Observations of irradiated brown dwarfs

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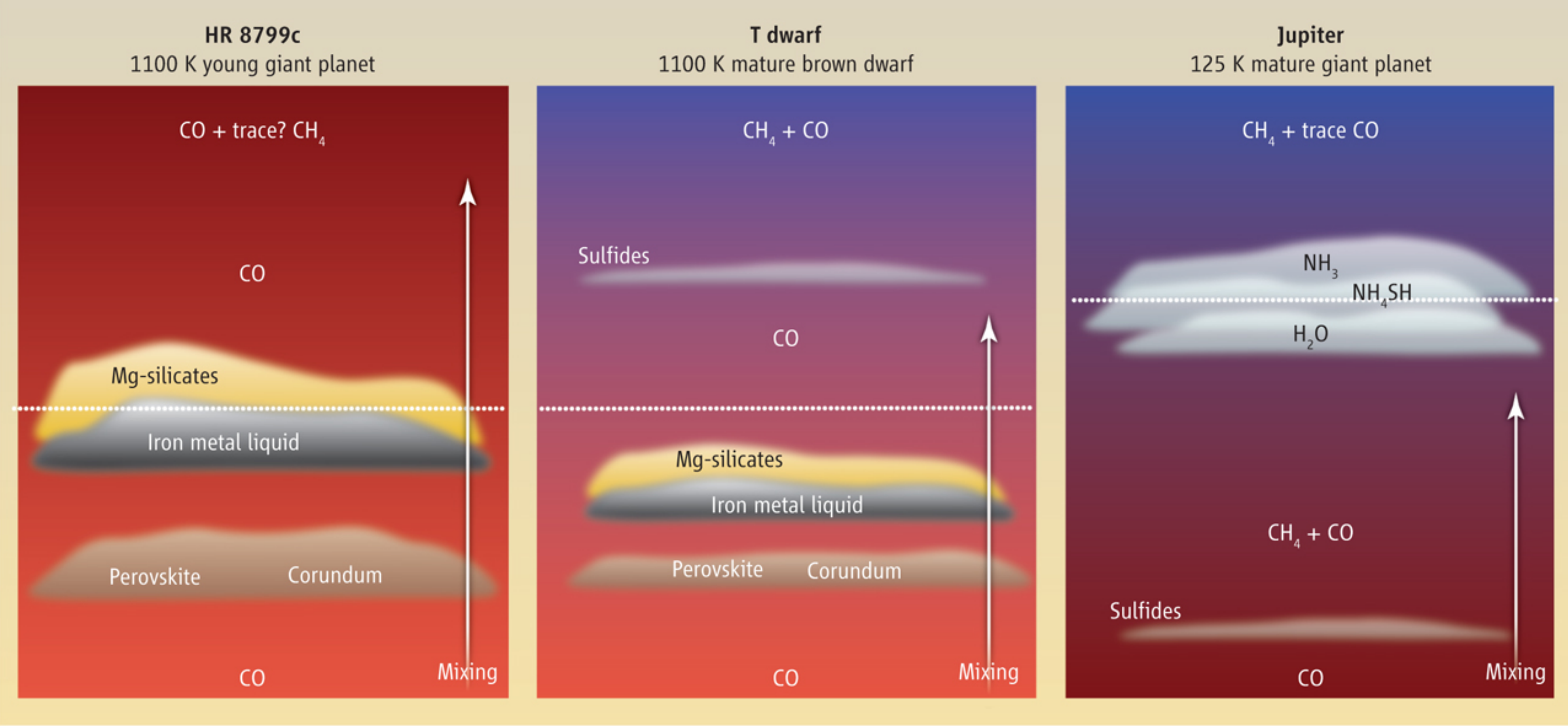
Brown dwarfs



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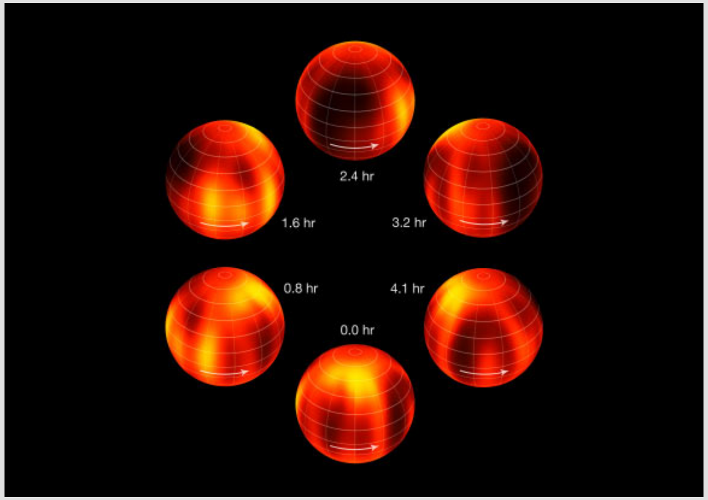
Irradiated brown dwarfs



