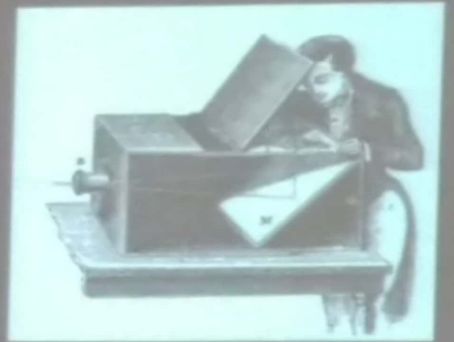
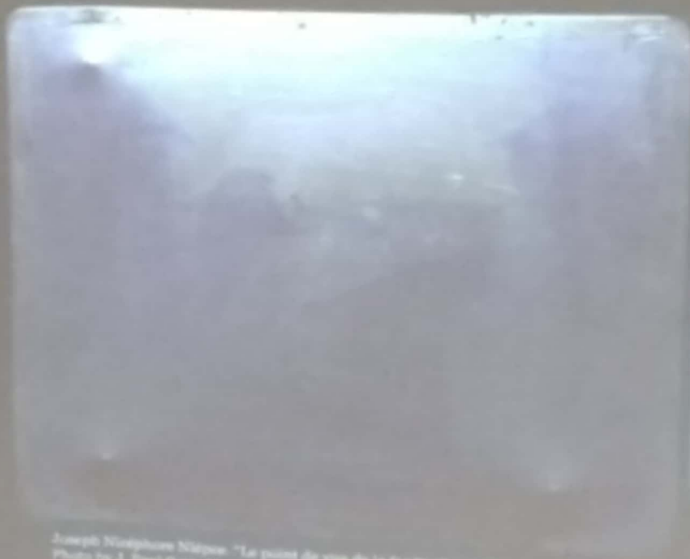


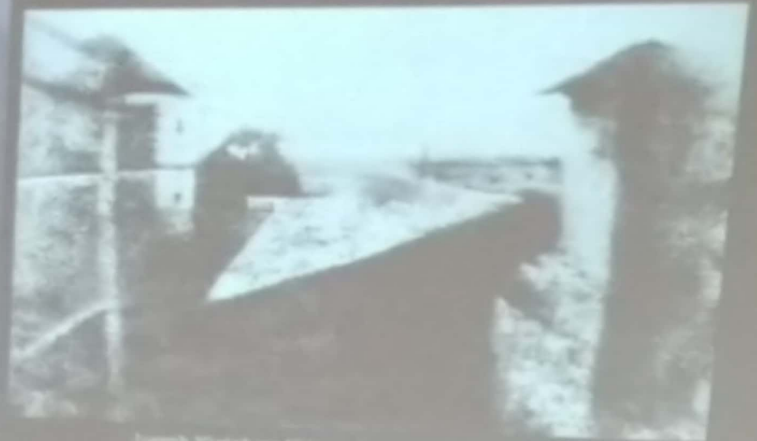
Camera Obscura (18th century)



Earliest Surviving Photograph (c.1826)



Joseph Nicéphore Niépce, "Le point de vue de la fenêtre" c.1826.
Photo by J. Paul Getty Museum, from [Wikimedia Commons](#)



Joseph Nicéphore Niépce, "Le point de vue de la fenêtre" c.1826.
Enhanced by Helmut Gornbein, c. 1982
public domain

Digital Imaging

First Digital Photograph (1957)



Resolution: 176x176,
Russell Kirsch, "Walden", 1957, from petapixel

First Digital Camera (1975)

