Plenoptic Principal Planes

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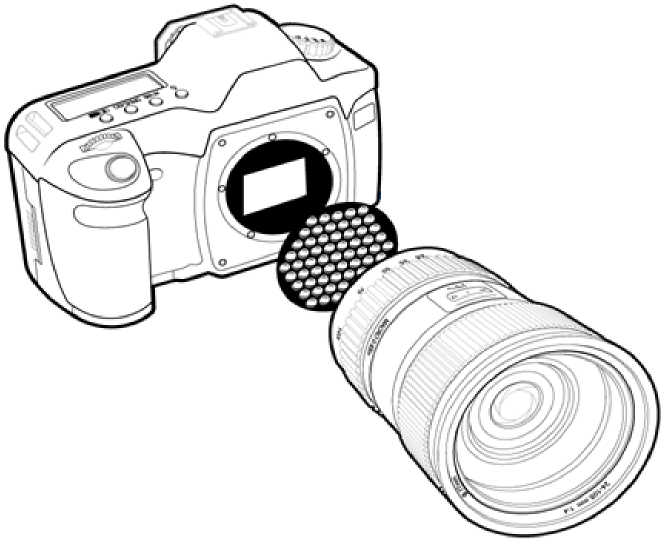
Plenoptic Cameras



Plenoptic cameras are
the future of photography
because of the completeness
of captured data