- Have a close companion
- Tidally locked so continually heated
- Do they still look like brown dwarfs?
- What about photochemistry?
- These objects can be used as testbeds for exoplanets

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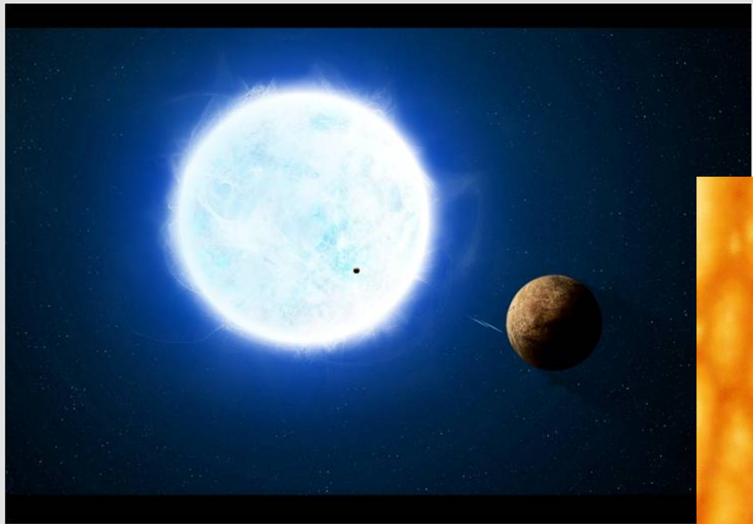
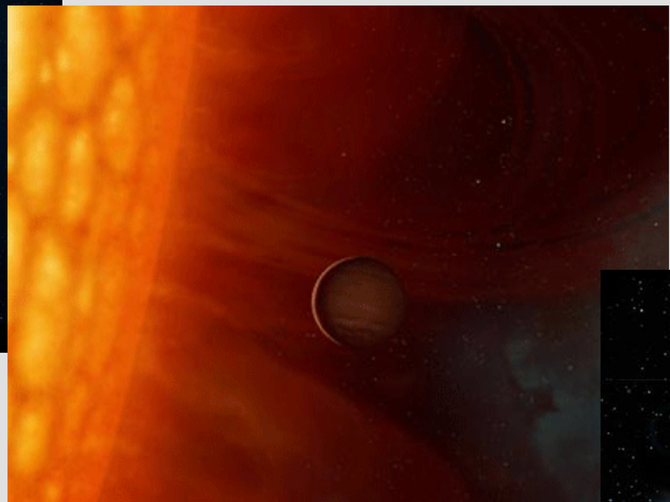
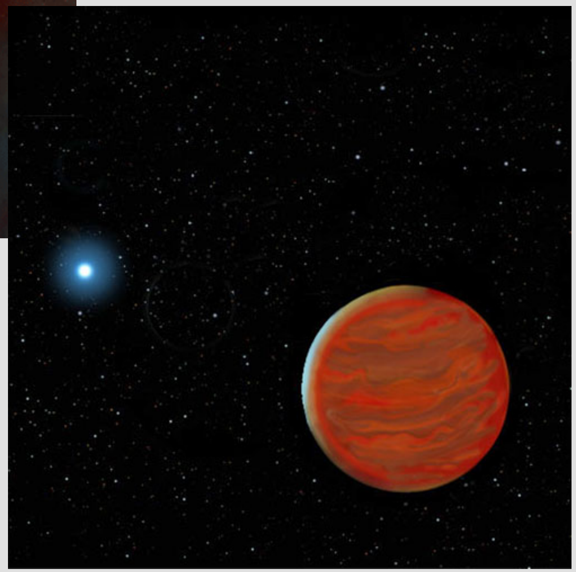
Close, non-interacting binaries







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Systems

GD1400
WD+L6
$0.67M_{sun}$ + 60 M_{Jup}
P=9.98 hours
WD T_{eff}=11000K

WD0137-349
WD+L6-L8
$0.4M_{sun}$+ 53 M_{Jup}
P=116 Min
WD T_{eff}= 16500 K

SDSS1411+2009
WD+L7-T5
$0.53M_{sun}$+50 M_{Jup}
P=121.73 min
WD T_{eff} = 13000 K

NLTT5306
WD+L4-L7
$0.44M_{sun}$+56 M_{jup}
P=101.88 min
WD T_{eff}=7756 K

WD0837+185
WD+>T8
$0.8M_{sun}$ + ~$30M_{Jup}$
P=4.2 hours
WD T_{eff}= 15000 K

Farihi & Christopher, 2004
Maxted et al., 2006
Steele et al., 2013
Casewell et al., 2012
Littlefair et al., 2014

