

tion of new kinds of *glass* that has enabled Abbe to work out the conditions of practical apochromatism.

In the same volume, p. 848f, Zeiss's catalogue, "Neue Mikroskop-Objective und Okularen aus Special-Gläser des Glastechnischen Laboratoriums" (Schott und Gen.), is reproduced "nearly *in extenso*." The same suggestion that only the new *glasses* are relied on is present throughout. Thus: "The objectives, however, like all productions of our firm, stand on an absolutely free basis. The glass employed is, by our own instrumentality, accessible to anyone, and no optician is in the least degree prevented from producing the same objectives as good and as cheap as he can." This is followed by extracts from the pamphlet by Abbe and Schott describing the new *glasses*, with their optical and other properties and prices. The abstractor seems by this time to have some suspicions as to whether scientific candour is not here tempered with commercial reticence, for he goes on:—

"Suggestions are made as to the glass best suited for various purposes, and on commencing the perusal of these passages we had the idea that we were coming to a description of the *glass* used for the new objectives. The following ingeniously worded paragraph, however, closes the subject.

"In the case of microscopic objectives which require for the attainment of the highest capacity of performance not only agreement in the course of the dispersion of the crown and the flint, but also the correction of the spherical aberration and its chromatic difference, it must be left to the skill of the practical optician to choose the most suitable means from the above series. The new objectives of Zeiss show what can be attained by their practical use."

We now pass to vol. vii., containing (p. 20f) a paper read before the Royal Microscopical Society on October 13, 1886, entitled "On Improvements in the Microscope with the Aid of *New Kinds of Optical Glass*." Its contents fully justify the title; throughout the same suggestion is made that the *glasses* are alone responsible for enabling the optician to attain the improvements connoted by the term apochromatism.

(I must state that the italics in the cited passages are all mine.)

Three comments will close this somewhat long letter:—

(1) Prof. Abbe, of Jena, was the brother-in-law of Carl Zeiss, the "practical optician" of Jena.

(2) It was soon discovered that one lens of fluorite (or flourspar), the native fluoride of calcium, was an essential component of the apochromatic objective, as well as certain of the new *glasses*.

(3) Before the new lenses were placed on the market the house of Zeiss had, as they believed, secured the whole supply of colourless, flawless fluorite, suitable for optical purposes, which, like so many minerals, is restricted to few localities. MARCUS HARTOG.

Cork, April 6

PROF. HARTOG, in his "comments" Nos. 2 and 3, revives an old charge which was made by Mr. Lewis Wright in the *English Mechanic* (1892), pp. 220–221. Mr. Lewis Wright, in speaking of the use of flourspar in the production of apochromatic objectives, there states:—

"Though some of them have managed to secure a little supply, others are painfully aware that before the use of fluorite was allowed to become public all the known available material had been secured by the firm of Zeiss at Jena; and the difficulty of getting material experienced by some of our best makers is a formidable obstacle to optical improvements and tends to artificially keep up the prices."

This charge was replied to and repudiated by Dr. Czapski, in a letter which appeared in the same

volume of the *English Mechanic*, p. 287. Dr. Czapski in this letter states:—

"As regards flourspar, Mr. Lewis Wright is labouring under a great delusion in assuming that before the use of fluorite was allowed to become public, all the known available material had been secured by the firm of Zeiss at Jena. The contrary may be said with more truth. The firm of Zeiss possessed but a very scanty supply at a time when, even previous to Mr. Koristka's groundless attacks in the *Journal de Micrographie*, the fact that flourspar was being used in the apochromatic lenses had been published three times in consequence of information supplied by the firm of Zeiss.

"The latter were completely prepared to produce their future apochromatic lenses without having recourse to flourspar, which by no means constitutes the condition *sine quâ non* for the production of apochromatic objectives, excepting, of course, in the case of such opticians who can only produce them by slavishly copying existing systems. As, however, the firm became eventually possessed of a considerable quantity of clear material, the employment of fluorite in their apochromatic lenses was continued."

The letters referred to above are reproduced in the *Journal of the Royal Microscopical Society* for 1892, pp. 552–555, from which the above quotations are taken.

I may be allowed to add that if Prof. Abbe and the firm of Carl Zeiss had wished to play the "dog-in-the-manger," they could easily have done so by taking out a patent for the application of the principle of apochromatic construction to microscope objectives. Prof. Abbe's "ethics," however, would not permit of this being done. He, I believe, held that since microscope objectives were practically entirely used for the purposes of scientific research, the taking out of a patent for them would have acted prejudicially to the best interests of science in general.

F. J. CHESHIRE.

The Remarkable Meteors of February 9, 1913.

THE large meteors which passed over Northern America on February 9, 1913, presented some unique features. The length of their observed flight was about 2600 miles, and they must have been moving in paths concentric, or nearly concentric, with the earth's surface, so that they temporarily formed new terrestrial satellites. Their height was about 42 miles, and in the *Journal of the R.A.S. of Canada* there are 70 pages occupied with the observations and deductions made from them by Prof. C. A. Chant.

The meteors were last seen from the Bermuda Islands, according to the descriptions in the journal named (May–June, 1913).

I have since made efforts to obtain further observations from seafaring men through the medium of the *Nautical Magazine*, and have succeeded in procuring data which prove that the meteors were observed during a course of 5500 miles from about lat. 51° N., long. 107° W., to lat. 5½° S., long. 32½° W.

Mr. W. W. Waddell, first mate of the s.s. *Newlands*, writes me that at 12.13 p.m., February 9, 1913, he saw a brilliant stream of meteors passing from the N.W. to the S.E. during a period of six minutes. The ship was in lat. 3° 20' S. and long. 32° 30' W. at the time. He says the meteors disappeared in the region of Argo to the south, and I have assumed they were over about lat. 5½° S. and long. 32½° W. when he lost sight of them.

Such an extended trajectory is without parallel in this branch of astronomy. Further reports from navigators in the South Atlantic Ocean might show that the observed flight was even greater than 5500 miles.

W. F. DENNING.

44 Egerton Road, Bristol.