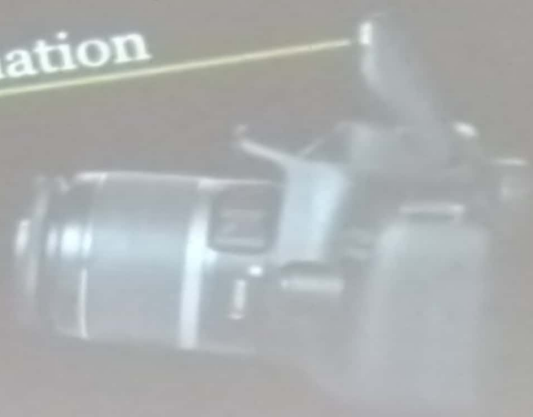


Steve Sasson, Eastman Kodak. Photo credit: Eastman Kodak

Digital Photography



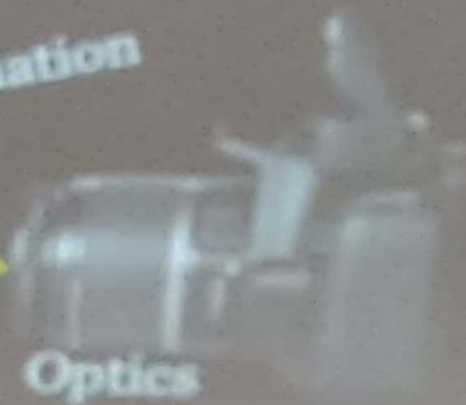
Illumination



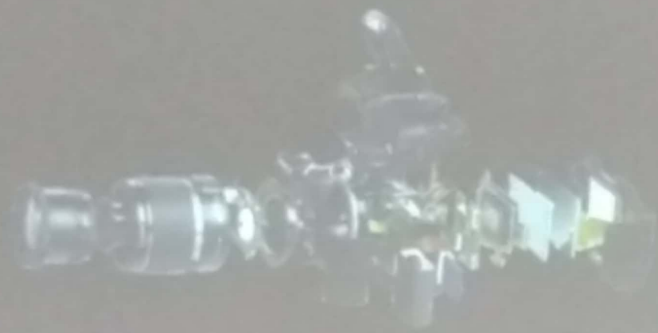
Digital Photography