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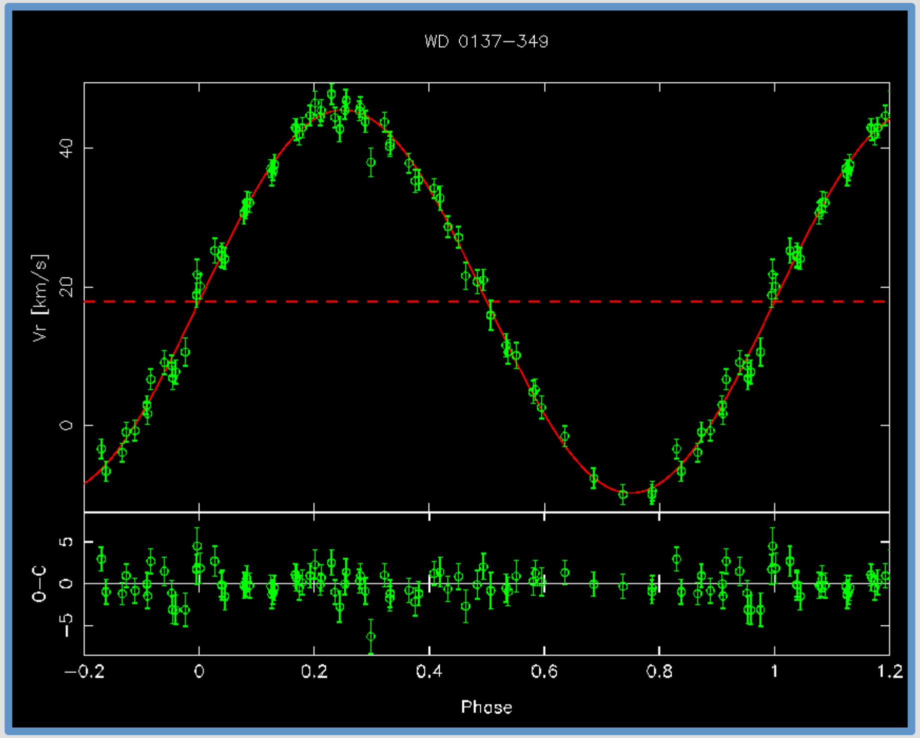
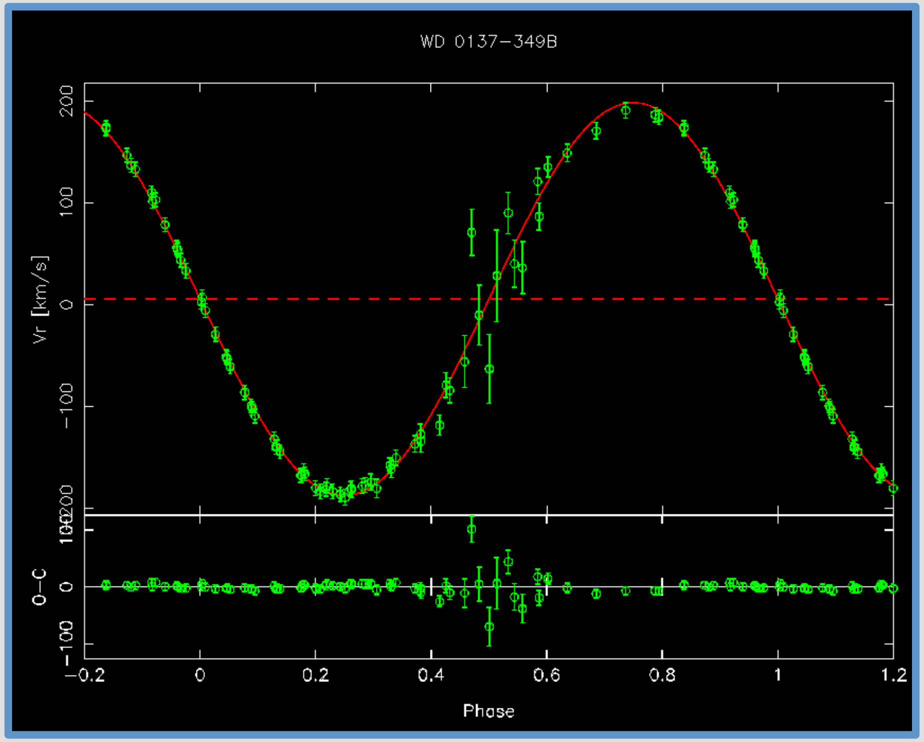
WD0137-349

