# **Synergy between ARIEL and HIRES**





Nicoletta Sanna on behalf of HIRES Consortium & the ARIEL Science Team in Arcetri

HIRES

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# **HIRES capability**

Wavelength coverage	Observing mode	R
0.4 – 1.8 µm	UHR	150,000
	HR	100,000
Possible extension in U e K bands	HR² (IFU+AO)	>100,000
	Possible MR	20,000

# **Exoplanets atmospheres in habitable zones**



Community White Paper: Maiolino et al. 2013, ArXiV:1310.3163

N. Sanna

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## **Exoplanets atmospheres**



### In reflected light

#### In transmitted light



In transmitted light

HIRES advantages:



Texp  $\propto$  D<sup>2</sup>  $\rightarrow$  HIRES achieves same S/N as ARIEL in less time  $(D = 39 \text{ m vs } D \sim 1.1 \text{ m} \longrightarrow 1200 \text{ times})$ 

Examples of HIRES expected performances :

- J = 6.0 \_\_\_\_\_ contrast ~  $5x10^{-5}$

- $J = 8.8 \longrightarrow contrast \sim 2x10^{-4}$

# In transmitted light: signatures of life



## In transmitted light: signatures of life



# In transmitted light: signatures of life



Example: for Trappist 1-b HIRES can detect  $O_2$  at 0.75  $\mu$ m in 25 transits and  $CO_2$  at 1.57  $\mu$ m in 4 transits

HIRES

# In transmitted light

#### HIRES limit:

It is a common user facility.

Only a (small) part of the time can be dedicated to transits. HIRES will mostly perform deep/detailed studies of a limited number of carefully selected targets.

Synergic with a ARIEL that is fully dedicated to the systematic study of the atmospheres of a large sample of transiting planets

High Spatial Resolution $\longrightarrow$  Enhance the planet-to-star contrastIFUat the planet location with AO

High Spectral Resolution → Use high-resolution spectroscopy to disentangle the (velocity-shifted) reflected spectrum of the planet from the stellar spectrum that is acquired simultaneously in the IFU observation





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Example: Proxima-b

HIRES can detect planet in few hours or few nights (depending on the AO adopted)



#### Simulation by HIRES Science WG1

N. Sanna

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### **Summary**

Full spectral coverage 0.4 - 1.8  $\mu m$ 

```
HR (100,000 ÷ 150,000)
```

Planets atmospheres in transmission  $(O_2, CO_2)$ 

HR<sup>2</sup> IFU study of reflected light from planets

### Summary

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HIRES will be synergic and complementary to ARIEL