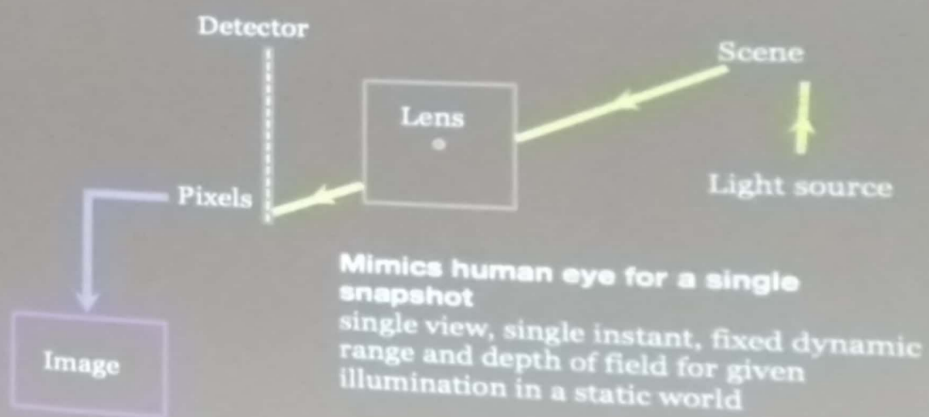
Illumination



Computational Photography

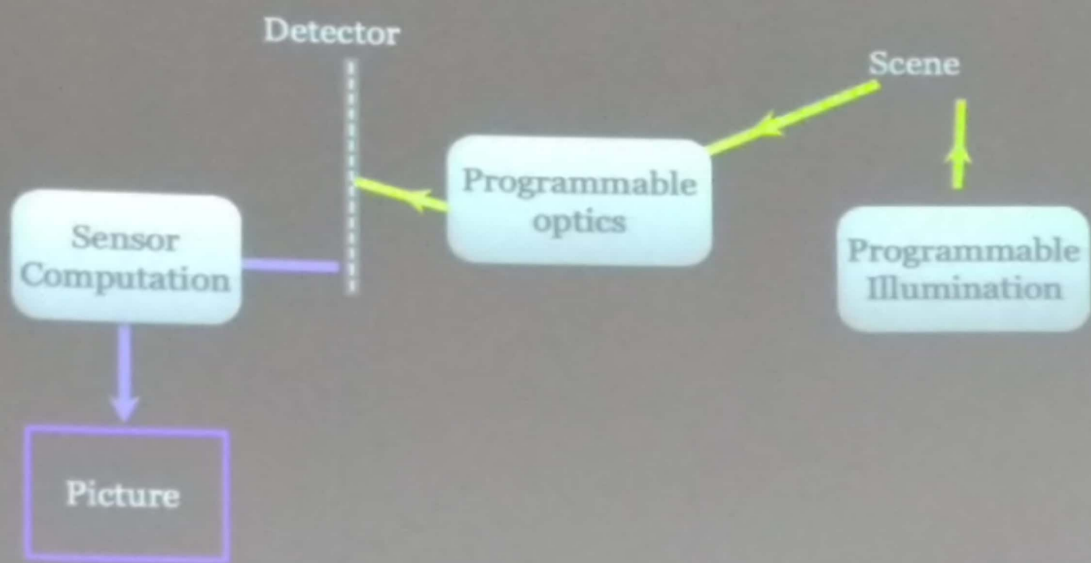


Traditional, “film-like” Photography

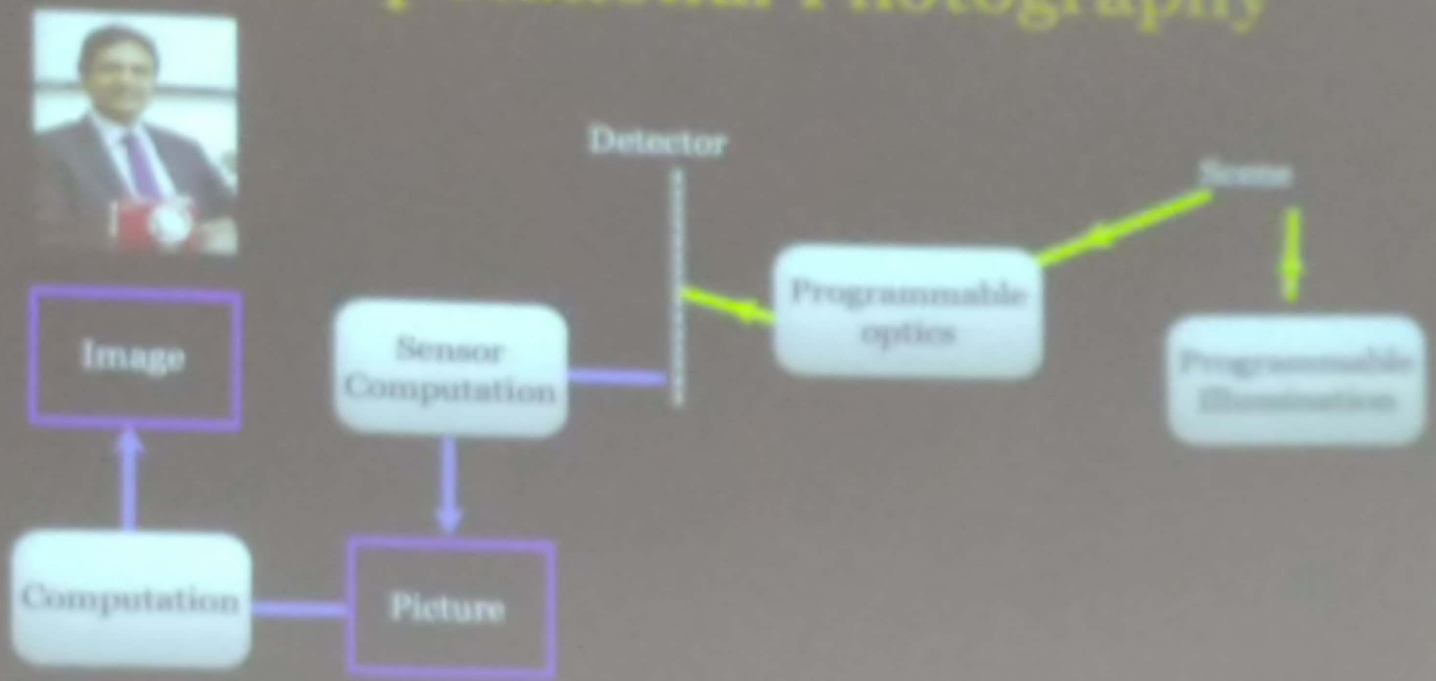


Slide credit: Steven Niewer

Computational Photography



Computational Photography

