

Hyperbolic Plots for Gaussian Paraxial Optics

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Abstract

The Gaussian thin lens equation is $\pm 1/u \pm 1/f = \pm 1/v$

LIMB A2 ($v > u$), the image is magnified. Examples are macrophotography, the microscope objective and the lensometer at its endpoint, when the exit beam is parallel.

LIMB B1 ($v > u$) and $u = f$, real objects form virtual images

An eye piece forms a magnified virtual image of the real objective image. A1 combined with B1 is the astronomical telescope; A2 combined with B1 is the microscope. Other examples of limb B1 are hand magnifiers, the direct ophthalmoscope, and the shaving mirror.

LIMB B2 ($U > V$) virtual objects form real images. Examples are hyperopic corrections; the correcting lens presents a converging beam to the eye which can then form a real image on the retina.

This study presents a graphical representation of the reciprocal relationship between object and image location across the whole spectrum of focal lengths. Examples are drawn from engineering, photography and clinical optics.

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Received December 09, 2020; Accepted December 25, 2020; Published January 01, 2021

Citation: John AP (2021) Hyperbolic Plots for Gaussian Paraxial Optics. Optom Open Access 6:1.

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