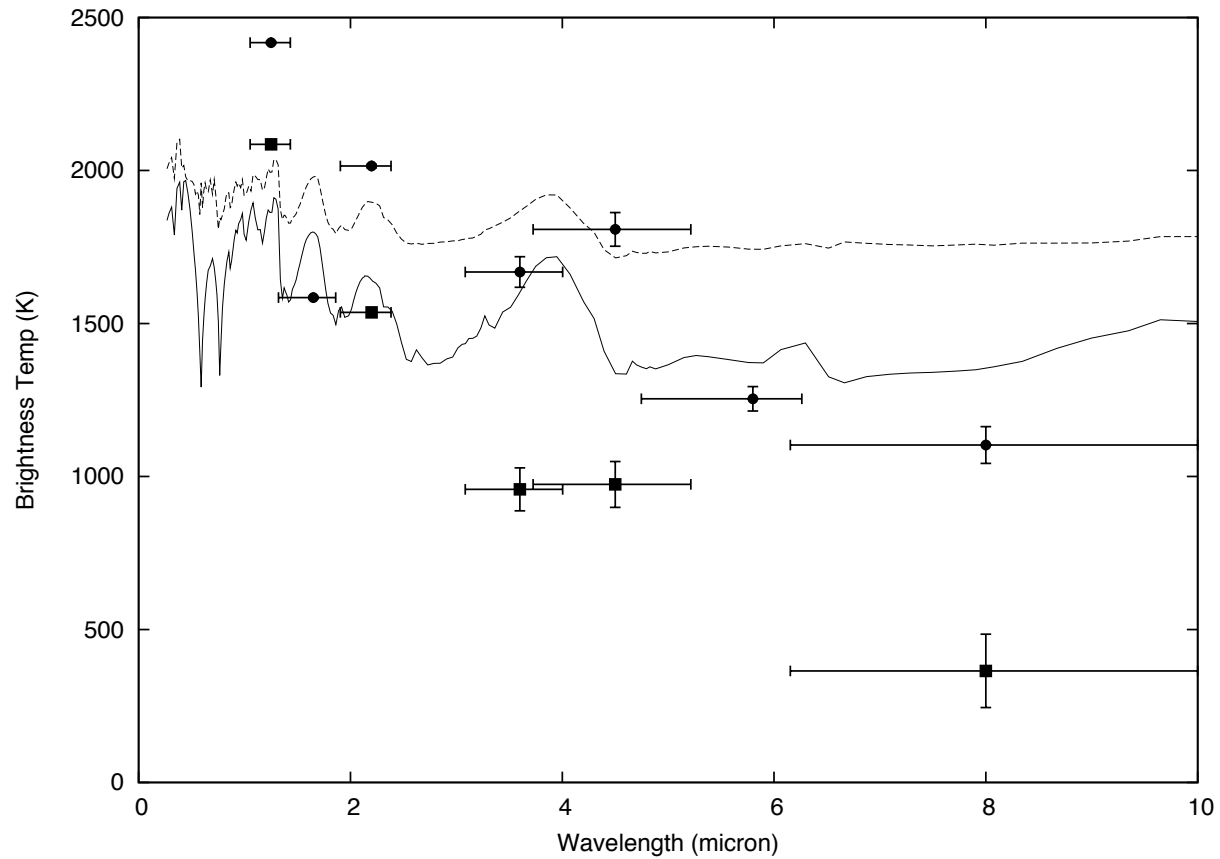
H_3^+

Red line: Model of BD H_3^+ broadened to ISAAC resolution
Grey line: ISAAC data when irradiated hemisphere faces us



Models

Solid line – non-TiO
Dotted line – TiO
Full circulation



Conclusions

- 3 of the 4 BDs in known systems are being irradiated
- H_3^+ seen when irradiated hemisphere faces us?
- Possibility of H_2 fluorescence – pumping?
- Possibility of additional photochemistry
- These objects can be used as testbeds for exoplanets