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3D camera solutions
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R5 – Low cost 3D-focus cameras.

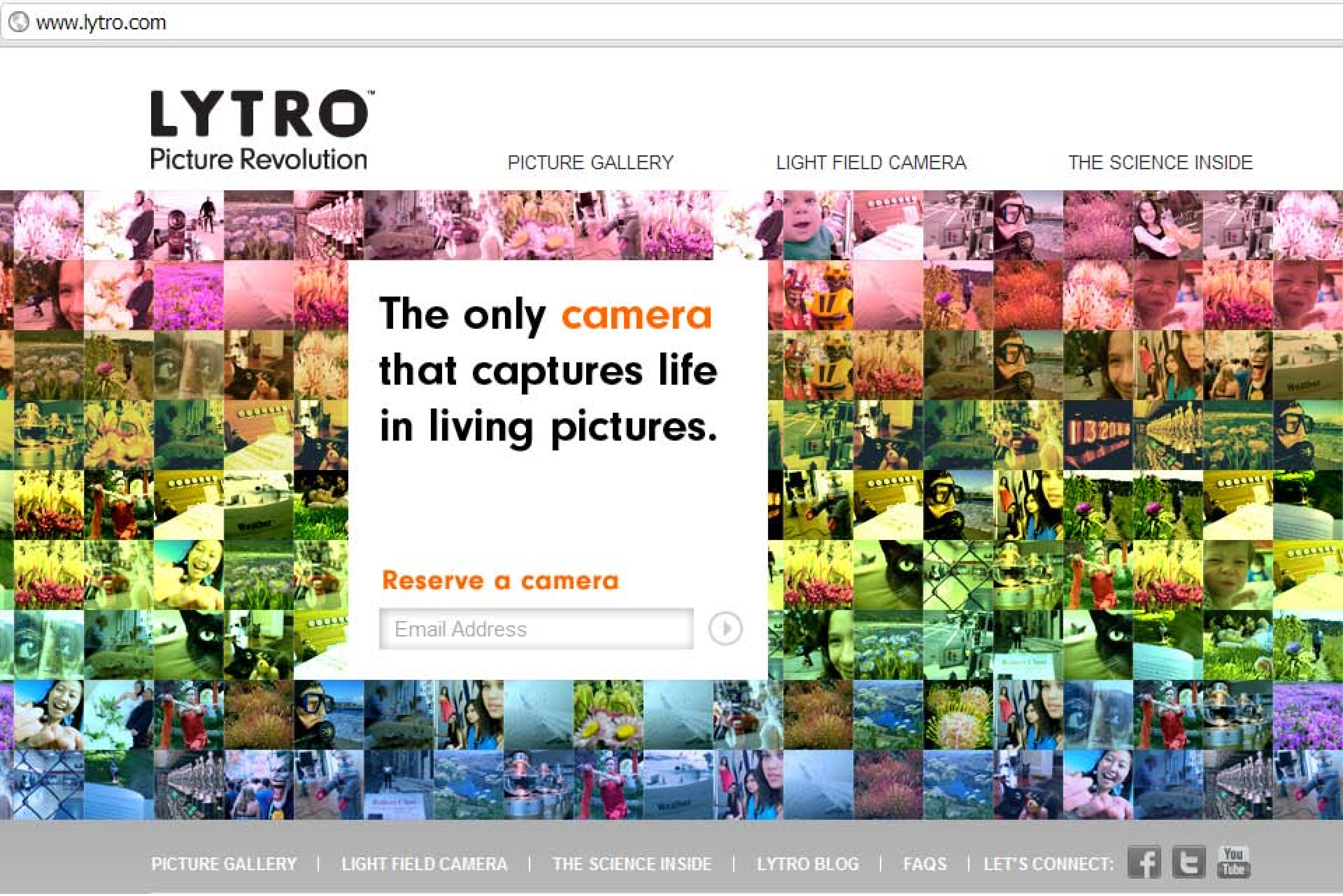
Raytrix presents the new economic 4D lightfield camera series.

