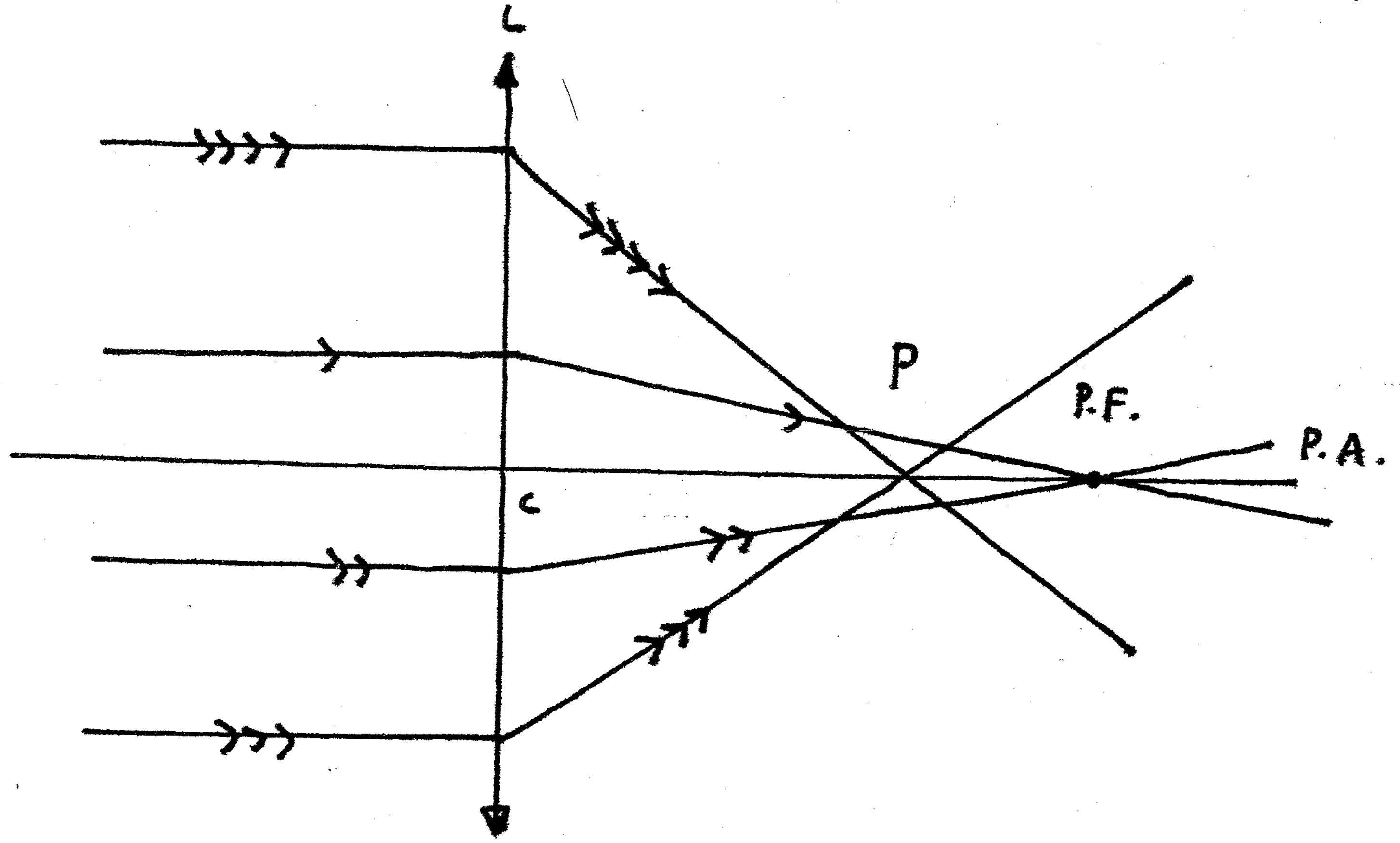
Defects of lenses (more of a reminder)

Spherical aberration

This aberration is also encountered with concave spherical mirrors. Hence the need for a paraboloidal surface with a telescope.