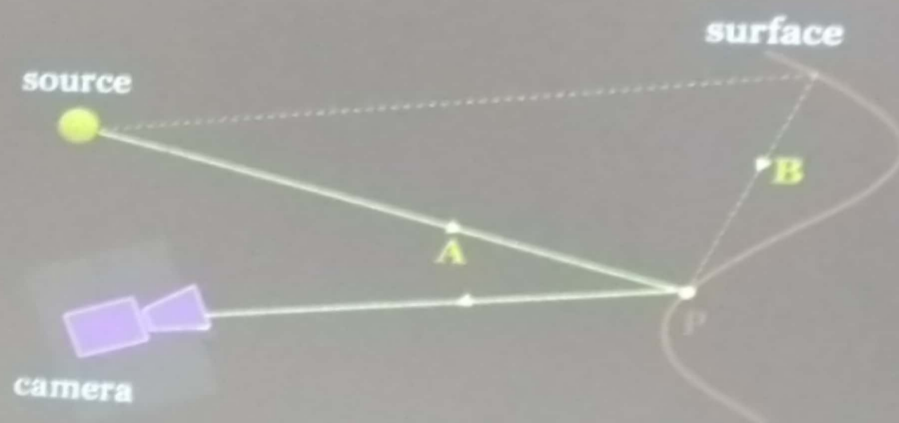


Separating Direct and Global Light

Shree K. Nayar, Guru Krishnan, Michael Grossberg, Ramesh Raskar,
“Fast Separation of Direct and Global Components of a Scene using
High Frequency Illumination”, SIGGRAPH 2006.

