Minutes of the Ordinary Monthly Meeting of the Cape Centre of the Astronomical Society of Southern Africa held at the Observatory, Cape Town on Wednesday November 14th at 8p.m.

Chairman Mr Molyneaux opened the meeting and extended a welcome to the 30 or so people present.

Apologies were received from Miss Parker, Mr Saville and Mr Utley.

The minutes were signed after being read and accepted.

Matters arising - nil.

Mr Molyneaux made several announcements:

1) He has arranged for binding Sky and Telescope at R3-85 per volume. Any member wishing to use this service should see the Chairman.
2) As this was the last meeting for the year, the next meeting would be held on the second week in February.
3) Mr Niel had displayed a copy of Patrick Moore's "The Starlit Sky" magazine, available for R2-75 delivered.
4) Mr passed around photographs of a telescope he was making out of wood, and the photographs revealed outstanding workmanship on the instrument.
5) Mr Churms said that Comet Kohutek was near its predicted minimum at the moment rather than its predicted maximum. Two

weeks ago it was of mag. 7-8. Mr Hurley and Mr Molyneaux intend to set up telescopes on the Rondebosch Common and at Sea Point in January for the viewing public, and organize notices to the press.

The Chairman then introduced Dr Fuhr who spoke on "Objective Lenses".

Dr Fuhr said that, as an amateur he was biassed in favour of the refractor. Comparing the advantages of reflectors over refractors, Dr Fuhr said that reflectors are superior in their freedom from chromatic abberation, in their light gathering power & in their ease of construction because only one glass surface needed to be ground. Reflectors are also smaller than the corresponding refractors; simpler to mount with short, stout tubes; easier to handle; and are cheap, being half to a quarter the price of a refractor, even for home-made instruments.

Refractors, however, often have better definition, suffer less from effects of changes in temperature, suffer less scattered light & have a greater magnifying power, so weaker eyepieces can be used. Short focus eyepieces introduce troubles, especially if you are looking at details on planets. Refractors also provide a better size of useable field and the upkeep of the lens system is easy. Crown glass is resistant during the cleaning process, no silver is required, and no re-alignment is needed after silvering. Furthermore, a refractor is mechanically robust and can be bumped.

Choice of telescope for the amateur should be determined by two considerations: average seeing conditions at the place of observation; and the objects desired to be viewed. Here in the Cape variables and lunar occulations are common objects of interest for the amateur, and for such objects a refractor is a better choice. An attractive velvety black field can be obtained, especially if suitable ~~diapragms~~ diaphragms are employed. For variables a black field is of great importance, though reflectors are also good. However, a 3"-4" refractor is equivalent to a 6" reflector, considering air conditions, so a refractor is a more suitable instrument for amateurs in Cape Town and vicinity. However, if price is the major consideration, a simply constructed reflector is better for the amateur.

Dr Fuhr then went on to discuss the properties of lenses, beginning with the single lens. Here the biconvex lens is the simplest form, and gives a good image near the optical axis i.e. a small aperture and long focal length is its characteristic.

The troublesome spherical abberation can be reduced by either (a) choosing two lenses whose two spherical abberations cancel each other out or (b) using a technique called "bending" the lens — on paper by using the formula $\frac{1}{f} = (n-1)\left(\frac{1}{r_1} + \frac{1}{r_2}\right)$

To deal with another problem — that of chromatic abberation, two types of glass with different dispersions are used to form an achromatic doublet e.g. a crown glass lens with a concave thin lens.

Achromats, however, still have colour left over, and this is the "secondary spectrum" which increases as the aperture increases. This can be counteracted by using a long focus. This desired focal length for the production of a colourless image by an achromatic doublet is calculated using the formula $f_{min} = 5A^2$ (A in inches), or, for a single lens, $f = 100A^2$. Application of this formula leads to the following desirable focal lengths: 20" for a 2" objective, 45" for a 3" objective (f/15) and 80" for a 4" objective (f/20).

The advantage of a long focus thus emerges - it reduces the light of the image and produces freedom from colour (the secondary spectrum).

Colour can be reduced further by adding a third lens to the doublet. This is useful for photography as well as visual observation.

Is it better to buy lenses or make them? Before the war it was better to make your own. With the advent of war lenses were mass produced and the market was flooded afterwards. Therefore any lens upto 3" could be bought cheaply.

A useful rule for magnification is 50 per inch of diameter. Therefore, for a 2" refractor under excellent seeing conditions x100 is possible. For average seeing about 60% of this is normal.

Dr Fuhr said that it should be possible for every school in South Africa to have a good 3½" refractor, f.l. 40" for R35.

Turning to the making of a lens by the amateur, Dr Fuhr displayed a home-made spherometer – simple, but impressive. An optically flat surface, if needed, could be obtained from random testing of broken pieces of ¼" plate glass with a mercury vapour light and Newton's rings. In Dr Fuhr's case he borrowed a 3" optical flat for an evening as the test surface, and this is obviously the best procedure.

Dr Fuhr then went on to describe how he made a doublet consisting of a double convex crown lens, radii $R_1$ and $R_2$, and a convex-concave flint glass lens, radii $R_3$ and $R_4$; 3" diameter for a 45" f.l. telescope. He referred to the textbook by Conrady "Applied Optics + Optical Design" for such figures as $R_1 = 0{,}6083$; $R_2 = -0{,}3585$, etc. ~~to~~ worked out by experts to produce negligible coma.

He went on to use the formula

$$\frac{f_{crown}}{f_{flint}} = \frac{V_{flint}}{V_{crown}} = \frac{36}{60{,}5} = 89{,}0$$

to derive

$$f_{crown} = 36'' \times \frac{45}{89{,}0} \Rightarrow 45''$$
$$f_{flint} = 60{,}5'' \times \frac{45}{89{,}0} \Rightarrow 45''$$

} as desired

Dr Fuhr outlined methods of testing the lenses, e.g. 1) Use a mirror behind the lens doublet to reflect incoming rays back through the lens. Each defect in the system is then doubled in error

2) Fill the space between each

pair of the doublet with e.g. toluene, n = 1.47, and use a pin hole light source. This procedure optically eliminates the lower surface of the lens.

3) Rotate the components of the doublet with respect to each other to obtain the best pairing. Mark their respective positions for permanent mounting.

Mr Molyneux suitably thanked the guest speaker for a most comprehensive talk, then introduced Mr Hurley who screened two science review films.

The Chairman wished everybody a happy Christmas season and prosperous new year, and the meeting adjourned for tea

[signature] 13.2.74.