Learn more about the new R5

R11 – Highend 3D-focus cameras.

Raytrix presents the new state-of-the-art 4D lightfield camera series with incredi

Learn more about the new R11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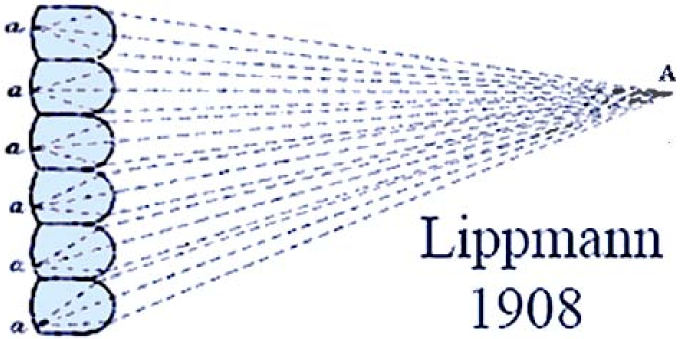
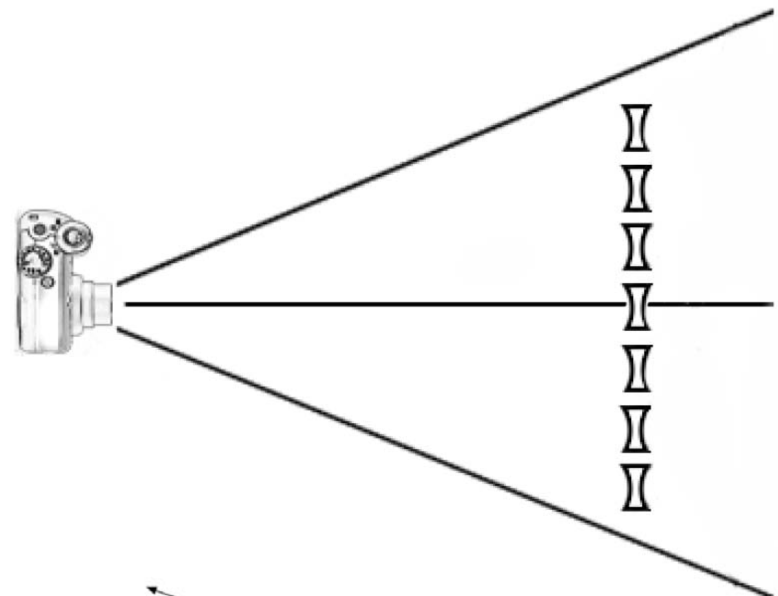
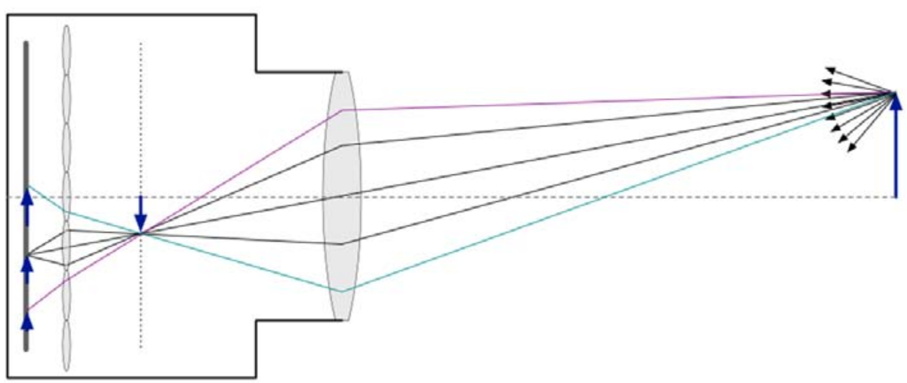
Integral (Plenoptic) Cameras