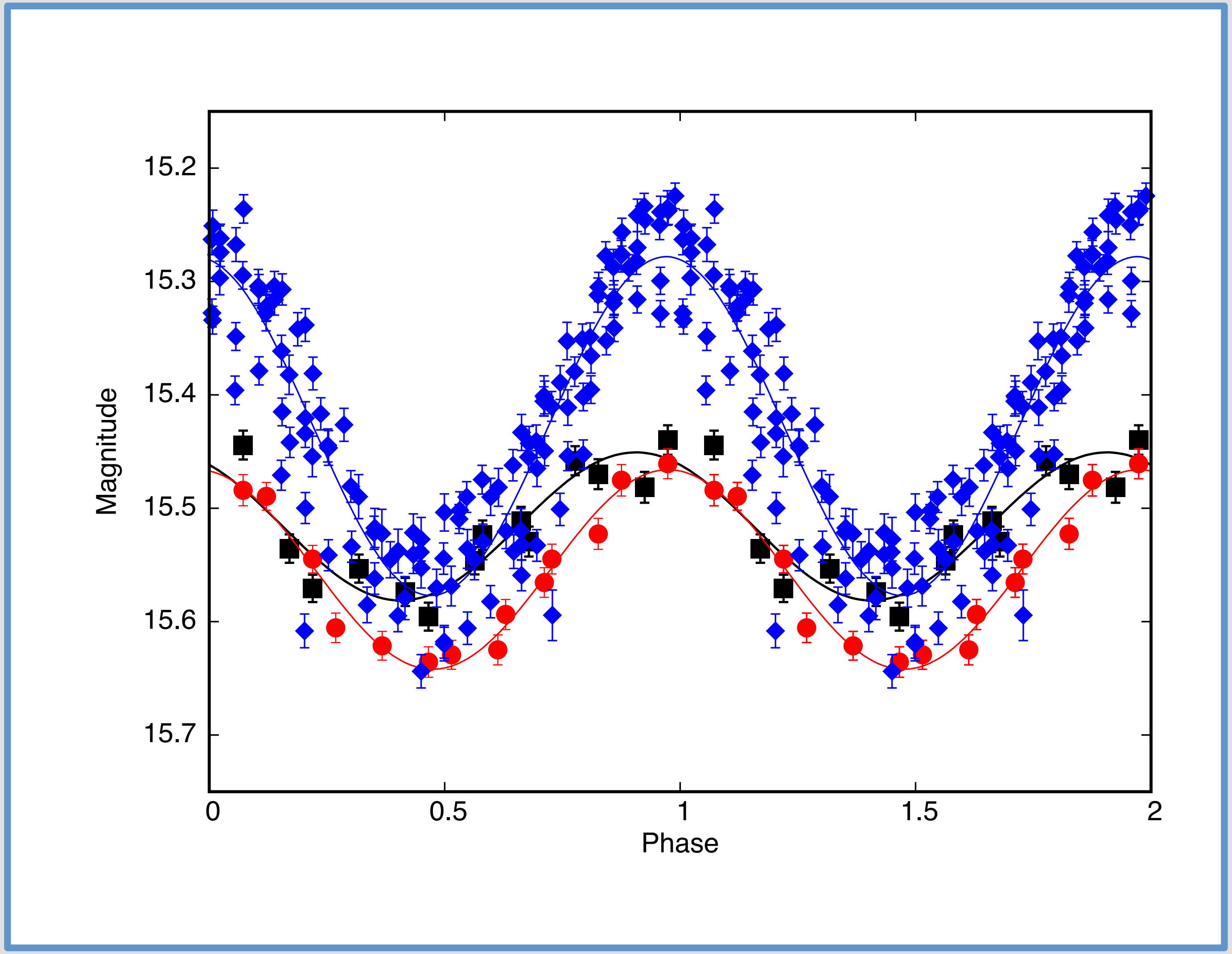
WD H Absorption lines



BD H alpha emission feature

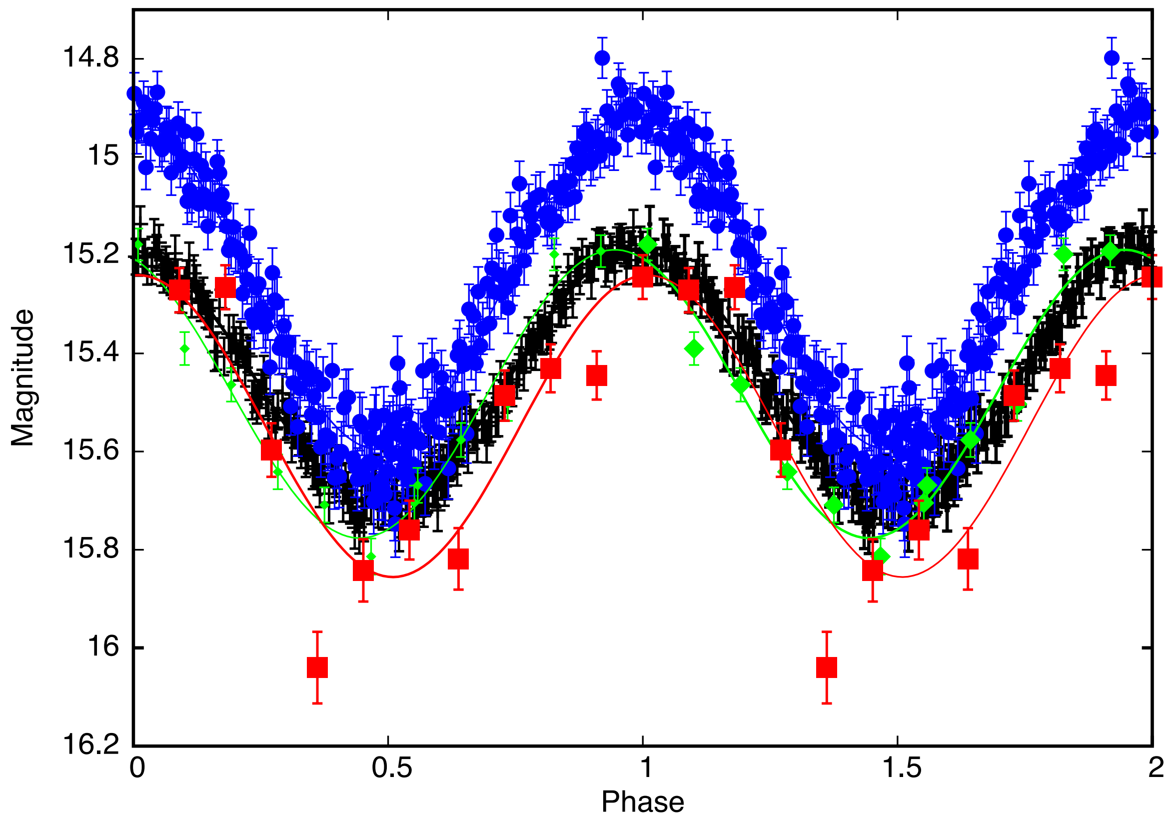


Irradiation



Black J
Red H
Blue K

Irradiation



Black [3.6]
Blue [4.5]
Green [5.8]
Red [8.0]

