

um die verschiedenen Farben der Sterne einer Himmelsgegend zu erkennen. Man hat nur nötig, die zwei gleichzeitigen Aufnahmen eines Doppelrefraktors, wie ich sie seit Jahren empfohlen habe, stereoskopisch zu vergleichen, um sofort alle stark verschieden gefärbten Sterne in verschiedenen Tiefen plastisch im Raume vor sich zu sehen.

Aus diesen Untersuchungen folgt auch, daß man oft aus länger exponierten photographischen Himmelsaufnahmen kaum Koordinaten von Sternen wird ableiten können, die Anspruch auf größere Genauigkeit machen.

Auf weitere Einzelheiten möchte ich mich an dieser Stelle nicht einlassen; aber darauf möchte ich hinweisen, daß man vor jeder Parallaxenbestimmung die Anschlußsterne stereoskopisch untersuchen und diejenigen auswählen soll, die eine größtmögliche Bürgschaft bieten, daß die Parallaxe nicht durch den Dispersionsfehler überdeckt wird. Einer stereoskopischen Messung dieses Fehlers steht natürlich auch nichts im Wege.

Noch eine andere Anwendung von ebenso großer Trag-

weite verspricht die Methode. Das Anzeichnen der kleinen Nebelflecke auf meinen Platten zum Zweck der Vermessung für meine Kataloge vollführe ich stets im Stereokomparator. Die stereoskopische Vergleichung zweier Aufnahmen bietet die Bürgschaft, daß man kein falsches Objekt markiert und in den Katalog aufnimmt. Dabei zeigte sich, daß ein großer Teil der Nebelflecken in anderer Tiefe erschien als die benachbarten Sterne. Das ist selbstverständlich gerade wie im obigen Falle eine Wirkung des Spektrums in Verbindung mit der Refraktion oder der Strahlenvereinigung der Linsen. Hat man nun einen sich als Nebelfleck präsentierenden kleinen Sternhaufen, der aus Sternen mit Durchschnittsspektrum zusammengesetzt ist, so muß das Objekt in derselben Tiefe wie die kleinen Nachbarsterne schweben. Ist es aber ein gasförmiger Nebelfleck, von eigenartigem Spektrum, so tritt es aus der Ebene des Grundes wahrnehmbar heraus. Wenn es sich also um schwache Objekte handelt, an die das Spektroskop nicht hinreicht, dann bietet das Stereoskop die Möglichkeit, Gasnebel von Sternhaufen zu unterscheiden.

Astrophys. Institut Königstuhl-Heidelberg, 1906 April 3.

Max Wolf.

## A Durchmusterung of variable stars.

(Harvard College Observatory Circular No. 116).

The plan described below for a Durchmusterung of variable stars has been proposed by Prof. *Solon I. Bailey*.

Certain regions of the sky have now been systematically examined for the discovery of variable stars, the number of which has already increased to more than three thousand. Taking into consideration the immense amount of work which is being carried forward in this line at the observatories of Harvard, Heidelberg, Moscow, and elsewhere, the right time appears to have come for concerted action among astronomers, looking toward a systematic examination of the whole sky, in order to determine the number and distribution of all variable stars, to the faintest magnitudes possible. Otherwise there may be needless duplication in the search, and, as a result, unfortunate waste of labor.

The objection may be made that, if the examination is extended to the whole sky, the number of variables will be so great that their careful observation will be impossible. This may be true; but at least we shall be able to study the distribution of the variable stars, and learn what part they play in the construction of the stellar universe. Since all variables will tend to fall into a few well-defined classes, an examination only sufficient for classification will be necessary for the greater part of them, and elaborate researches will need to be extended only to representative types, and to objects of special interest. A Durchmusterung of variable stars, therefore, would be a worthy achievement for the present generation of observers.

While we recognize the eminent service which has been rendered during the last century by visual observers, it is certain that photographic methods now yield vastly greater results for a given expenditure of time. This is especially true for densely crowded and faint stars. For a

study of the whole sky, the plates should be taken with a telescope of the form known as a photographic doublet, since this gives good definition over a large area. This plan would leave, nevertheless, extended fields of investigation, for those who have instruments of other forms, such as the study of clusters, nebulous regions of small extent, and other special objects. This scheme offers to amateur astronomers an opportunity to take part in a research of permanent value. There are a number of suitable instruments in the possession of those in charge of small observatories, or of amateurs, who can give only limited time to astronomical research; but the thorough and systematic examination of even small portions of the sky would have high value, irrespective of the number of variable stars discovered.

It is undesirable at present to divide the sky into definite areas, and to assign them, by means of some variable-star committee, to the different institutions and observers taking part in such a research. The field is so vast that it will probably be sufficient for each observer to indicate the regions which he prefers to examine. If, after all, a certain amount of duplication takes place, it may be useful, as providing a check on the results obtained by different observers.

For a discussion of the distribution of variable stars it seems absolutely essential that all stars, which surely vary, should be included. No variable should be omitted because its range of variation is so small that it seems to be lacking in interest. While the inclusion of doubtful objects is objectionable, the exclusion of any stars which really vary is still more unwise. Also, all stars which appear on the plates, in the regions selected, should be examined, and the published results should include, if possible, not only the

variables found, but also the approximate number of the stars examined. Negative results are next in importance to the discovery of new variables. In a discussion of the distribution, a region void of variables would have nearly the same interest as a rich region like the Small Magellanic Cloud, which contains a thousand variables.