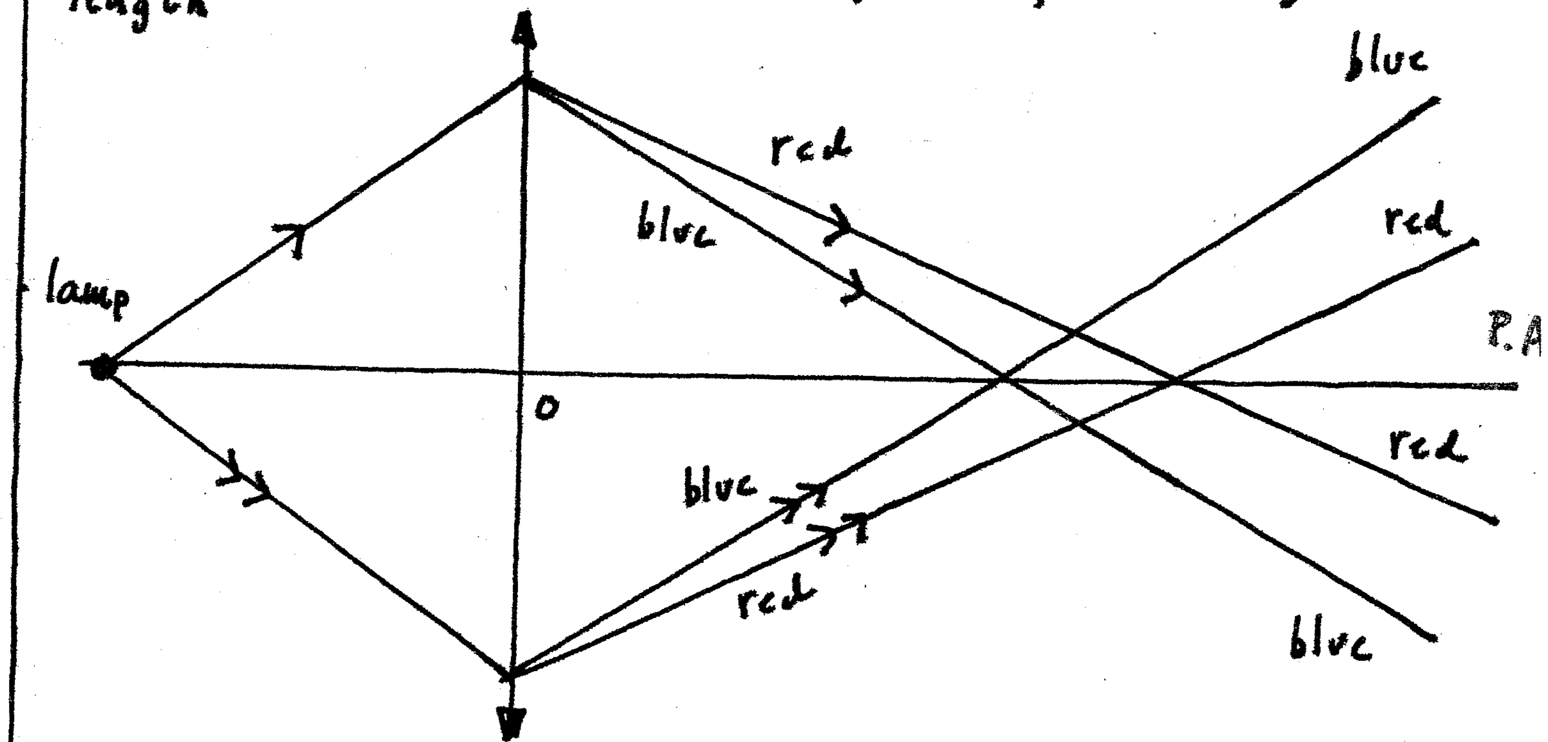
The distance between P and the P.F. is called the longitudinal spherical aberration. Clearly, there will be no sharp image point. A stop, reducing the aperture of the lens to a small central portion, will improve definition — with a consequent reduction in image brightness.

Chromatic aberration

The refractive index of glass is greater for blue light than for red. That is, $n_b > n_r$

Since $\frac{1}{f} = (n-1)\left(\frac{1}{r_1} + \frac{1}{r_2}\right)$, $f_b < f_r$

(f: principal focal length; r_1, r_2: radii of curvature of the surfaces of the lens)



An ordinary lens used to produce a real image of a small bulb, demonstrates chromatic aberration. A screen moved outwards from the lens produces a patch of light orange-red on the outside until the blurred image is reached. Beyond this point, the outside will be blue. An achromatic doublet reduces, but does not eliminate, th problem.

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