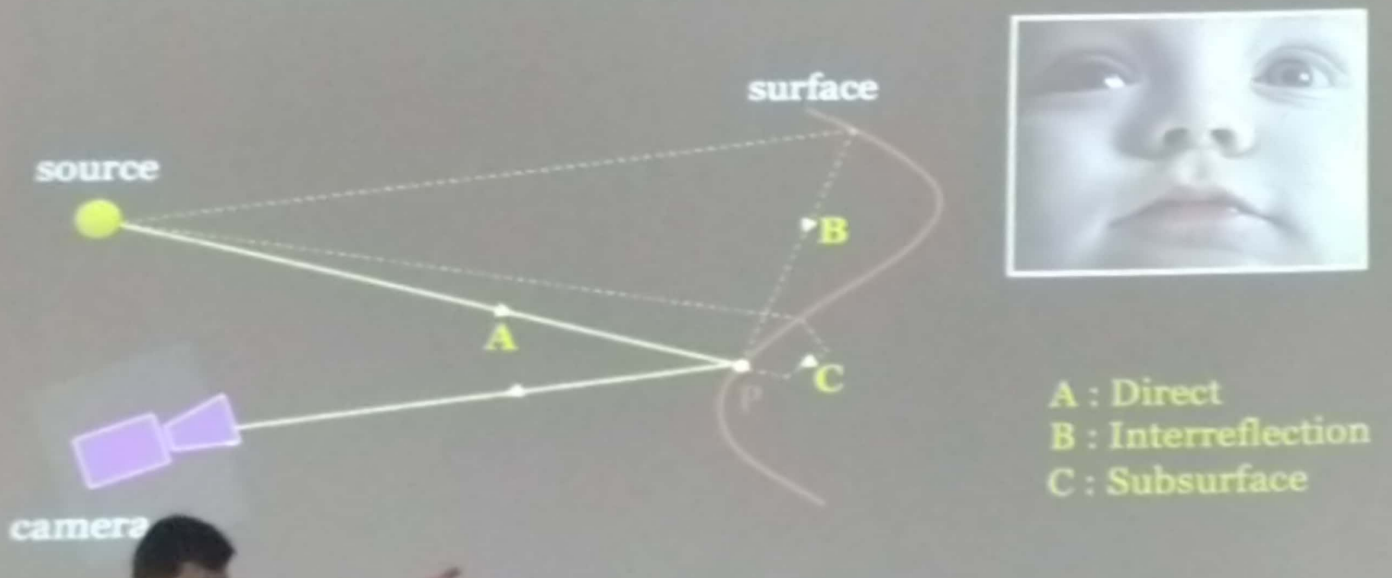


Direct and Global Illumination

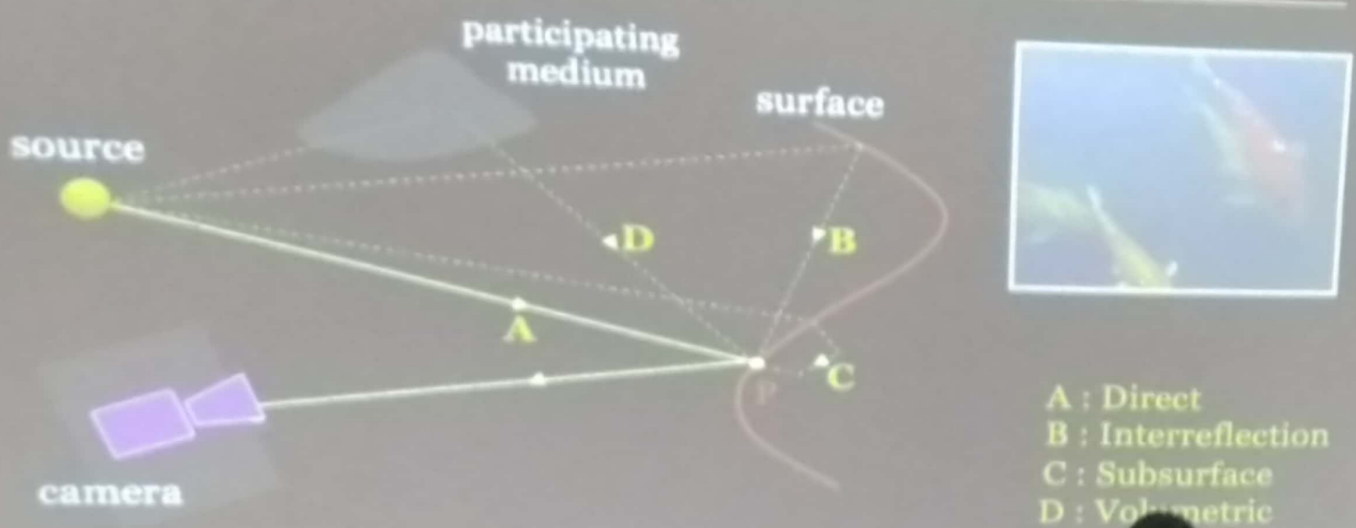


A : Direct
B : Interreflection

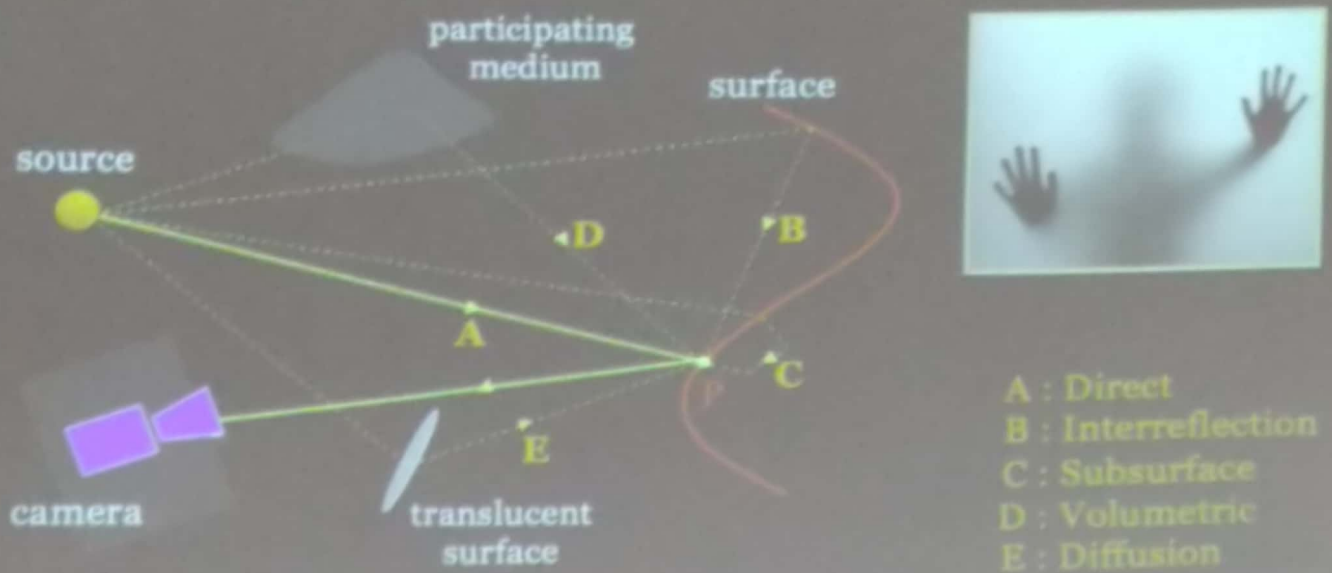