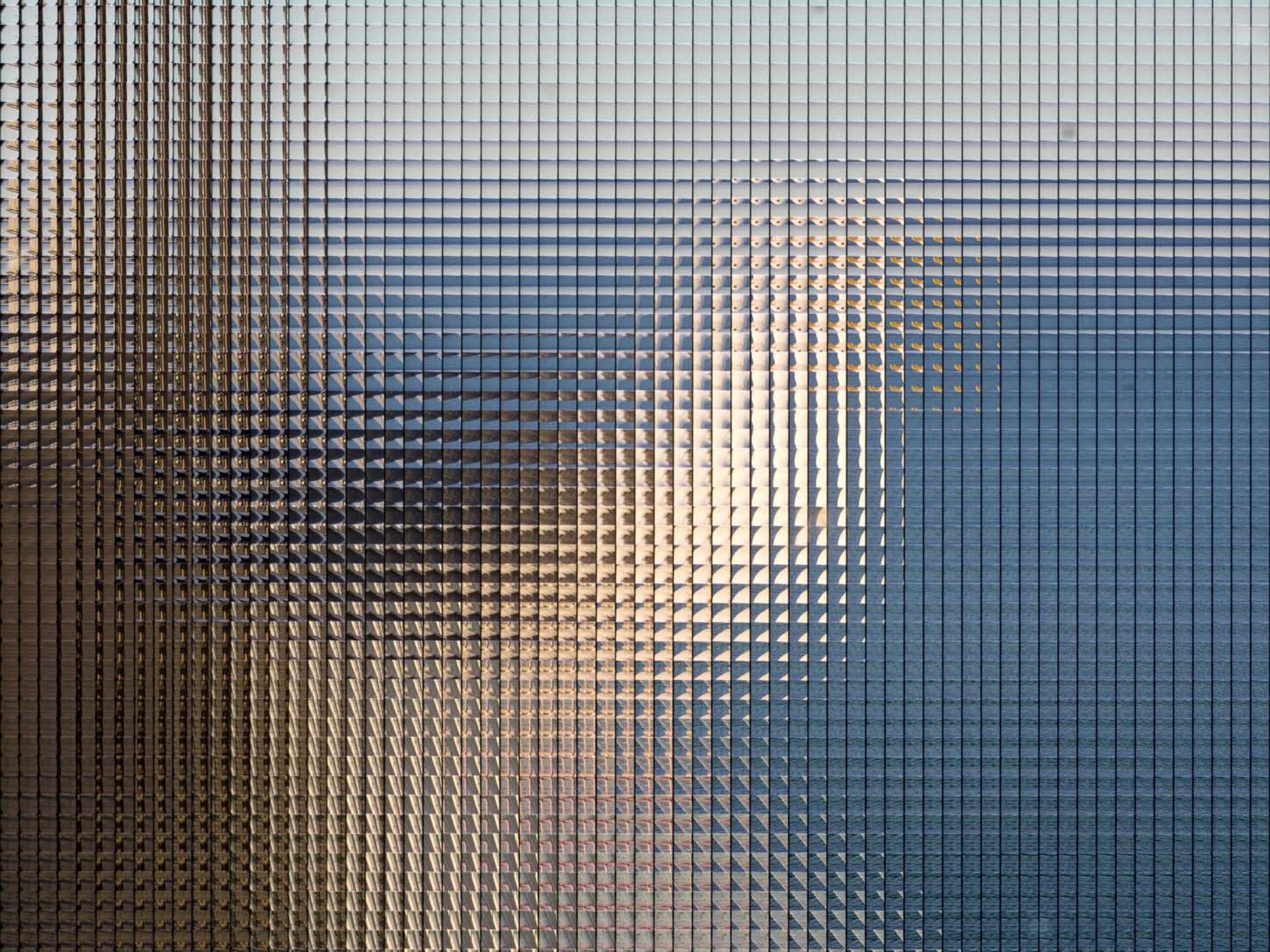






Integral (Plenoptic) Images

Integral (Plenoptic) Images

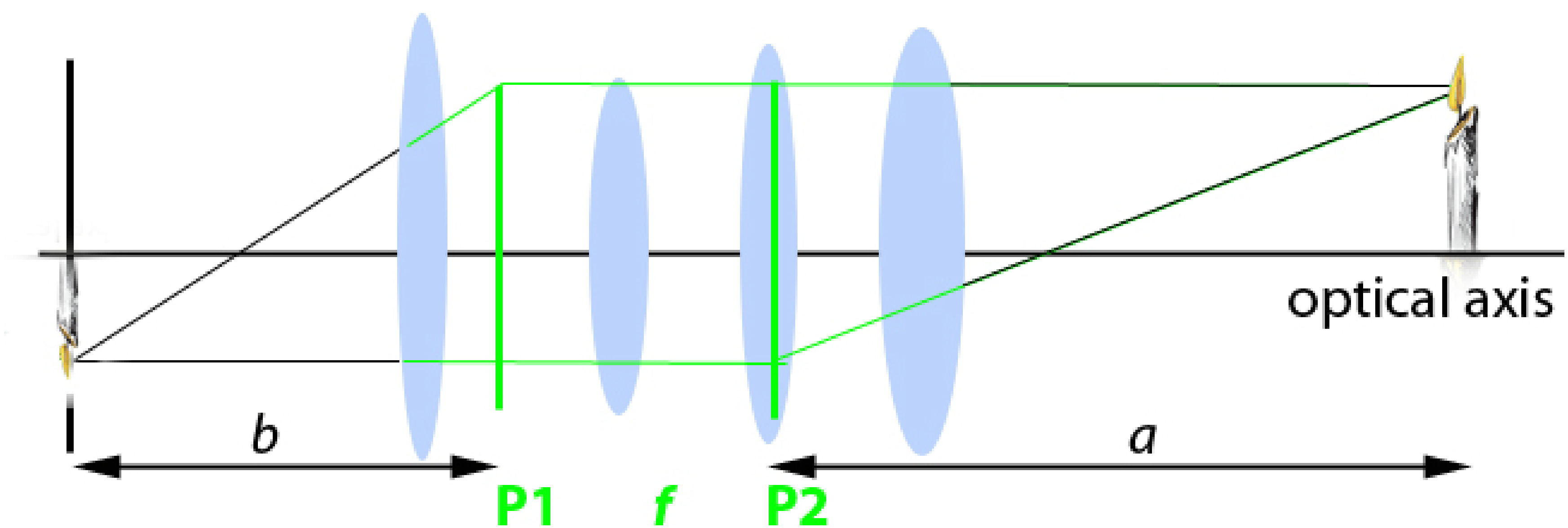


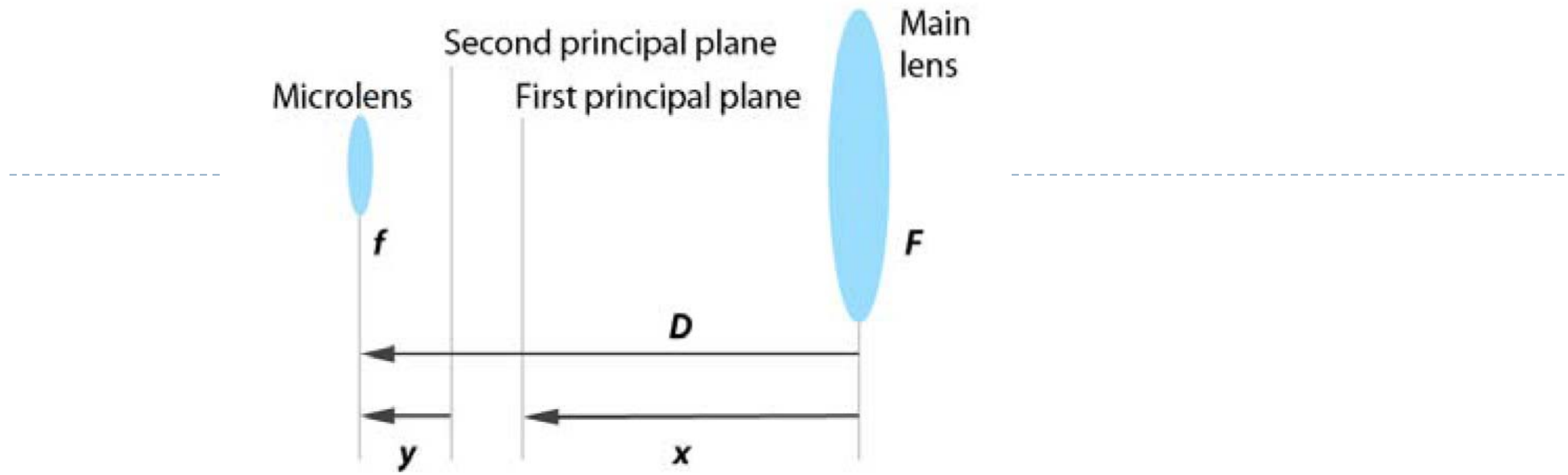
Integral (Plenoptic) Images

Integral (Plenoptic) Images

Principal Planes

Gauss discovered that the matrix for ***any*** optical transform can be written as a product of some appropriate **translation, lens, and translation** again.