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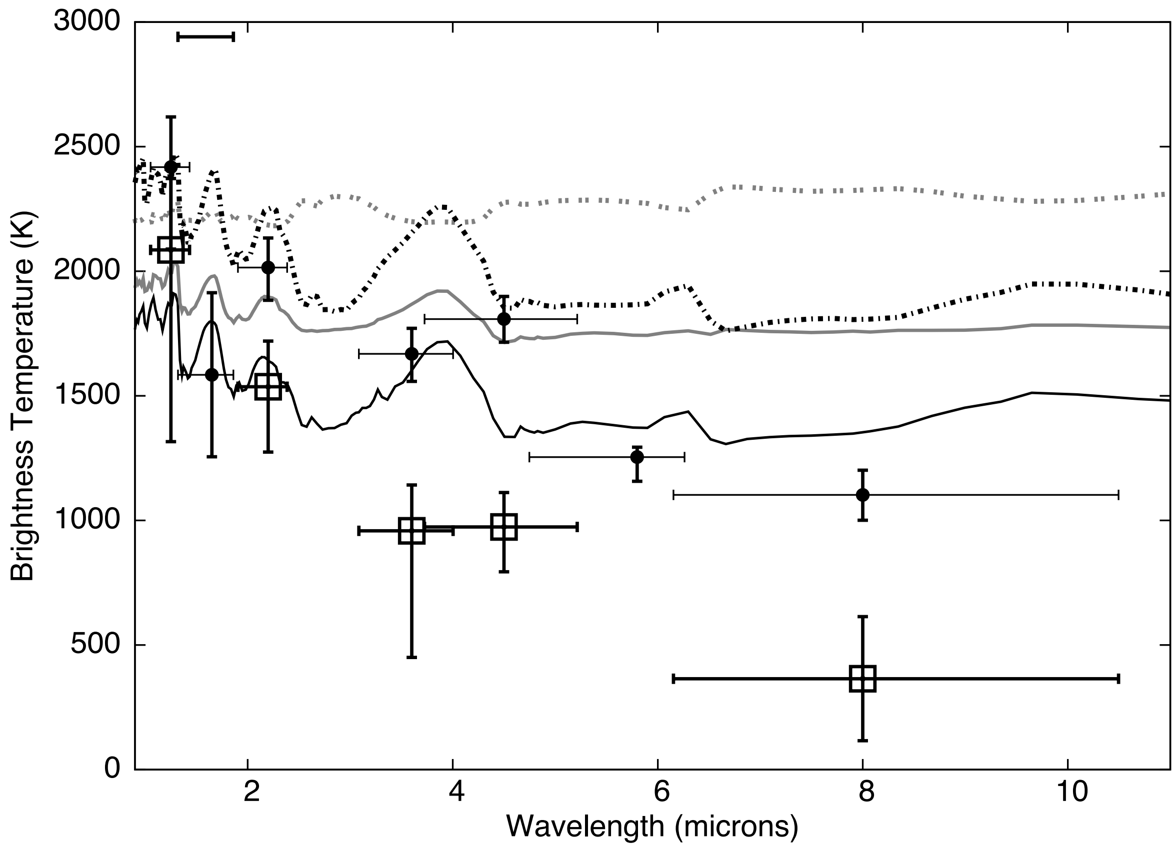
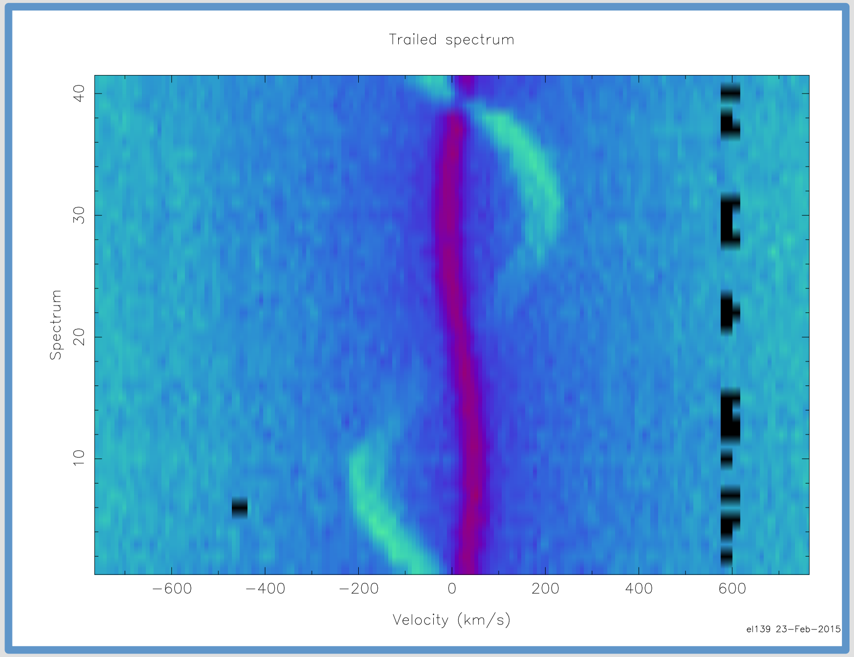
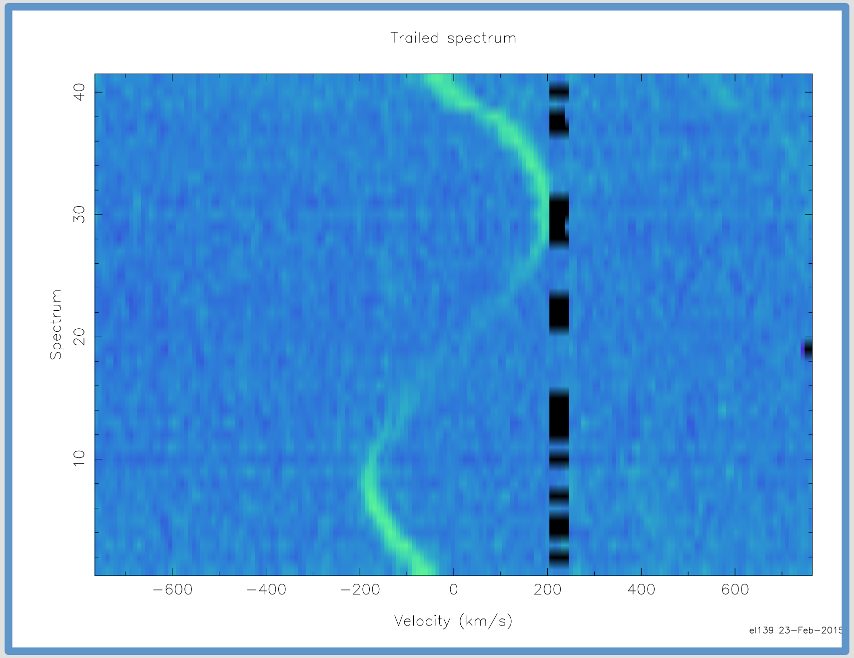
Models

