

THE FOCUSED PLENOPTIC CAMERA

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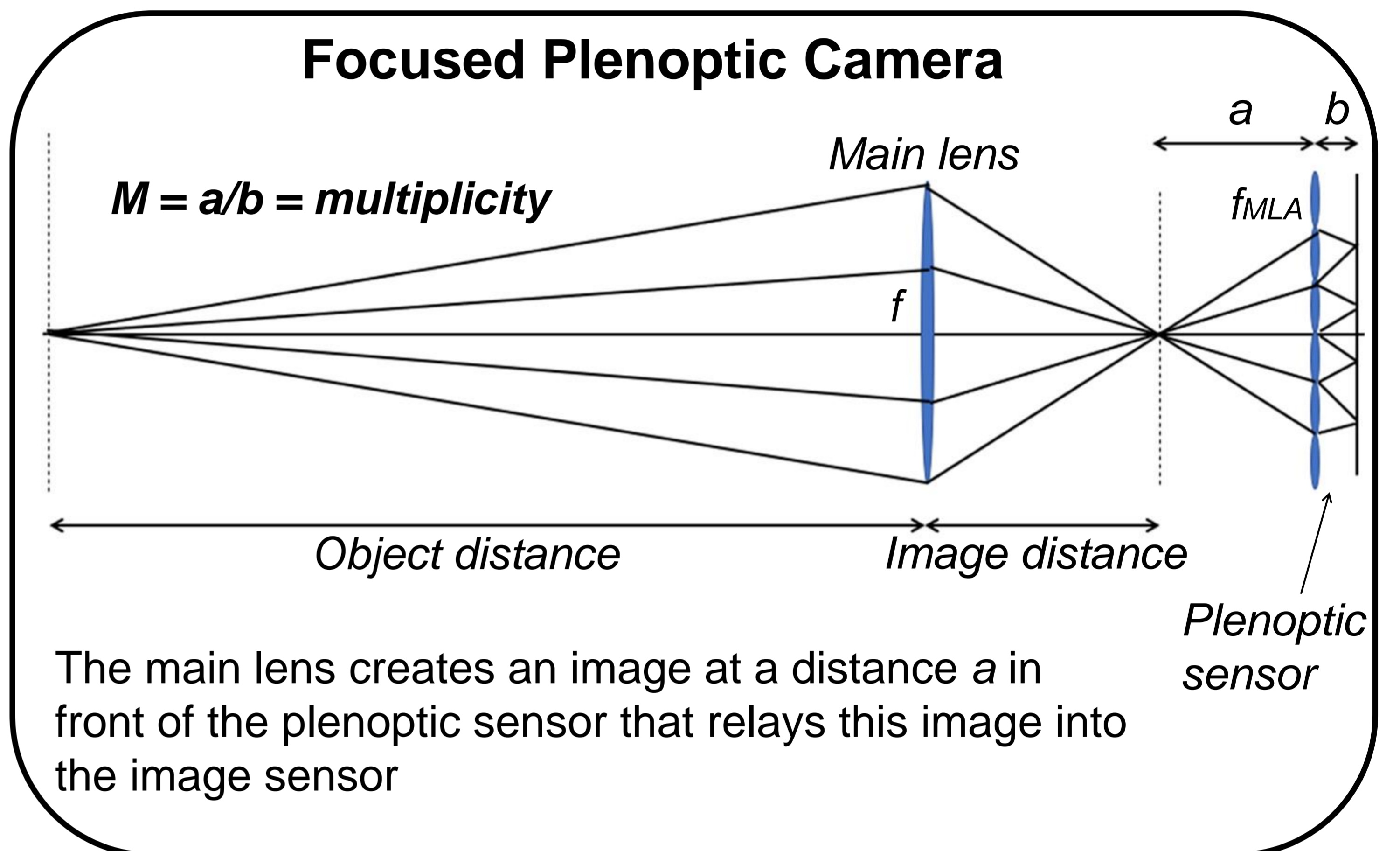
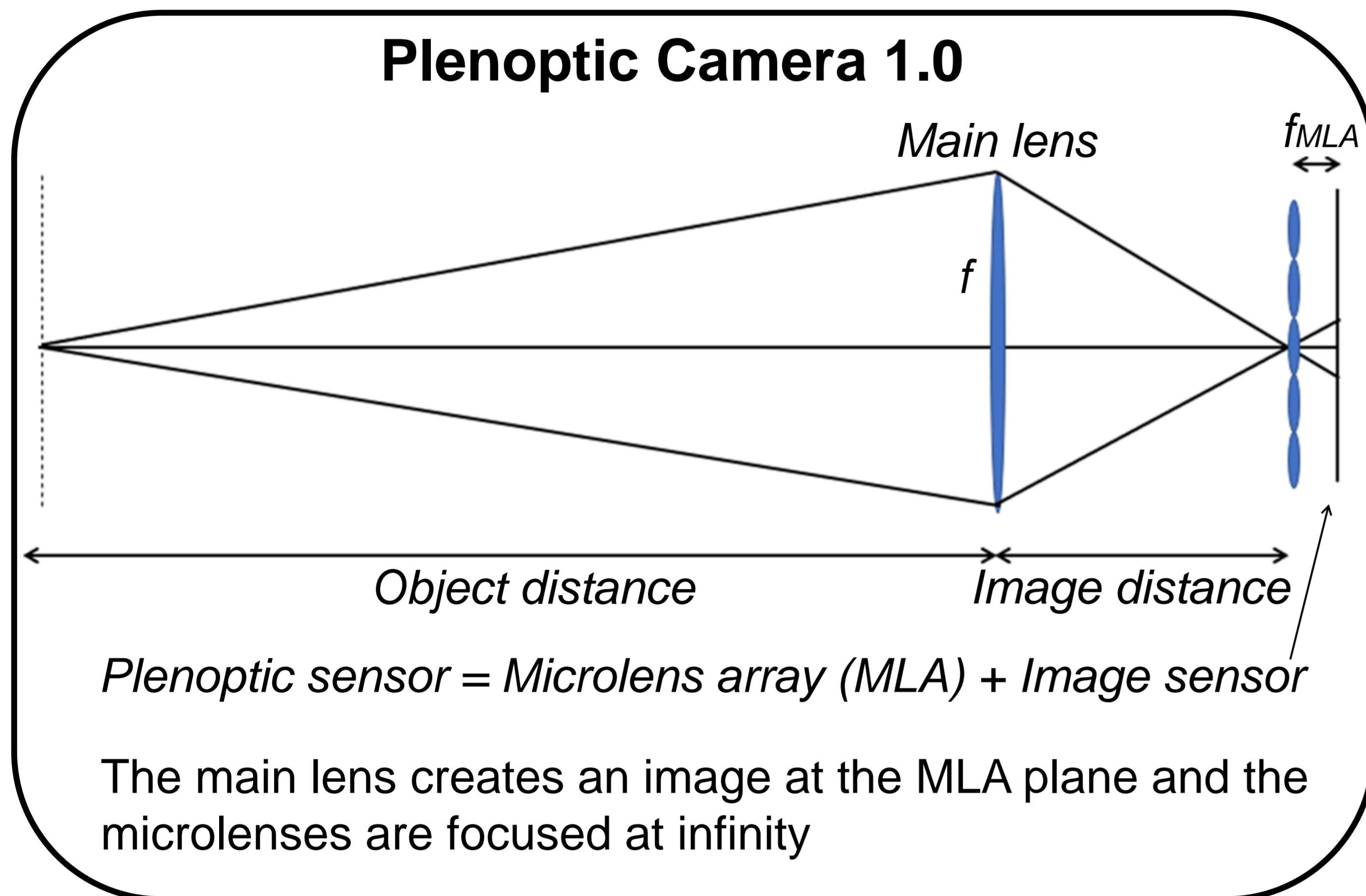
