

# Objectives of the meeting

- Define/confirm the various needs for limb darkening for PLATO
- Answering some questions
  - When are they needed : § prior to the launch (PLATO database) ?  
§ during run of the pipeline in operation ?
  - What accuracy/precision is needed ?
  - What LD tables/formulation are available ?
  - Which one is the best for what purpose ?
  - What remains to be done in the years to come ?

**Action : this will have to be documented in a technical note, first draft may 2019**

- Define/confirm the various needs for limb darkening for PLATO
- What accuracy/precision is needed ?

→ **Exoplanets : fit of transits and  $R_p/R^*$  ratios :**

Needed precision to get planet radius at 2% level : 0.3% , seems quite small !

**Action : to be justified/checked/ confirmed.**

**Who ? How ?**

**Can this be achieved ?**

→ **Interferometric stellar radii**

Needed precision : 2%

Can be achieved for bright stars. For PLATO, P2 sample

**Action : - sensitivity to LD choice in the visible ?**

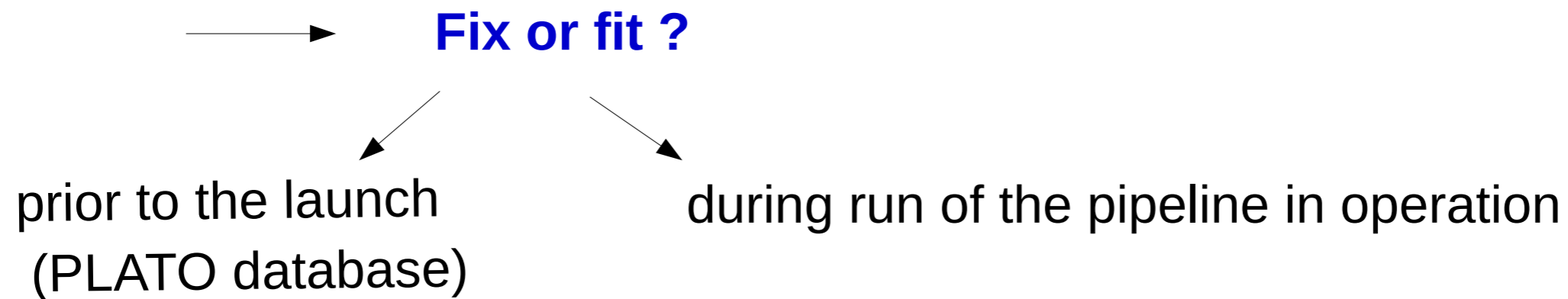
**-cross-match the spectral type/magnitude/precision on angular Diameter table with the expected list of stars in sample 2. Use of the PLATO inp catalogue**

- Define/confirm the various needs for limb darkening for PLATO
- What accuracy/precision is needed ?

→ **Stellar activity-spot modelling** ↔ Intensity profile- LD coef.- interfer. radii

- Would require a whole workshop
- conclusions from the PLATO exoplanet meeting 1 last november ?

- When are they needed : § prior to the launch (PLATO database) ?  
§ during run of the pipeline in operation ?
- What LD tables/formulation are available ?



- 1) **Fix the LD law and fit the coefficients using 3D simulation : power2-qpower2 -**

→ prior to the launch (PLATO database)

tools are ready for exoplanets (CHEOPS, bright stars)

Validated with eclipsing binaries

Direct use or can serve as prior

**Action : application to interferometric radii ?**

**Application to 'faint' stars (mag 8-9) ?**

- When are they needed : § prior to the launch (PLATO database) ?  
§ during run of the pipeline in operation ?
- What LD tables/formulation are available ?

2) Fix the LD law and fit the coefficients for each star  
→ during run of the pipeline in operation

Fast but problems of degeneracy

**Issue : Still worth to do it ?**

- When are they needed : § prior to the launch (PLATO database) ?  
§ during run of the pipeline in operation ?
- What LD tables/formulation are available ?

### 3) Fit the intensity profile from model atmosphere for each star

—————▶ during run of the pipeline in operation

- 1D models : fast - large extended grids available ?  
radiative transfer more sophisticated than in 3D models

**Issue/Action :** - is it accurate enough to get  $R_p$  at 2%  
- what if non local prescription for convection?  
- can serve as prior ?

- 3D models : require validation by comparison with observations (Sun) and other benchmark stars but then

**Issue/action** - B comes into play  
- opacity improvement ?  
- increase accuracy due to opacity group and can the process be speed up ?

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## Which one is the best for what purpose ?

- If fit to model atmosphere for each star is the option, compromise :  
1.5D model atmospheres : (3D thermal gradient in 1D model atmosphere ?)  
is the optimized solution for PLATO pipeline?

- **Other issue concerning limb darkening for transit and  $R_p/R^*$  measurement**

What part of these issues is our stellar business ?

What part is the exoplanet colleagues' business ?

- **Other issue concerning the interferometric radius**

--Assuming  $T_{\text{eff}}$  from spectroscopy  
 $T_{\text{eff}}$  from interferometry

are available :

If they disagree (at 3 sigma level ? ), just give a flag ?

If they agree within error bars, which one should be used as the PLATO value ?

--Same for  $R$  from interferometry  
 $R$  from seismology

If they disagree (at 3 sigma level ? ), just give a flag ?

If they agree within error bars, which one should be used as the PLATO value ?



**Other issue : consistency between the physical descriptions in model atmospheres and stellar interiors**

Important at the level of PLATO requested precisions