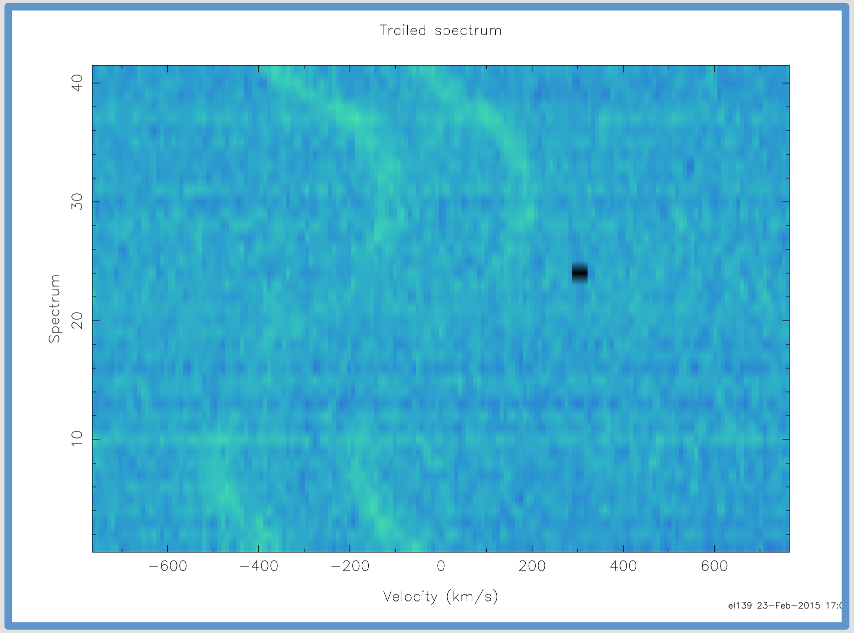
Solid line – 4π circulation
Dotted line – 2π circulation
Grey – TiO, Black – no TiO



Irradiation







- Halpha
- Ca II
- K
- Na I
- Mg

See Emma Longstaff's poster!

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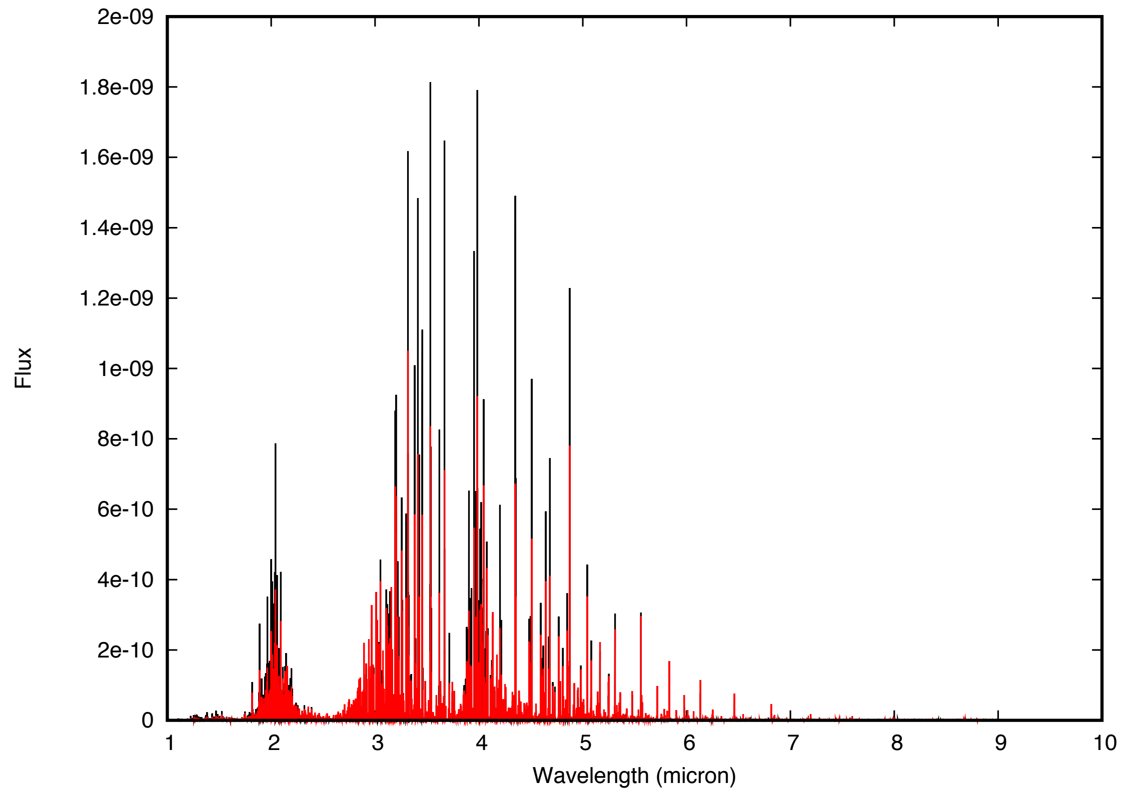
H_3^+

