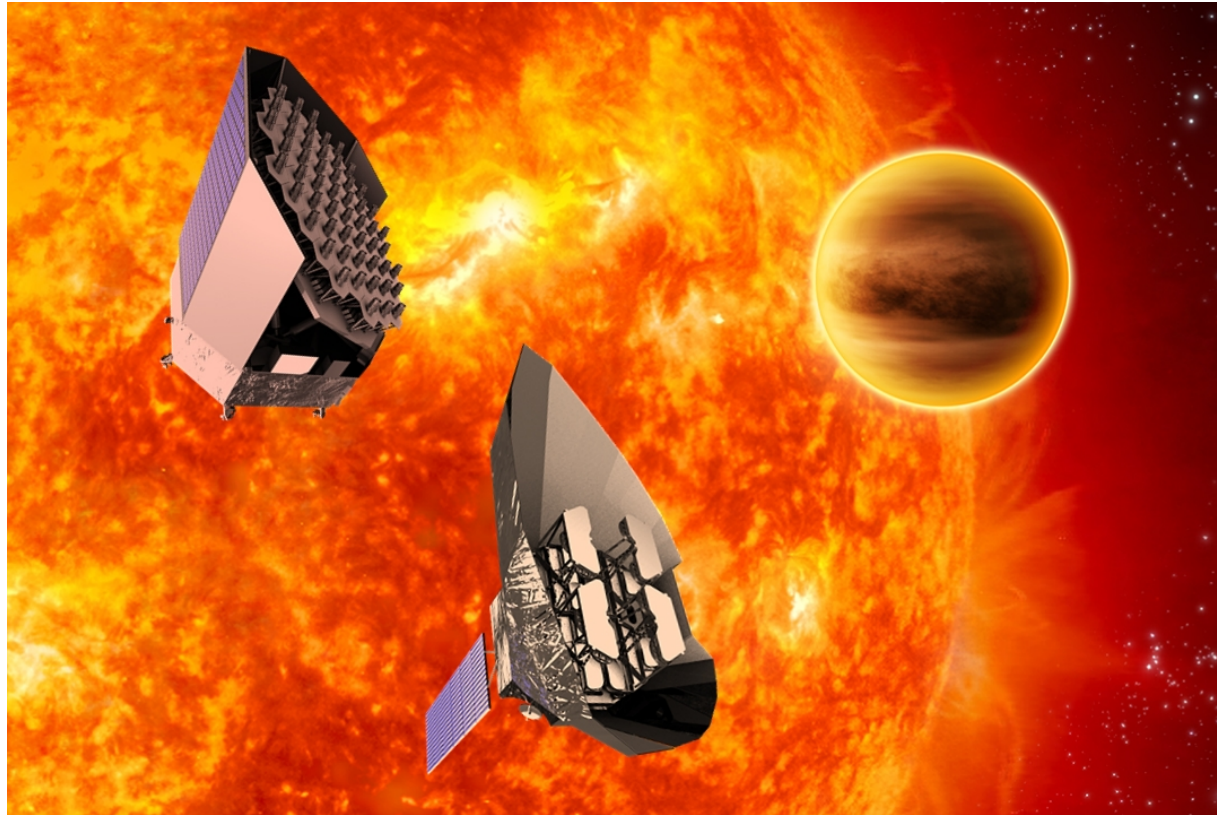# PDAAS: Exoplanet Analysis
Items for discussion in the parallel session
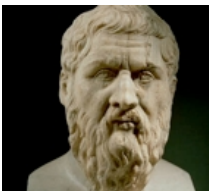

Nicholas Walton

(PLATO PDAAS Assessment Study Team)

Institute of Astronomy
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PDAAS: Delivering Key Plato Products

- The ultimate product of Plato is a catalogue of extra-solar planetary systems with associated characterisation information
  - Scientific exploitation of Plato planetary systems falls outside the scope of the PDAAS
- PDAAS will deliver the software infrastructure and analysis modules required to process the Plato data stream
  - Integration of Ground Based observations
- PDAAS will be responsible for the operation of the processing system

Building the PDAAS: items for consideration in the parallel sessions

- Development of data flow diagrams
  - Initial assessment of processing requirements
- Required inputs
  - core processing, supplemetary observations, simulations
- Assessment of key algorithms
  - Use of established algorithms
  - Those requiring further development
- Work Breakdown Structure
  - Initial assessment of development effort requirements
- Assessment of key 'risk' areas in the processing
  - Identification of key science/ technical challenges
- Work timelines
  - Study phase report will be required by mid May 2011!