Direct and Global Illumination



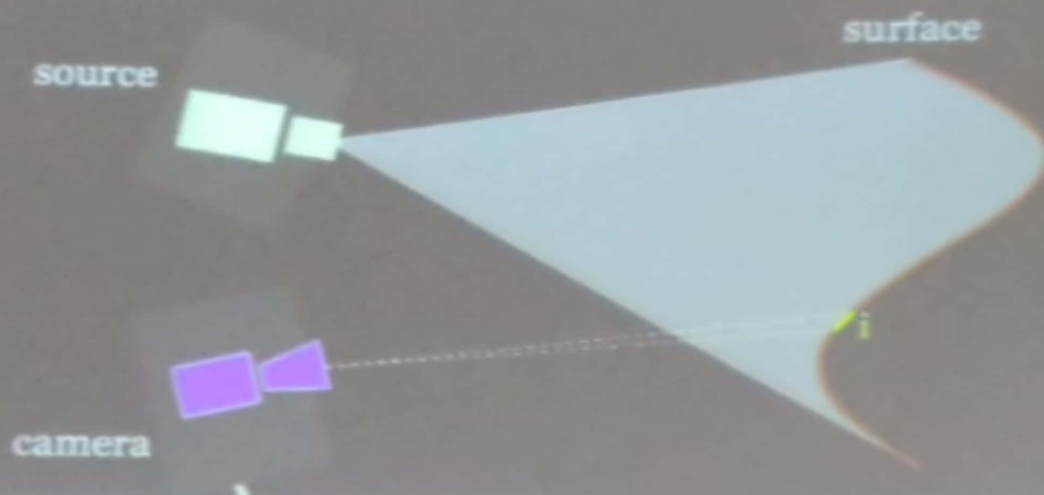
Direct and Global Illumination



Direct and Global Illumination



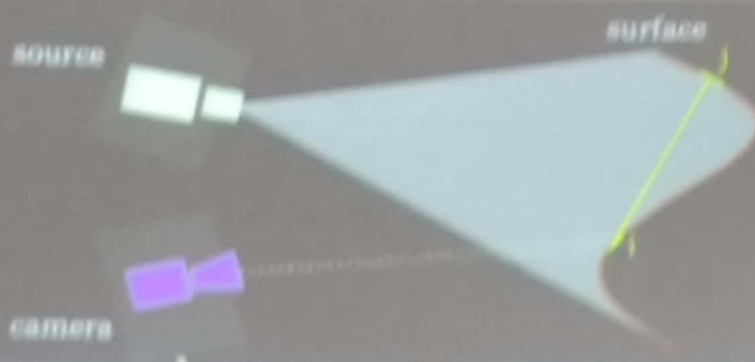
Direct and Global Components: Interreflections