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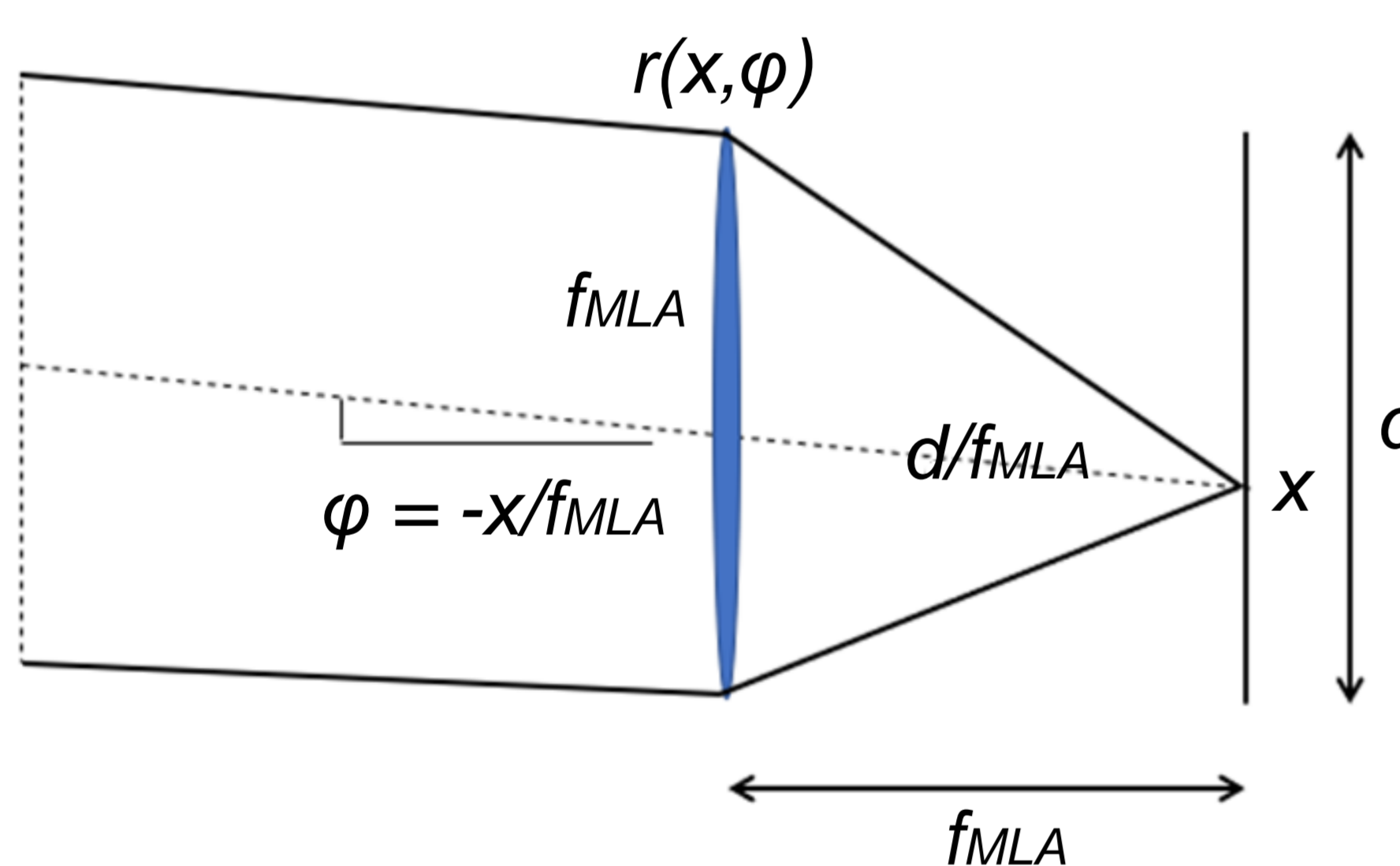
Project objective

