Eclipsing binaries in the SMC and LMC from OGLE-II data

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Abstract

We searched for eclipsing binaries of the Large Magellanic Cloud OGLE catalogue. We found 752 new eclipsing binary candidates in the LMC.

Reference

ECLIPSING BINARIES IN THE SMC AND LMC
from OGLE-II data
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1. OGLE-II data: a scientific gold mine

Photometric Time Series:
- Bulge Data: 220,000 Stars
- LMC, SMC Data: 68,000 Stars

- Microlensing events
- Planetary Transits
- Catalogues of Cepheids, RR Lyrae stars, eclipsing binaries
- Properties of Mira, Semi-Regular, Small Amplitude red variables
- Standard Candles
- Galactic Structure
- LMC in 3D
- Weird objects

Note: Prof. B. Paczynski looked at ~190,000 individual light curves! He is probably a record holder!

2. Eclipsing binaries in the LMC and SMC

Scientific Motivation: Comparison of eclipsing binary rates at different metallicities

* From an automated search of eclipsing binaries in OGLE-II data
  → already available in the literature

<table>
<thead>
<tr>
<th></th>
<th>LMC</th>
<th>SMC</th>
</tr>
</thead>
<tbody>
<tr>
<td># of fields</td>
<td>21</td>
<td>11</td>
</tr>
<tr>
<td># of stars</td>
<td>7,000,000</td>
<td>2,000,000</td>
</tr>
<tr>
<td># of variable stars</td>
<td>53,000</td>
<td>15,000</td>
</tr>
<tr>
<td>Fraction of variable stars</td>
<td>0.76%</td>
<td>0.75%</td>
</tr>
<tr>
<td># of eclipsing binaries</td>
<td>2,580</td>
<td>1,351</td>
</tr>
<tr>
<td>Fraction of eclipsing binaries among variable stars</td>
<td>4.90%</td>
<td>9%</td>
</tr>
</tbody>
</table>

According to this automated search, the fraction of eclipsing binaries in the SMC seems larger than in the LMC. The same observation holds when comparing the fraction of eclipsing binaries among Main Sequence B stars in the SMC and LMC.

* From a semi-automated search, per field
  → this work

752 new eclipsing binary candidates in the LMC!

Remarks:
- Brings the fraction of eclipsing binaries to 6.3% of the variable stars.
- 178 systems also found by Groenewegen (2005, A&A 439, 559)
- Further checks needed on candidate stars in overlapping fields, which will reduce this number.

* From a more detailed study as done by Mazeh → still to be done

3. Some “new” eclipsing binaries

4. Conclusion: a lesson for Gaia and other surveys

Gaia mission:
1 billion stars: 82 measurements per star over 5 years
2,000,000 – 3,000,000 estimated eclipsing binaries
Fully automated analysis planned.
The pipeline for variability processing will allow manual verification of individual stars or subgroups of stars

Importance to check outputs of automated processing
The current study shows that a semi-manual analysis of the results of automated processing is essential.
Semi-manual analysis is always possible on subsamples for statistical quality checks.

Note: Prof. B. Paczynski was very excited by the Gaia mission

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Prof. Paczynski’s genuine curiosity, his insassiable thirst for knowledge, his love for science and astronomy, his energetic enthusiasm for small and large projects, his generosity and continuous encouragements have been a source of inspiration for many who have known him.