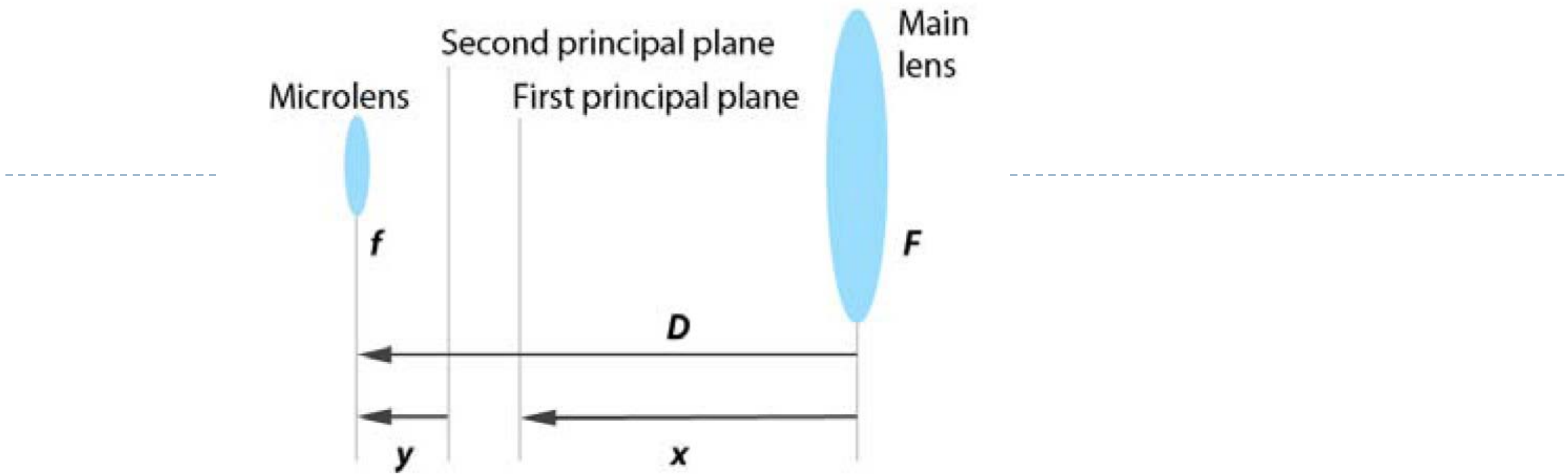




$$L(f)T(D)L(F) = \begin{bmatrix} 1 - \frac{D}{F} & D \\ \frac{D}{fF} - \frac{1}{f} - \frac{1}{F} & 1 - \frac{D}{f} \end{bmatrix}$$

$$T(y)L(\Phi)T(x) = \begin{bmatrix} 1 - \frac{y}{\Phi} & x + y - \frac{xy}{\Phi} \\ -\frac{1}{\Phi} & 1 - \frac{x}{\Phi} \end{bmatrix}$$

Adobe

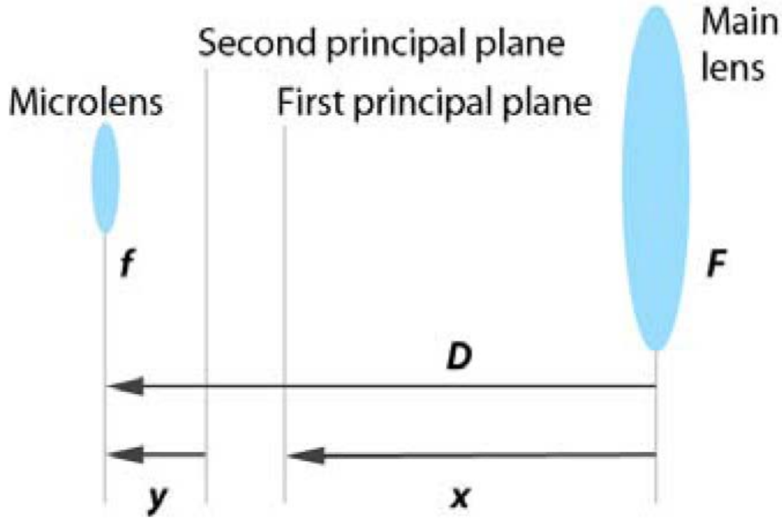


$$L(f)T(D)L(F) = \begin{bmatrix} 1 - \frac{D}{F} & D \\ \frac{D}{fF} - \frac{1}{f} - \frac{1}{F} & 1 - \frac{D}{f} \end{bmatrix}$$

$$T(y)L(\Phi)T(x) = \begin{bmatrix} 1 - \frac{y}{\Phi} & x + y - \frac{xy}{\Phi} \\ -\frac{1}{\Phi} & 1 - \frac{x}{\Phi} \end{bmatrix}$$