Black – WD0137 (15000 K)
Red – NLTT5306 (7000 K)
SdB (28000 K) – maybe none



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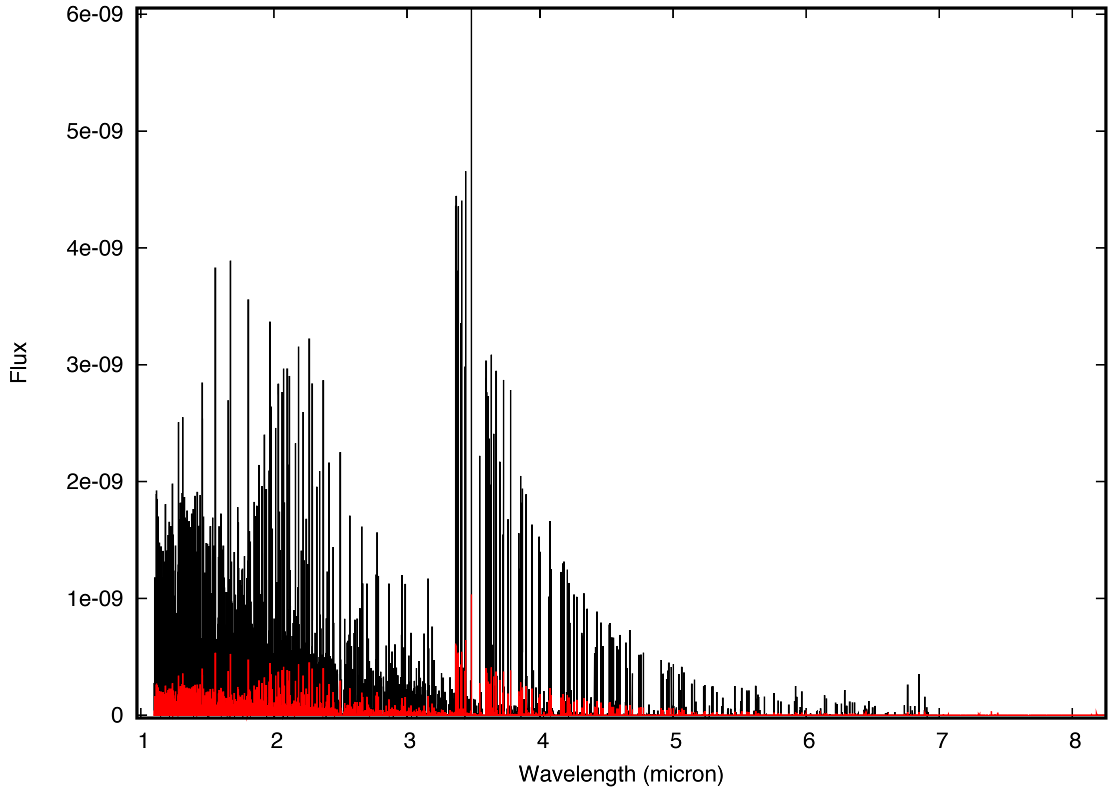
H_2 fluorescence

Black- sdB (28000 K)
Red- WD0137 (15000 K)
NLTT5306 (7000 K) – no H_2



Conclusions

- The BDs in known systems are being irradiated
- This changes their spectra so they don't look like BDs
- H_3+ seen when irradiated hemisphere faces us?
- Possibility of H_2 fluorescence?
- Possibility of additional photochemistry
- These objects can be used as testbeds for exoplanets

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NAM2015

Session: Magnetic fields of planets and cool stars, Wednesday 8 July at 9:00 and 13:30

Submit abstracts at http://nam2015.org by 1 April

Magnetic fields of planets and cool stars

This session will explore the magnetic fields of planets, extra-solar planets and cool stars, at a time of rapid advancements in this area. The magnetospheres of planets such as Jupiter and Saturn have been studied both by in-situ observations of their magnetospheres and through auroral emissions. Although much has been learnt about planetary magnetospheres, many questions remain unanswered, some of which will be addressed by the upcoming Cassini Grand-Finale mission at Saturn and the Juno mission to Jupiter. With the improvements in instrumentation and data analysis techniques, magnetic fields can now be detected and studied at ultra-cool dwarfs, which have surprisingly been revealed as potential analogs of planets in their manifestation of magnetic activity by the emission of bright radio bursts of a similar nature to auroral planetary radio bursts. This session will focus on the observations of magnetic fields, using in-situ and remote sensing within our solar system, to techniques available to detect exoplanetary and ultra-cool dwarf magnetic fields, as well as associated theoretical studies. Discussion will focus on how best to bridge our understanding of activity across the mass gap from planets to cool stars. To facilitate this, we plan to hold a half-hour panel discussion as part of the session.

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