Zweifarben-Fotometrie
und vorläufige Elemente für
CV Draconis und DD Draconis

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Zweifarben-Fotometrie und vorläufige Elemente
für CV Draconis und DD Draconis.

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Abstract: We report on photoelectric photometry of two variable stars in Draco made with an automatic photoelectric telescope. CV Dra, previously classified as irregular, turned out to be an eclipsing binary of the W UMa type and period 0.617, whereas DD Dra, previously classified as an eclipsing binary, is shown to be a pulsating variable of type RRc and period 0.326. Complete light curves in B and V are presented for both stars, and we give the epochs of minima resp. maxima derived from them.


Im Gegensatz zu der bereits erwähnten Voraus-Publikation sind alle in dieser Arbeit mitgeteilten Helligkeiten auf das Internationale UBV-System reduziert.

CV Draconis


Tabelle 1: CVC Draconis und Vergleichsstern

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CV Draconis</td>
<td></td>
<td>17h31m06s</td>
<td>+57°12'48&quot;</td>
<td>F5</td>
</tr>
<tr>
<td>Vergleichsstern</td>
<td>SAO</td>
<td>17h31m16s</td>
<td>+57°29'48&quot;</td>
<td>A2</td>
</tr>
<tr>
<td>Kontrollstern</td>
<td>SAO</td>
<td>17h28m56s</td>
<td>+57°31'13&quot;</td>
<td>K5</td>
</tr>
</tbody>
</table>
CV Draconis ist ein Bedeckungsveränderlicher vom Typ W Ursae Majoris. Aus insgesamt 323 Beobachtungen in V und 381 Beobachtungen in B, die wir am Ende der vorliegenden Arbeit in den Tabellen 7 und 8 einzeln ausweisen, konnten wir rechnerisch (parabolische Approximation in der Umgebung des Minimums) folgende heliozentrische Minimazeiten ermitteln:

Tabelle 2: Rechnerisch ermittelte Minimazeiten (HJD) für CV Dra

<table>
<thead>
<tr>
<th>V</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>2447288.4558</td>
<td>2447288.4563</td>
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<tr>
<td>293.3957</td>
<td>239.3983</td>
</tr>
<tr>
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<td>295.5575</td>
</tr>
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<td>305.4380</td>
<td>305.4400</td>
</tr>
<tr>
<td>308.5279</td>
<td>308.6281</td>
</tr>
</tbody>
</table>

Aus allen uns verfügbaren Minimazeiten leiten wir folgende Elemente für den Lichtwechsel ab:

\[
\text{Min I (HJD)} = 2447308.5277 + 006176214 \times E \ (\text{This paper})
\]

\[
\pm 5 \quad \pm 46
\]

Mit diesen Elementen lassen sich alle uns bekannten Minima wie folgt darstellen:

Tabelle 3: Verzeichnis der Minimazeiten von CV Dra

<table>
<thead>
<tr>
<th>Nr</th>
<th>HJD 24......</th>
<th>Art</th>
<th>Epoche</th>
<th>(B-R)</th>
<th>Beobachter/Quelle</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>47003.417</td>
<td>vis.</td>
<td>-494</td>
<td>-0.006</td>
<td>J. Fabregat (Locher, 1988)</td>
</tr>
<tr>
<td>2</td>
<td>47008.370</td>
<td>vis.</td>
<td>-486</td>
<td>+0.006</td>
<td>Wieck &amp; Wunder (Priv. comm.)</td>
</tr>
<tr>
<td>3</td>
<td>47276.405</td>
<td>pe(V)</td>
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<td>-0.006</td>
<td>F. Agerer (This paper)</td>
</tr>
<tr>
<td>4</td>
<td>47288.4561</td>
<td>pe(V,B)</td>
<td>-32.5</td>
<td>+0.0011</td>
<td>F. Agerer (This paper)</td>
</tr>
<tr>
<td>5</td>
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<td>pe(V,B)</td>
<td>-24.5</td>
<td>+0.0010</td>
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</tr>
<tr>
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<td>pe(V,B)</td>
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</tr>
<tr>
<td>7</td>
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<td>-0.0006</td>
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<tr>
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<td>+0.001</td>
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</tr>
<tr>
<td>10</td>
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<td>pe(V)</td>
<td>55</td>
<td>+0.000</td>
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</tbody>
</table>

Das Minimum 47276.405 wurde auf der Nürnberger Sternwarte beobachtet und uns von Herrn E. Wunder freundlicherweise zur Verfügung gestellt. Die Zeitpunkte der beiden letzten Minima wurden graphisch bestimmt.

Aus den Lichtkurven von CV Dra (Abb. 1) lesen wir die in der Tabelle 4 mitgeteilten Werte für die Amplituden ab.