The focused plenoptic camera is composed of a sequence of an objective and a plenoptic sensor: it allows to capture both position and direction of light rays. The flexibility of the optical setup enables to adjust the spatial and angular contents of the sampled information enhancing either the Depth of Field and sacrificing spatial resolution, or optimizing the system for high spatial resolution and losing depth information.



Plenoptic sensors: a comparison

Plenoptic Camera 1.0



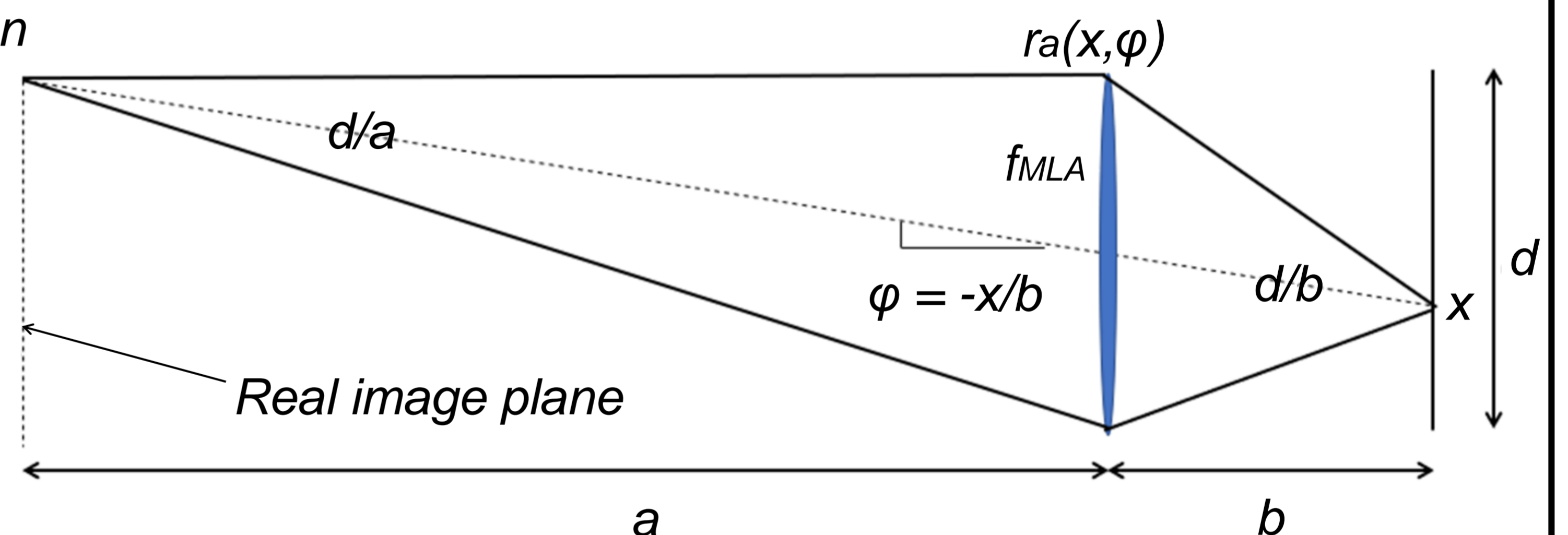
In the 1.0 model, the plenoptic sensor samples the radiance at the MLA plane