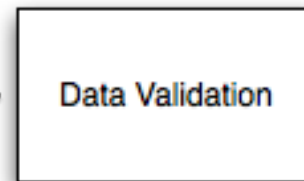# Assessment of what is required from the L0, L1 processing chain

- Validated light curves (Level 0) for all stars:
  - validated light curves and centroid curves for the 32+2 telescopes
  - CCD in-flight calibration / radiation damage
- Flux calibrated light curves (Level 1) for all stars:
  - NT flux-calibrated light curves and the centroid curves for each star, averaged over all 32 telescopes and their associated errors
  - two FT calibrated light curves and centroid curves for each star
  - data quality parameters
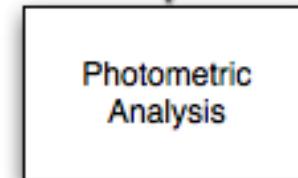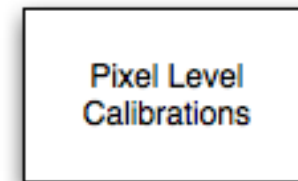 - improved environment analysis, specific for stars for which imagettes are available

Process Flow

- Definition of envisaged S/C on-board processing
  - Calibrated light curves transmitted to ground
  - Strategy for use of imagettes
- Baseline downlink rate → 109 Gb/day
  - How would increased downlink be best used?
- Processing data flow in L2
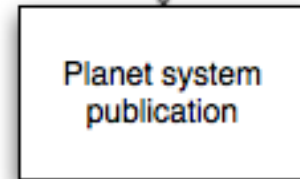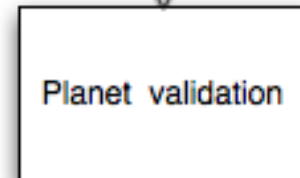- Advances over Corot and Kepler science pipelines
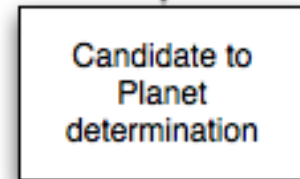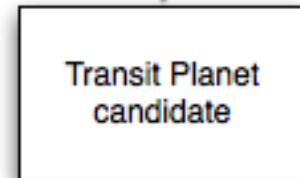
L0

Data Validation

L1

Pixel Level Calibrations

Photometric Analysis

L2

Light Curve Cleaning

Transit Planet candidate

Candidate to Planet determination
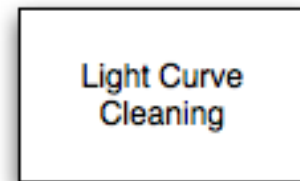
Planet validation

Planet system publication

ioa

27 May 2010

PDAAS Exoplanets: Outputs

- Transit candidates and their basic parameters
  - Ranking indicating planetary likelihood
- Planetary systems and their characteristics
  - List of confirmed planets, using follow-up observations
  - Assessment of false alarm probability
  - Potentially several hundreds of planetary systems for which the seismology of the central stars is possible.
  - Determination of the planet parameters: orbital parameters, planet size, mass, density (average composition), age (from central stars)
  - Any additional characterization of planet properties from follow-up observations and light curves analysis

Exoplanets: candidate to confirmed

- Analysis of required GB followup observations
- Requirement to assess form of these observations
  - ancillary observations to define input catalogue
  - ancillary observations to validate transit systems
- Organisation issues for GB programme
  - Large supporting observational programme(s)
  - Organisation of telescope applications (ESO agreements?)
  - Arrange access to (buy?) followup telescopes/instruments
  - Data analysis of ancillary observations
- Interface of results to the PDAAS

Gaia and Relevance to Plato

- Gaia launches August 2012
- Measures a billion stars: astrometry, photometry, radial velocities, spectroscopy
  - Proper motions, parallaxes $\rightarrow$ distances to 1% for 10^7 stars
  - Radial velocities (V < 17) to 10 kms^{-1}
  - Physical properties: M, L, log g, Teff, [Fe/H]
- Provides a rich resource for Plato or relevance for:
  - Plato input catalogue: aid in selecting cool dwarfs/ subgiants via Gaia astrometry and spectrophotometry
  - Characterisation of Plato targets: determine nature of nearby polluting objects
 - Gaia data crucial in characterising the impacts of jitter
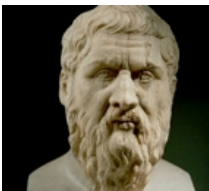
Exoplanet Outputs
Implications for Plato Data Releases

- Organisation/ operation of Plato data products archive
  - For use by the Plato team before/during/after the mission for data analysis and operations
- Organisation and operation of the public interface to the Plato data products
  - Key data
  - Applications and services to interpret Plato data
  - Interface to user provided value added information
- Scale of data and timelines for development
- Plato Data Access Policy
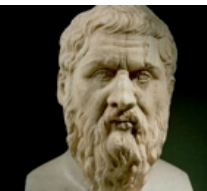
PDAAS: timelines

- Now – May 2011: Phase A study
- Mid June 2010 : ESA Plato AO call issued
- Mid Sept 2010 : Plato consortium response to AO
- May 2011: delivery of study report
- June 2011: down-select by ESA
- July 2011 – Dec 2011? : Phase B1 (definition phase)
- Timelines on required GB information
  - Requirement for input catalogue (due mid 2016)
  - Observational programmes from end 2017
  - Characterisation programmes for Plato fields pre 2017
- Plato launch: 2018
- 2019 onwards: first data releases (TBD)

Parallel Session Agenda
volunteer needed to take notes!

- 09:00 – 11.00
  - L2 exoplanet analysis work breakdown structure
    - Data flow to/from Asteroseismology/ stellar analysis
    - Process and Quality management
  - Key Challenges in meeting science goals
    - Major sources of noise
  - Algorithms
    - Data flow rates and processing implications
  - Requirements on input data from L0/ L1
    - Assessment of requirements on simulation data
  - Integration of Ground Based data/ Gaia data
  - Outputs to Archive
- 11:20 – 11:45: Conclusions
- 11:45 – 12.05: Feedback in Plenary