Tabelle 4: Amplituden von CV Dra

<table>
<thead>
<tr>
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<th>Min I</th>
<th>Min II</th>
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</thead>
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<tr>
<td>V</td>
<td>0°43</td>
<td>0°40</td>
</tr>
<tr>
<td>B</td>
<td>0°44</td>
<td>0°41</td>
</tr>
</tbody>
</table>
Im zweiten Maximum ist das System in beiden Farben um $0^\circ 02$ schwächer als im ersten Maximum. Ferner ist aus den Lichtkurven wie auch aus der Tabelle 3 zu ersehen, dass das Min II gegen die Phase 0.5 geringfügig verschoben zu sein scheint.
DD Draconis


\[ \text{Min} = 2131587.248 + 0^4 784 \times E \] (Filatov, 1960)

ab. Mit diesen Elementen wurde der Veränderliche in die 4. Ausgabe des GCVS (Kholopov et al., 1985) erstmals aufgenommen.

Die sehr ungenaue Periode war für uns zunächst der Anlass, die von Filatov mitgeteilten neun Zeiten von Plattenschwächen einer Nachprüfung zu unterziehen. Dabei stellten wir fest, dass sich diese Minimazeiten mit einer Periode von 0.563 Tagen wesentlich besser darstellen lassen, wobei zwischen diesen beiden Perioden die Scheinperiodenbeziehung

\[ \frac{1}{0.563} - \frac{1}{0.784} = \frac{1}{2} \]

besteht. Zur Klärung der Diskrepanz setzten wir DD Draconis auf unser Beobachtungsprogramm.

**Tabelle 5: DD Draconis und Vergleichsstern**

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
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<td>DD Draconis</td>
<td></td>
<td>18^h43^m29^s</td>
<td>+60°43'06&quot;</td>
<td>B9</td>
</tr>
<tr>
<td>Vergleichsstern</td>
<td>Anonyma</td>
<td>18^h43^m16^s</td>
<td>+60°35'10&quot;</td>
<td>--</td>
</tr>
<tr>
<td>Kontrollstern</td>
<td>SAO 018015</td>
<td>18^h46^m16^s</td>
<td>+60°40'26&quot;</td>
<td>K2</td>
</tr>
</tbody>
</table>


Unsere Beobachtungen ergaben, dass DD Draconis kein Bedeckungsveränderlicher, sondern ein Pulsationsveränderlicher vom Typ RRc ist. Aus jeweils 146 Messungen in V und in B erhielten wir die in Abb. 2 dargestellten Lichtkurven. Weiterhin konnten wir aus unseren Beobachtungen graphisch drei Maxima ableiten und somit erste Elemente für den Lichtwechsel bestimmen:

\[ \text{Max (HJD)} = 2447271.460 + 0^4 32673 \times E \] (This paper) \[ \pm 1 \]

Mit diesen Elementen stellen wir unsere Maxima folgendermassen dar:

**Tabelle 6: Verzeichnis der Maximazeiten (HJD) von DD Dra**

<table>
<thead>
<tr>
<th>Nr</th>
<th>HJD 24.....</th>
<th>Art</th>
<th>Epocbe</th>
<th>(B-R)</th>
<th>Beobachter/Quelle</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>F. Agerer (This paper)</td>
</tr>
<tr>
<td>2</td>
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<td>47306.420</td>
<td>pe(V)</td>
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</table>
Aus den in der Abb. 2 gegebenen Lichtkurven ermitteln wir die Amplituden zu 0,54 für V und 0,66 für B.

Für den physikalisch veränderlichen DD Draconis listern wir keine Meßwerte in dieser Arbeit nicht einzeln auf. Interessenten können sie jedoch bei der "Berliner Arbeitsgemeinschaft für veränderliche Sterne (BAV)", Münsterdamm 90, D-1000 Berlin 41, anfordern.

Herr B.-G. Kämper (Sternwarte der Universität Bonn) hat uns bei unserer Arbeit tatkräftig unterstützt und Herrn Prof. Dr. E. Geyer (Observatorium Hoher List) verdanken wir viele nützliche Ratschläge. Beiden Herren sei an dieser Stelle dafür herzlich gedankt.

F. Agerer  
Dorffstr. 19  
D-8311 Zweikirchen-Tiefenb.

D. Lichtenknecker  
Paul Bellefroidlaan 29  
B-3500 Hasselt
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<tr>
<th>Beob. Datum</th>
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</tr>
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<td>Beob. Datum</td>
<td>$\Delta m(V)$</td>
<td>Beob. Datum</td>
<td>$\Delta m(V)$</td>
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**Literatur:**

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