x : light ray position
 φ : light ray direction

$r(x, \varphi)$ = radiance at the MLA plane

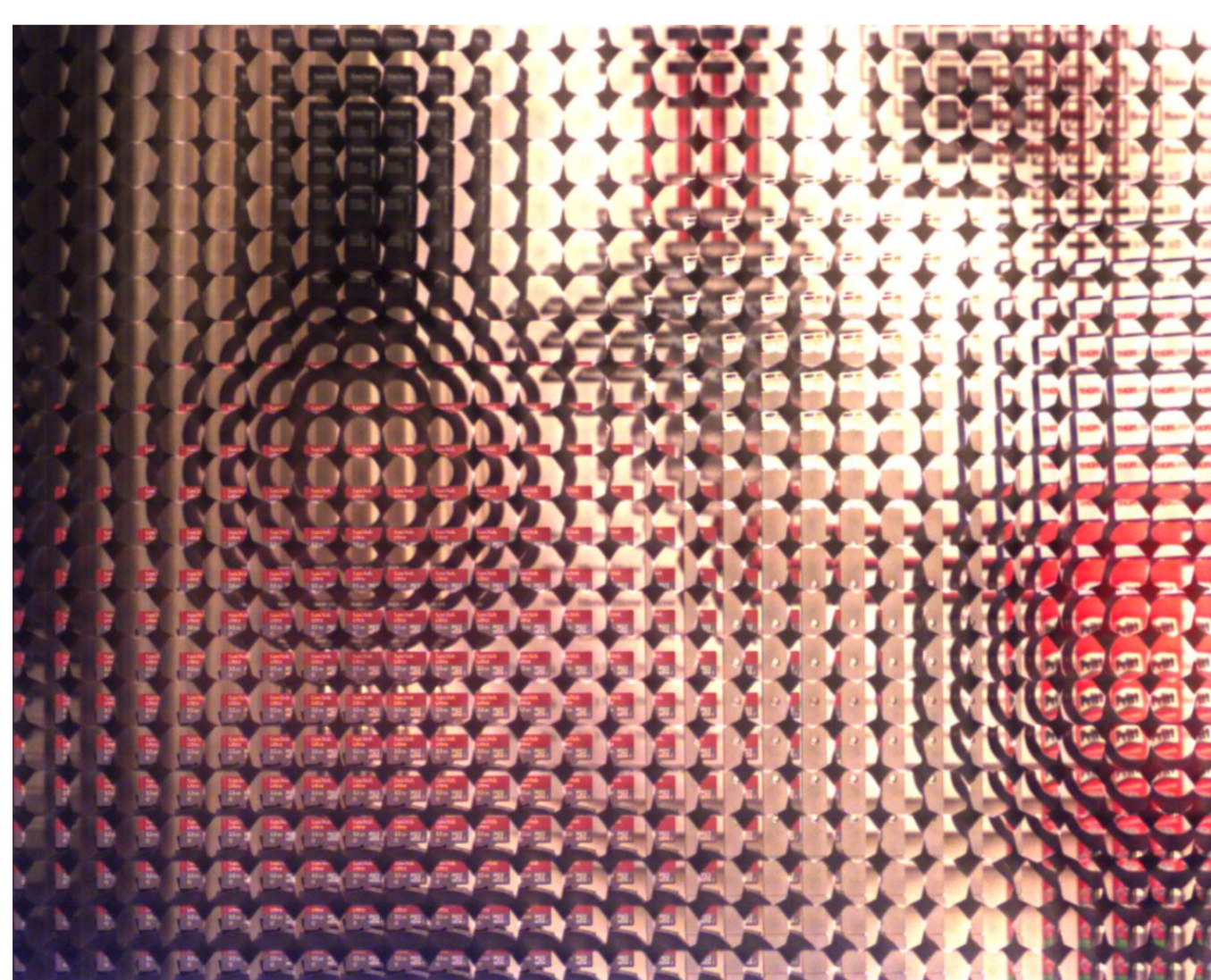
$ra(x, \varphi)$ = radiance at the real image plane