$$L[c, i] = L_d[c, i] + L_g[c, i]$$

radiance direct global

Direct and Global Components: Interreflections



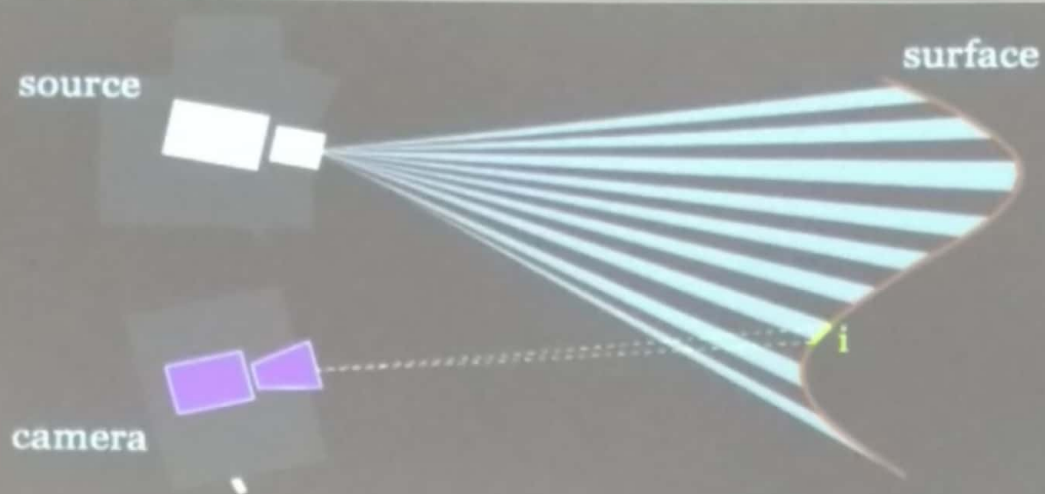
$$L[e, \ell] = L_d[e, \ell] + L_g[e, \ell]$$

