A New "Cave-Nebula" in Cepheus. By Max Wolf, Ph.D.
(Plate 6.)

I have the pleasure to announce the discovery of a new interesting nebula in the midst of the constellation of Cepheus.

The nebula was found by Dr. Kopff on a plate taken by him with my Bruce-telescope on the night of October 21st, 1908, and I photographed the object as soon as possible with our reflector. It has a very remarkable shape; and, as it forms an important addition to this class of nebulae, I forward the accompanying description.

The nebula involves the star B.D. $+69°$, 1231:

$$\alpha = 22^{\mathrm{h}}\ 10^{\mathrm{m}}\ 1^{\mathrm{s}},\quad \delta = +69°\ 31'{\cdot}7\quad (1855{\cdot}0),$$

which is given in the *B.D.* as 8·8 magnitude. This star was observed in three zones of the Christiania A.G. Catalogue where it has the number 3552 and is given as a star of magnitude 8·9, without any remark. The bright star visible south-west of the nebula on the photograph is B.D. $+69°$, 1228; it is given as 5·5 mag. in the same Catalogue. This nebula is a good example of the singular phenomenon of cave-formation amongst Milky Way stars. In some respects it shows the general characteristics of other cave-nebulæ, but it also offers several new features. It forms the end of a long starless lacuna, directed from south to north, resembling that of the T Cephei nebula. It has a bright condensation seen visually as a star of the ninth magnitude; it shows waves similar to those in the π_2 Cygni and T Cephei nebulæ, but has dark spaces north of the brighter parts, which seem darker than the sky in the neighbourhood. Round these dark spots extremely faint nebulous material is spread over the lacuna. The lacuna itself is about 1° to 2° long from south to north, and about 7′ to 10′ broad, but can be traced, with some interruptions, much further north. At about $22^{\mathrm{h}}\ 10^{\mathrm{m}}, +70°{\cdot}0$ a bridge of stars traverses the long lacuna from east to west.

All over the cave lies a network of still darker spots and channels. This raises the hope that we may understand the interesting process more thoroughly at some future time, when we can photograph the region in more detail with greater optical power.

The bright southern edge of the nebula overlaps the region still filled with faint stars. So we find here, as already noted in some other objects, that the stars do not begin to decrease in number at the exact border of the visible nebula, but somewhat within it. The same was the case with the Z Orionis, the ψ Eridani, and other nebulæ. All such nebulæ have one border of great intensity, and this border overlaps the stars.

Some fine, complicated, but very small dark channels are visible in the south-western edge, near the stellar nucleus.

The reproduction given here is from a plate taken by me with the 28-inch Waltz-reflector of this observatory, November 16th, 1908, with two and a half hours' exposure through thin clouds.

Astrophysical Observatory, Heidelberg:
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An Improved Telescope Triple Object-Glass.
By J. William Gifford. (Plate 7.)

(*Communicated by Sir David Gill, K.C.B.*).

The idea of employing three separate kinds of glass for the purpose of eliminating the secondary spectrum from the object-glasses of telescopes is not new. With the more limited choice of optical glass then possible, the problem was attacked successfully some thirty years ago by Sir Howard Grubb, Hastings, and Shroeder, and in more recent years by Abbe, Dennis Taylor, and Harting. Of the earlier workers, that of Hastings has come more immediately to my notice. Hastings draws attention (*Amer. Journ. Science and Arts*, vol. xviii., No. 108, p. 433) to the inaccurate measurements of the optical constants at his disposal, and attributes some anomalies in his results to this cause alone. Before proceeding further, it is my purpose to refer to a series of measurements of the optical constants of glasses which I have made for the purpose of comparison with those sent out by the makers, and from some of which the triple referred to and other lenses have been made.

The system adopted for making the measurements has already been described (*Roy. Soc. Proc.*, Feb. 13, 1902). Briefly, it is independent of measurements of angle. By means of a temperature refraction coefficient the indices are all brought to a temperature of 15° C., and by a new system of illumination greater accuracy in reading the goniometer circle is ensured. In all, 14 different glasses have been measured for the following wave-lengths:—

A′. 7682·45 (K_α)	E. 5270·11 (Fe)
B′. 7065·59 (He)	F. 4861·49 (H_β)
C. 6563·04 (H_α)	Φ. 4678·35 (Cd_6)
D. 5893·17 (Na)	G′. 4340·66 (H_γ)
Λ. 5607·1 (Pb)	

Seven of these have also been measured for wave-length H′ 3961·68 (Al), and the seven others for wave-lengths 4553·0 (Pt) 4415·0 (Cd).

By this we get a range of refractive indices for line D from 1·501118 (light Borosilicate crown) to 1·746410 (extra dense flint); and if the indices are placed in columns in ascending series by interpolating between corresponding elements in contiguous columns, it is easy to check any considerable errors in a glass whose optical position lies between those of the glasses to which the columns correspond.

It may be taken that all errors lower than the 5th. decimal place have been eliminated, and that in this place there are few greater than unity. The various lenses which have been calculated from these measurements, and since constructed by Hilger, have