Focused Plenoptic Camera



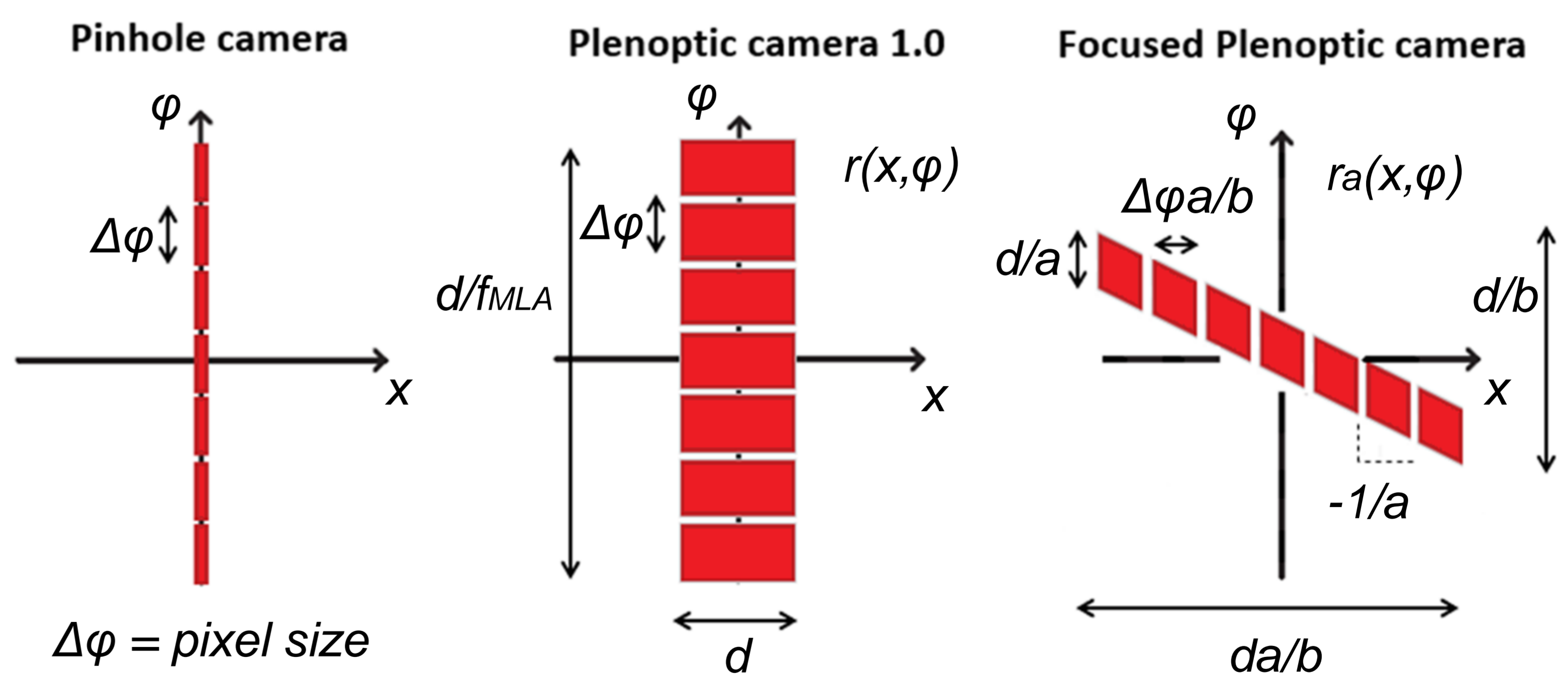
In the focused model, the plenoptic sensor samples the radiance at the real image plane

Plenoptic raw image



In the Focused Plenoptic Camera each microlens captures a number of angular samples defined by the multiplicity which also defines the loss of spatial resolution. The angular resolution is $\frac{d}{a}$ and the spatial resolution is $\Delta\varphi \frac{a}{b}$

Radiance Sampling models in phase space



References

R. Ng, M. Levoy, M. Bredif, G. Duval, M. Horowitz, et al. Light field photography with a hand-held plenoptic camera. Computer Science Technical Report CSTR, Jan 2005.

T. Georgiev and A. Lumsdaine, Depth of Field in Plenoptic Cameras, EUROGRAPHICS 2009.

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