PLATO WP 121 Stellar models

General goal : - R* ~ 1%

- Age ~ 10% Correlated !

- Mplan ~ 10% M* : 2-3%

Our product : Grids of accurate stellar models and codes

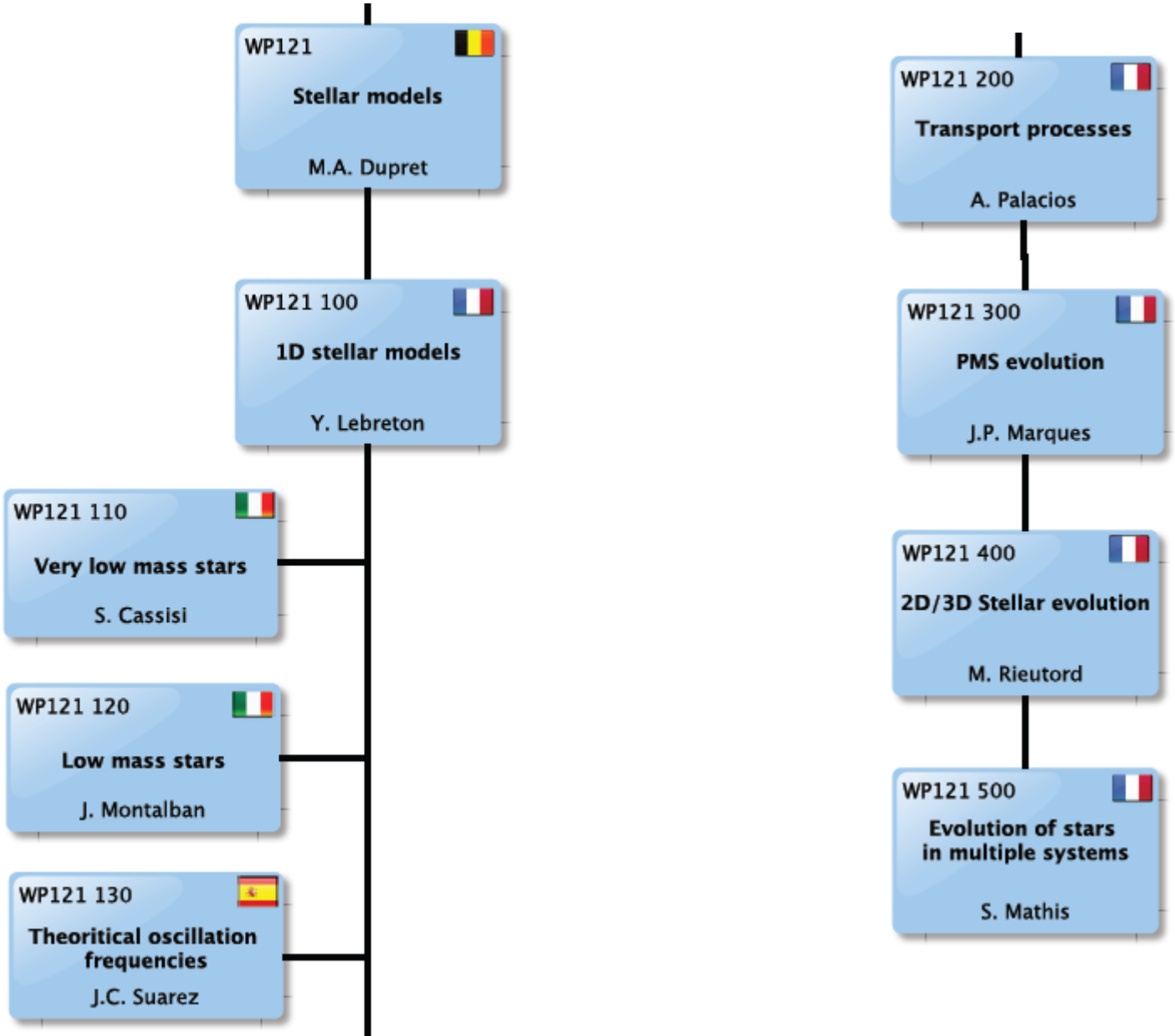
Quantification of uncertainties.

Our task : - Accurate stellar models

- Defining the parameter space of the grid

- Computing the grid

PLATO WP 121 Stellar models



PLATO WP 121 Stellar models

The sources of uncertainty :

Defining a strategy …

- One reference grid for the M,R, age measurements

- Procedure for error estimates

  - User friendly softwares to move in the parameter and physical assumption spaces

  - Discussion with WP124 (seismic diagnostics) and WP125 (Determination of stellar parameters)

  Forget isochrones fitting !!

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The sources of uncertainty :

Convection : MLT, CM, 3D

MLT : alpha must be calibrated

- Simus 3D
- Sismo (CoRoT-Kepler)
- Binaries

Other treatments: CM, …

Simus 3D : for calibration

Interaction with WP 122100 (3D sim. Asplund) and WP 123 200 (1D-3D Kupka)

Preliminary grid : sol calibrated MLT

Final grid : 3D-seismic-rotation-calibrated alpha

Other treatments for error estimates

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The sources of uncertainty :

Convection : Convective cores:

- Classical limits, μ-gradient region :

  Precise determination of Brunt-Vaisala freq.

- Overshooting : Extra-mixing only ? Diffusive ? Adiabatic gradient ? …

- Calibration :
  - Sismo (CoRoT-Kepler)
  - Binaries
  - Clusters
  - Simus 3D

  Preliminary grid : Extra-mixing only

  Final grid : Seismic-3D calibrated $alpha_{ov}$

- Undershooting ?

  Other treatments for error estimates

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The sources of uncertainty :

Transport of chemicals and angular momentum :

State of the art ? Microscopic diffusion, meridional circulation, rotational turbulence, waves, magnetic field, …

Impact on ages ?

What should be done ?

Asteroseismic constraints

- Could be a not so significant source of errors but must be justified through appropriate tests
- Included in error estimate procedure

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The sources of uncertainty :

- Opacities
- Equation of state
- Atmosphere models

Interaction with WP 122 (T. Morel)

We need a grid of 3D atmospheres from

WP 122100 (3D sim. Asplund) and WP 123 200 (1D-3D Kupka) !!

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The sources of uncertainty :

Advanced stages of evolution:

Very low mass stars

Specific difficulties ?

Mass loss

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Defining the parameter space of the grid

- Boundaries : [α_{MLT}], [α_{ov}], [Y], … ?

  How using CoRoT-Kepler's legacy ?

- Resolution ?

  Mixed modes in subgiants

  Input from WP124 and WP125

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Calendar

1. Our stellar evolution code

Quality criterion and comparisons of models

Proposition: Web portal for exchanges of models,

tests and comparisons, documentation, …

Taking legacy of previous studies (ESTA, …) into account.

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Interface with other WPs

Input from :

3D atmospheres

Resolution of the grid, mesh points, …

Requirements for scenario of minimization

Requirements from PDC, disk space, computation times…

Ranges of modes ?

Precision of theoretical frequencies

Range of metallicities

Rotation

Activity

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Output to :

Grid of models

Evolution and oscillation codes

Procedure for error estimates

Documentation about our softwares and our models

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Goal of the workpackage

State of the art

Specific developments

- Estimates of performances

- Tests of performances with expected PLATO data

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Specific developments

- Improvements of the tools: the stellar evolution code(s)
  - Biases on precision and accuracy
  - Improvements
  - Tests
  - Procedures for validation
  - Sample of benchmark observed stars

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Specific developments

- Preliminary schedule

- Organisation chart for the relations with other WP