It is hoped that exposures of one or better two hours can be used, and photographic telescopes of eight inches, or more, aperture. This may be expected to show stars as faint as the sixteenth magnitude. An examination of several plates of each region is desirable in order to make the search reasonably complete. The variability should also be confirmed by a second observer.

There should be complete freedom for each observer to use such methods of examination, discussion, and publication, as seem best to him.

Various methods for comparing stellar images on different plates have been used with success. In globular clusters, where the stars are too closely packed to make the method of superposing one plate on another seem feasible, all the stars in a small area were arranged in a sequence in order of brightness, and this sequence was kept in mind while successive plates, usually ten in number, were examined. In the Magellanic Clouds and elsewhere, on the Bruce plates, a positive is made from one negative, on which another negative is superposed, so that bright and dark images of the same stars are seen together. This method is found in practice exceedingly successful and rapid. At some obser-

vatories a stereocomparator is employed. Several exposures on the same plate, but taken at different times, may be used. But in order to find variables of long period in this way the exposures should be distributed over several months, at least. When the period is very close to one day, or a submultiple of a day, plates taken at about the same hour on successive nights will fail to show any variation. They must be taken at different hours of the night, or separated by long intervals. Of course, a variable with a period of precisely one day and with a maximum, or minimum, extending throughout the night, would never be discovered by an observer working at a single station. Special methods for detecting variables, such as the observation of bright hydrogen lines in the spectra of stars of the third type, are probably not practicable for such a Durchmusterung.

The number of stars in the sky of the sixteenth magnitude and brighter is not accurately known, but may be estimated at fifty millions. The comparison of such a vast number of stars on several plates is indeed so great an undertaking, that at first it seems impossible. By the rapid methods of photography, however, this work is probably not too extensive for the present generation of variable-star observers, provided systematic methods are employed, and duplication is avoided. The photographs made for this purpose, also, will be valuable for other lines of astronomical research.

Should this plan of cooperation meet the approval of astronomers, the Harvard Observatory will be glad to undertake its part.

Harvard College Observatory, 1906 May 11.

*E. C. Pickering.*

## Beobachtungen des Kometen 1905 IV (1906 b)

am 9<sup>1</sup>/<sub>2</sub>-zölligen Refraktor der Hamburger Sternwarte.

1906	M. Z. Hamb.	$\Delta\alpha$	$\Delta\delta$	Vgl.	$\alpha$ app.	$\log p.A$	$\delta$ app.	$\log p.A$	Red. ad l. app.	*
März 29	9 <sup>h</sup> 44 <sup>m</sup> 30 <sup>s</sup>	+1 <sup>m</sup> 23 <sup>s</sup> 63	-6' 26".9	24,4	11 <sup>h</sup> 25 <sup>m</sup> 15 <sup>s</sup> 50	9.055 <sub>n</sub>	+2° 16' 43".5	0.838	+1 <sup>s</sup> 19 -8".9	1
April 1	9 51 38	+0 22.66	-3 4.1	20,5	11 24 14.52	8.924 <sub>n</sub>	+2 20 6.3	0.837	+1.18 -8.9	1
3	11 8 6	-0 15.81	-0 55.4	16,4	11 23 36.05	8.658	+2 22 15.0	0.837	+1.18 -8.9	1
Mai 12	10 36 41	-0 6.87	-0 24.6	6,5	11 21 52.76	9.340	+2 6 9.1	0.841	+0.88 -7.5	2

### Vergleichsterne.

*	$\alpha$ 1906.0	$\delta$ 1906.0	Autorität
1	11 <sup>h</sup> 23 <sup>m</sup> 50 <sup>s</sup> 68	+2° 23' 19".3	AG. Albany 4288
2	11 21 58.75	+2 6 41.2	12 <sup>m</sup> . Anschl. Hamb. an * 19 und 22 in A. N. 171.76

### Bemerkungen.

März 29. Gesamthelligkeit 10<sup>m</sup> 4, Kern 10<sup>m</sup> 8, kurzer Schweif im PW. 280°; Pointierung gut. — April 1. Gesamthelligkeit 11<sup>m</sup> 0, Kern 11<sup>m</sup> 3, kurzer Schweif deutlich erkennbar. — April 3. Komet trotz Mondschein (Mondalter 10<sup>o</sup> 0) gut sichtbar. — April 24 war der Komet in unserem Refraktor bei leidlich klarem Himmel nicht zu erkennen. — Mai 12. Komet eben noch erkennbar, etwa 0<sup>m</sup> 3 schwächer

als der Anschlußstern. — Mai 13. Anschluß trotz guter Luft nicht mehr möglich; Komet 0<sup>m</sup> 2 schwächer als obiger Anschlußstern 2 (12<sup>m</sup>) und 0<sup>m</sup> 1 schwächer als ein Stern 12<sup>m</sup>, nördlich vorangehend dem Stern BD. +2° 24' 29". — Mai 22. Komet trotz sehr durchsichtiger, klarer Luft nicht mehr aufzufinden.

Hamburg, Sternwarte, 1906 Mai 26.

*K. Graff.*