PyWD2015 – A New GUI for Wilson – Devinney Code

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• What is PyWD?
  – Why?
  – How?

• A Simple Example
  – Modelling a System
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What is PyWD?

• **Graphical user interface for Wilson – Devinney (WD) 2015**
  – Generates dcin and lcin files
  – Runs DC and LC programs
  – Visualises the outputs

• **Covers nearly all features of WD2015**
  – With the exception of subsets (will be included)

• **Has Additional User Tools**
  – Drawing critical Roche potentials, solution history, project management etc.
What is PyWD? - Why?

• 2 Main Reasons:
  – Currently, no GUI for WD2015
  – WD is a great “dedicated study” code
What is PyWD?
- How?

• Written in Python 2.7
  – Matplotlib
  – Numpy
  – Scipy

• Qt4 GUI Framework
  – Cross-platform (Linux and Windows tested)
A Simple Example
- Modelling a System

- Main Window
A Simple Example
- Modelling a System

- Loading Observations

![Loading Observations Panel]

<table>
<thead>
<tr>
<th>Filename</th>
<th>Type</th>
<th>Band</th>
</tr>
</thead>
<tbody>
<tr>
<td>KIC7385478_Vr1_PHASE.txt</td>
<td>Velocity Curve (#1)</td>
<td>KEPLER</td>
</tr>
<tr>
<td>KIC7385478_Vr2_PHASE.txt</td>
<td>Velocity Curve (#2)</td>
<td>KEPLER</td>
</tr>
<tr>
<td>KIC7385478_PHASED_INTENSITY.dat</td>
<td>Light Curve</td>
<td>KEPLER</td>
</tr>
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</table>
A Simple Example - Modelling a System

• Loading Observations
A Simple Example
- Modelling a System

- Adding spots
A Simple Example
- Modelling a System

- Eclipse timings

![Eclipse Timings](image)
### A Simple Example - Modelling a System

- **System Parameters**

![PyWD2015 System Parameters](image)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ephemeris</td>
<td>54954.534784</td>
</tr>
<tr>
<td>Semi-major axis</td>
<td>7.51</td>
</tr>
<tr>
<td>Q (M2/M1)</td>
<td>0.21</td>
</tr>
<tr>
<td>Period</td>
<td>1.655473</td>
</tr>
<tr>
<td>Omega (ω)</td>
<td>1.570796327</td>
</tr>
<tr>
<td>T1</td>
<td>7000</td>
</tr>
<tr>
<td>T2</td>
<td>4293</td>
</tr>
<tr>
<td>dP/dt</td>
<td>0</td>
</tr>
<tr>
<td>dω/dt</td>
<td>0</td>
</tr>
<tr>
<td>Phase Shift</td>
<td>0.0015983790</td>
</tr>
<tr>
<td>Inclination</td>
<td>70.966</td>
</tr>
<tr>
<td>V Unit</td>
<td>1</td>
</tr>
<tr>
<td>Eclipse semi-dur.</td>
<td>0</td>
</tr>
<tr>
<td>Log(distance)</td>
<td>1.83714</td>
</tr>
<tr>
<td>Gaussian abs.</td>
<td>1</td>
</tr>
<tr>
<td>Duration of Obs.</td>
<td>0</td>
</tr>
<tr>
<td>V Gamma</td>
<td>-16.2446</td>
</tr>
<tr>
<td>Pot1</td>
<td></td>
</tr>
<tr>
<td>Pot2</td>
<td></td>
</tr>
<tr>
<td>Conjunction</td>
<td></td>
</tr>
</tbody>
</table>
A Simple Example
- Modelling a System

• Surface Parameters
A Simple Example - Modelling a System

• Third Body Parameters
A Simple Example
- Modelling a System

• LC Tab
A Simple Example
- Modelling a System

- Synthetic Curves (MPAGE 1 and 2)
A Simple Example
- Modelling a System

- Spectral Line Profiles (MPAGE 3)
A Simple Example
- Modelling a System

- Component Dimensions (MPAGE 4)
A Simple Example
- Modelling a System

- Star Positions (MPAGE 5)
A Simple Example
- Modelling a System

- Roche Potentials
A Simple Example
- Modelling a System

• Star Positions (MPAGE 5)
A Simple Example
- Modelling a System

• Conjunction (MPAGE 6)

<table>
<thead>
<tr>
<th>HJD</th>
<th>Min Type</th>
<th>Date (D/M/Y) - Time (H:M:S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>58729.01322</td>
<td>1</td>
<td>2/9/2019 - 12:15:24.71</td>
</tr>
<tr>
<td>58733.97964</td>
<td>1</td>
<td>7/9/2019 - 11:27:12.29</td>
</tr>
<tr>
<td>58735.63512</td>
<td>1</td>
<td>9/9/2019 - 3:11:9.06</td>
</tr>
<tr>
<td>58734.80738</td>
<td>2</td>
<td>8/9/2019 - 7:19:10.65</td>
</tr>
<tr>
<td>58738.11833</td>
<td>2</td>
<td>11/9/2019 - 14:47:3.65</td>
</tr>
</tbody>
</table>
A Simple Example
- Modelling a System

- O – C (MPAGE 6)
A Simple Example
- Modelling a System

- DC Tab
A Simple Example
- Modelling a System

- Differential Corrections
A Simple Example
- Modelling a System

• Solution History
A Simple Example
- Additional User Tools

- Radius to Potential Conversion
A Simple Example
- Additional User Tools

- Temperature Estimation

![Temperature Estimation screenshot](image-url)

**PyWD2015**

**Radius to Ω Conversion**

<table>
<thead>
<tr>
<th>B - V (mag)</th>
<th>0.600 ± 0.100</th>
</tr>
</thead>
</table>

**Temperature Estimation**

**Calculate Temperature (K)**

- Gray (2005) 5910 ± 339
- Flower (1996) 5895 ± 361
- Drilling and Landolt (2000) 5876 ± 431
- Popper (1980) 5947 ± 360

**JD - UT Conversion**

<table>
<thead>
<tr>
<th>V - K (mag)</th>
<th>0.600 ± 0.100</th>
</tr>
</thead>
</table>

**Calculate Temperature (K)**

- Tokunaga (2000) 7339 ± 245
A Simple Example
- Additional User Tools

- JD – UT Conversion
Future

- **Code Refactoring**
  - Upgrading from Qt4 to Qt5
  - Major code rewrites
  - Still Python 2.7 (3.* ?)

- **Release & Beyond**
  - GitHub for releases, bug tracking and manuals
  - ???
Thanks to:

- Dr. Robert E. Wilson
- Dr. Walter van Hamme
- Dr. Dirk Terrell

- Dear listeners, for your patience