



Habitable planets, M dwarfs and NIR spectrographs
13-15 July 2015 • Bern, Switzerland
Pathways towards habitable planets
Triple satellite meeting

Open discussion

Habitable planets around M
dwarfs and NIR spectrographs
(synergies and future)

[Poll: max 1 min per question]



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Q1: do M dwarfs have planets?

- a) Yes, from microlensing (e.g. OGLE)
- b) Yes, from radial velocity (e.g. HARPS)
- c) Yes, from transits (e.g. *Kepler*)
- d) Yes, from protoplanetary disc observations
- e) All of the above
- f) No



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Q2: spectral type of **inactive** dwarfs for which NIR “>” VIS?

a) M3V or earlier

b) M4V

c) M5V or later



Q3: impact of **tidal locking** on habitability?

- a) 0% (i.e. 100% of planet surface is habitable)
- b) 100% (i.e. 0% of planet surface is habitable)
- c) 1-99% (i.e. only certain areas are habitable)



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Q4: spectral type of **active** dwarfs for which
NIR “>” VIS?

a) K7V or earlier

b) M0V

c) M1V or later



Q5: impact of **stellar activity** on habitability?

- a) 0% (i.e. 100% of planet surface is habitable)
- b) 100% (i.e. 0% of planet surface is habitable)
- c) 1-99% (i.e. only certain areas are habitable)



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Q6: best passband for RV monitoring ~M4V?

- a) V, R, I
- b) Z
- c) Y
- d) J
- e) H
- f) K
- g) $>3.5 \mu\text{m}$



Q7: most important parameter for **HZ** in M dwarfs? (but tidal locking and stellar activity)

- a) Ocean/initial water content
- b) Atmospheric composition
- c) Atmospheric pressure/scale height
- d) Stellar spectral type
- e) Planet magnetosphere
- f) Planet Bond albedo
- g) Other (e.g. Multiplanet system, continent distribution, migration, asteroid belt, tectonics, carbonate-silicate cycle...)



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Q8: best NIR spectral resolution?

a) $R=60,000$ or less

b) $R=70,000-90,000$

c) $R=100,000$ or more



Q9: most probable habitable planet example?

- a) *Tatooine* (Mars, Arrakis): **desert** planet
- b) *Kamino* (Caladan, Solaris): **ocean** planet
- c) *Hoth* (Europa, Snowball Earth): **ice** planet
- d) *Mustafar* (Io): **lava** planet
- e) *Endor* (Kashyyyk, Yavin IV): **jungle** planet
- f) *Terra...*



Q10: best monitoring approach (I)?

- a) 8-10 m telescope, less than 20% of telescope time
- b) 4 m telescope, more than 80% of telescope time
- c) Dedicated 2 m telescope, 100% of telescope time



Q11: best monitoring approach (II)?

- a) Large sample (>500 stars), few visits (<50)
- b) Small sample (<50 stars), many visits (>500)
- c) Compromise between sample size and number of visits per star (is there a telescope-size compromise?)



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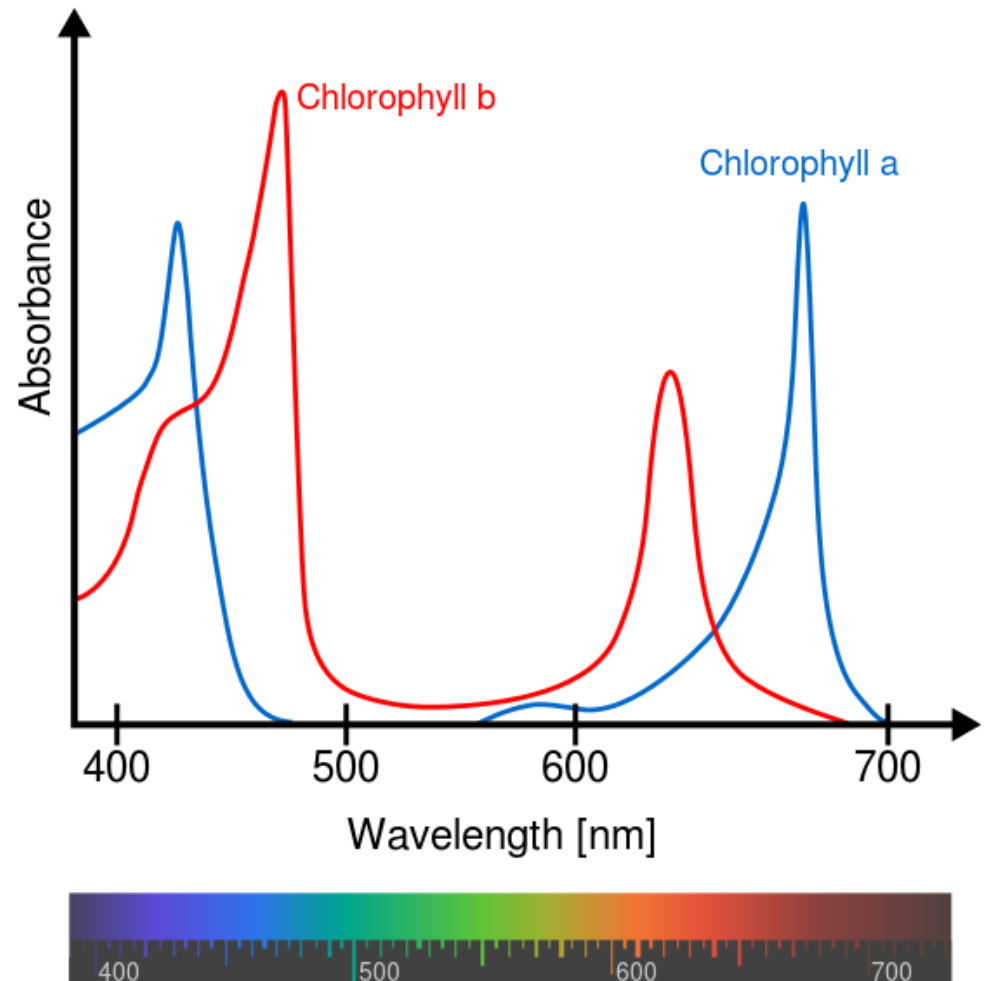
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Q12: photosynthesis in M-dwarf planets?

a) Yes

b) No





Q13: best wavelength calibration procedure?

- a) Gas cell
- b) Simultaneous Th-Ne lamp
- c) Simultaneous U-Ne lamp
- d) Other simultaneous lamp
- e) Fabry-Pérot etalon
- f) Laser comb
- g) Just opto-mechanical stability
- h) Mix



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Q14: the latest achievable spectral type with a current NIR s'graph?

a) M8V or earlier

b) M9V

c) L0V or later



Q15: synergies?

- a) CARMENES and SPIRou for intermediate M dwarfs (and active early M dwarfs), HPF and IRD for late M dwarfs (and follow up)
- b) Exchanging (part of) target lists
- c) Dedicated meeting(s) on NIR spectrographs? Science?