$$\frac{1}{\Phi} = \frac{1}{f} + \frac{1}{F} - \frac{D}{fF}$$

Bottom left matrix element



$$\Phi = \frac{Ff}{F + f - D}$$

$$x = \frac{DF}{f + F - D}$$

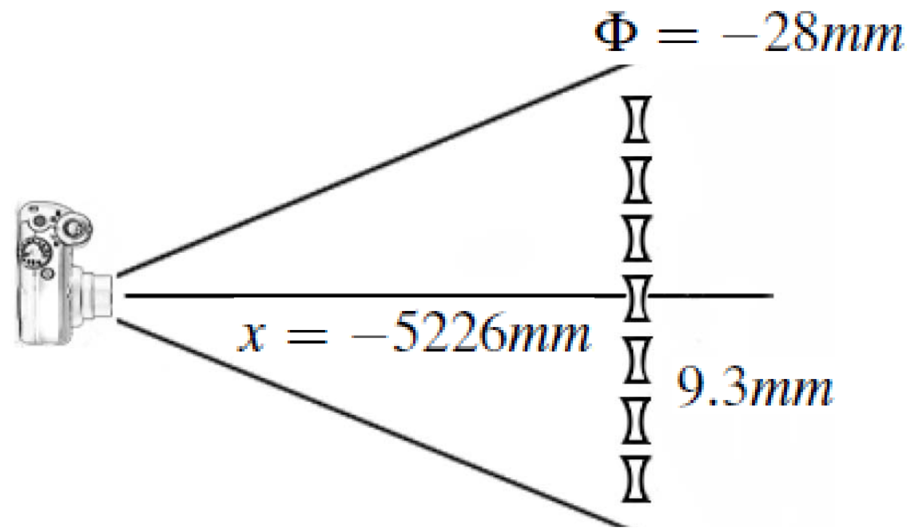
$$y = \frac{Df}{f + F - D}$$

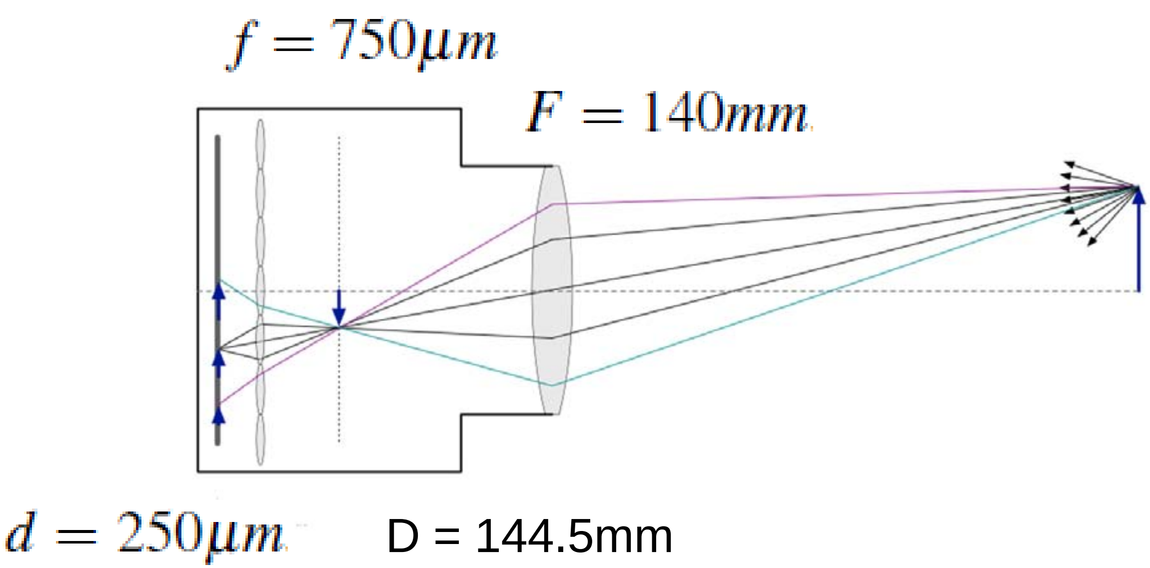
First principal plane can be far in front of the main lens (negative *x*), establishing optical equivalence between plenoptic cameras.

Adobe

Parameters

Keplerian case:
Microlenses equivalent to negative lenses





D = 144.5mm

Conclusions

Keplerian case:
Microlenses equivalent to negative lenses in front

Galilean case:
Microlenses equivalent to positive lenses behind

Put the camera in physically impossible places

Microlenses are better quality than lenses because they are smaller and have proportionally smaller aberrations.
In aberrations there is no equivalence!