COMA

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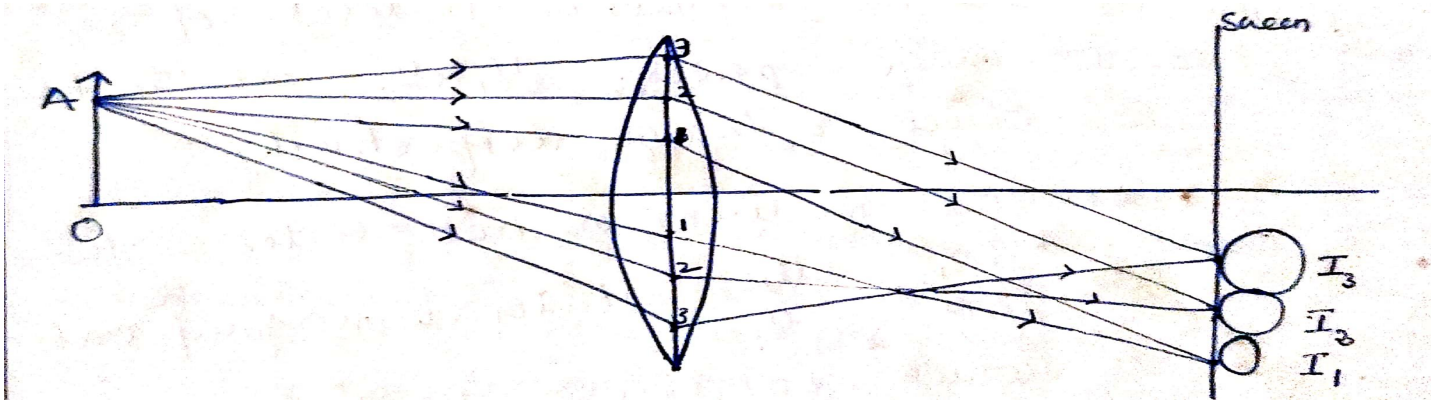
COMA

A lens free from Spherical Aberration produces a point image of the point object, situated on its principle axis . When the point object is situated away from the axis , then the image of the object appears like a Comet (COMA) . Hence this aberration is called **COMA.**



This defect arises due to the following reasons:

1) The lateral magnification produced by different zones of the lens are different . Hence the rays ' A ' and passing through different zones { (1,1) (2,2) (3,3)..... } of the lens come to focus at different points I_1, I_2 , I_3 .

2) Each zone forms the image of a point, in the form of a circle . The radius of cometic circle increases with the increase of the radius of the zone of the lens. The resultant image has comet like appearance.

ELIMINATION OF COMA

- Coma may be reduced to a certain extent by using a stop at certain distance.
- It may be maintained by using lenses having radius of curvature in the ratio of 1:9.
- If a lens satisfies Abbe's sign condition . It is free from Spherical Aberration & Coma.

  i.e $\mu_1 y_1 \sin\theta_1 = \mu_2 y_2 \sin\theta_2$. where θ_1 , θ_2 are the angles which the conjugate rays meet with the axis . μ_1 , μ_2 are the refractive indices of the object and the image spaces . y_1 , y_2 are the heights of the object and image respectively.
- When the medium on both sides is the same then **$\sin\theta_1 / \sin\theta_2$ =** y_1 / y_2 = lateral magnification.
- A lense which satisfies **$\sin\theta_1 / \sin\theta_2$ = constant** is called an **Aplanatic lens.**

ASTIGMATISM

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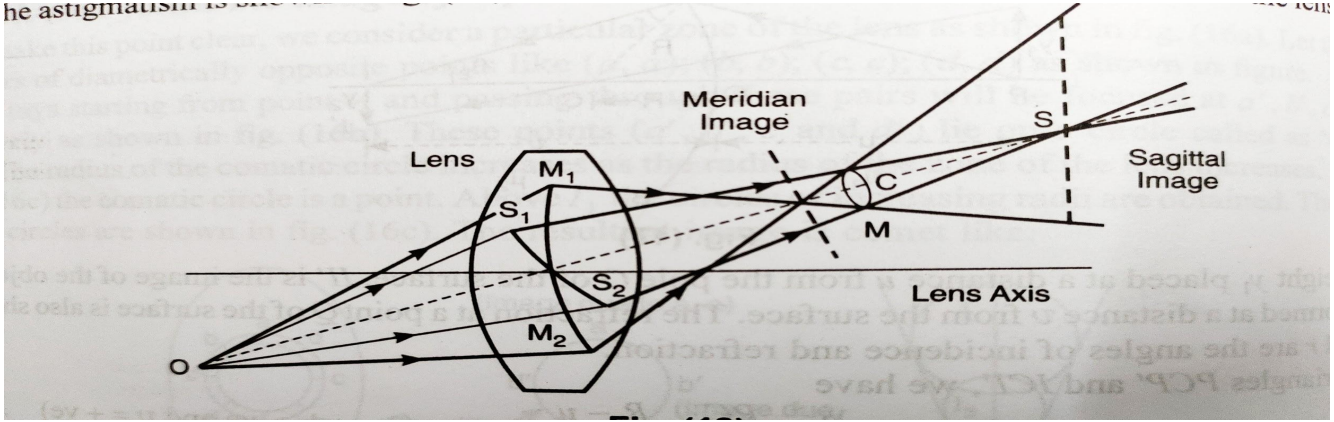
When a point object is situated far away from the axis of the lens ,its image consists of two mutually perpendicular lines separated by a finite distance and these two lines lie in perpendicular planes . The defect in image is called **ASTIGMATISM.**



- ‘ O ‘ is an point object situated far off the axis of the lens .
- A plane passing through ‘ O ‘ and principal axis is known as **Tangential (Meridian) plane (M_1M_2)** .
- Another plane ⊥r to this plane passing through the principle axis is known as **‘ Sagittal plane’ (S_1S_2).**
- The rays passing the Tangential plane do not meet at the same point . A line image is obtained passing through ‘M’ .
- Similarly another line passing through ‘S’ is obtained from Sagittal plane . These two lines are called 1st and 2nd focal lengths of a screen moved in between M & S , an irregular image is formed . This defect is called Astigmation.
- When the screen is moved between the two lines (M&S) circle of least confusion is formed . The difference distance between two line images is the measure of Astigmatism and is known as Astigmatic Difference.

ELIMINATION

The defect of astigmatism is due to the large inclination of the rays with the axis of the lens. The defect may be eliminated by

- By using STOPS .
- Astigmatism can be reduced by using convex and concave lenses of suitable focal length. Such a combination is known as **Astigmat** .
- For a system of several lenses this defect may be eliminated by adjusting relative positions.
- This defect is also absent if the lens has different horizontal and vertical curvatures. Such a lens is called a **TORIC LENS.**