radiance direct global

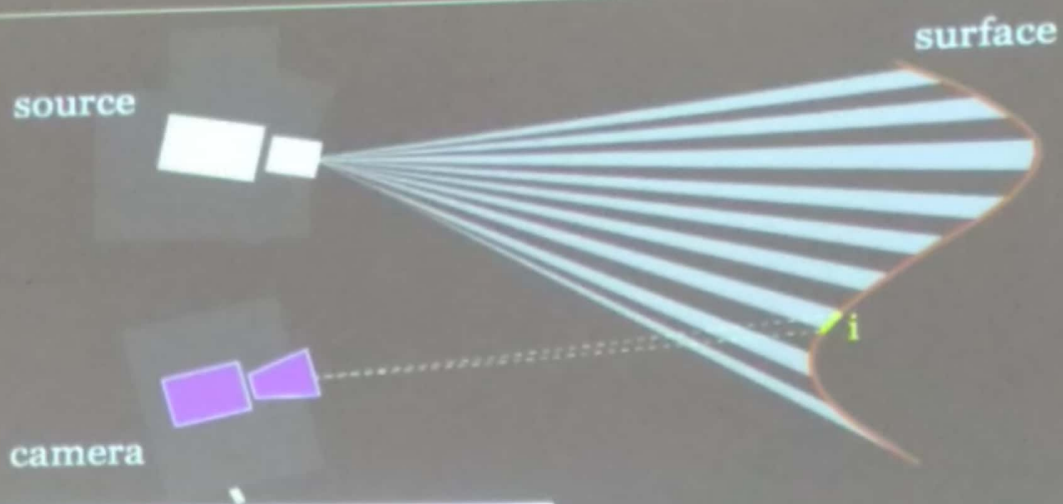
$$L_g[e, \ell] = \sum_f A[f, \ell] L[f, \ell]$$

BRDF and geometry

High Frequency Illumination Pattern



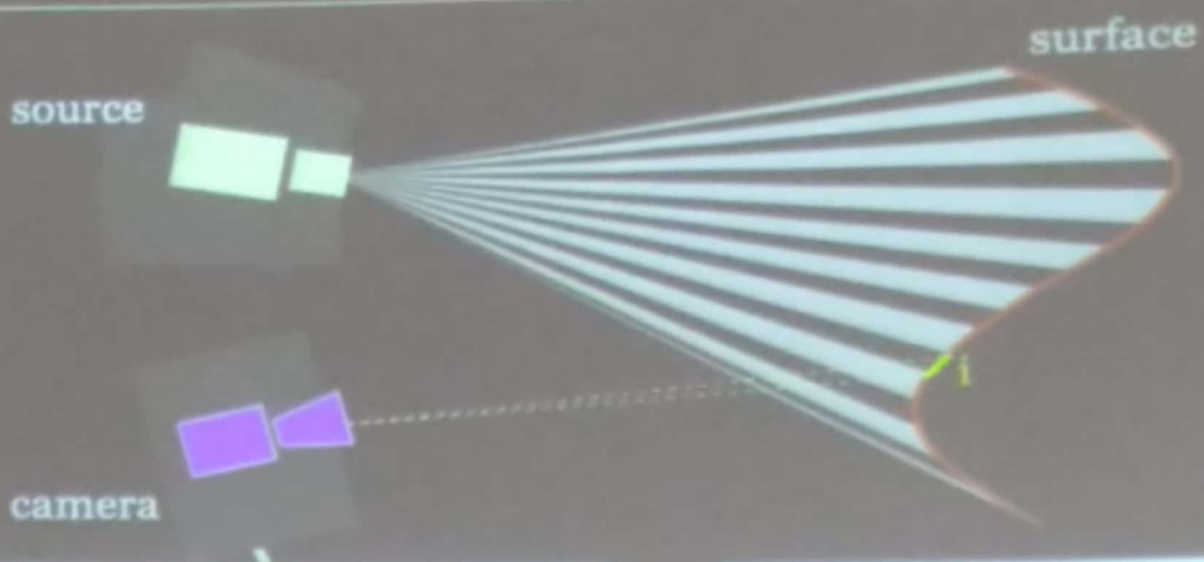
High Frequency Illumination Pattern



$$L^+[c, i] = L_d[c, i] + \alpha L_g[c, i]$$

fraction of activated source elements

High Frequency Illumination Pattern



$$L^+[c, i] = L_d[c, i] + \alpha L_g[c, i]$$

$$L^-[c, i] = (1 - \alpha) L_g[c, i]$$

fraction of activated source elements

Separation from Two Images

$$\alpha = \frac{1}{2}:$$

$$L_d = L_{\max} - L_{\min}, \quad L_g = 2L_{\min}$$

direct

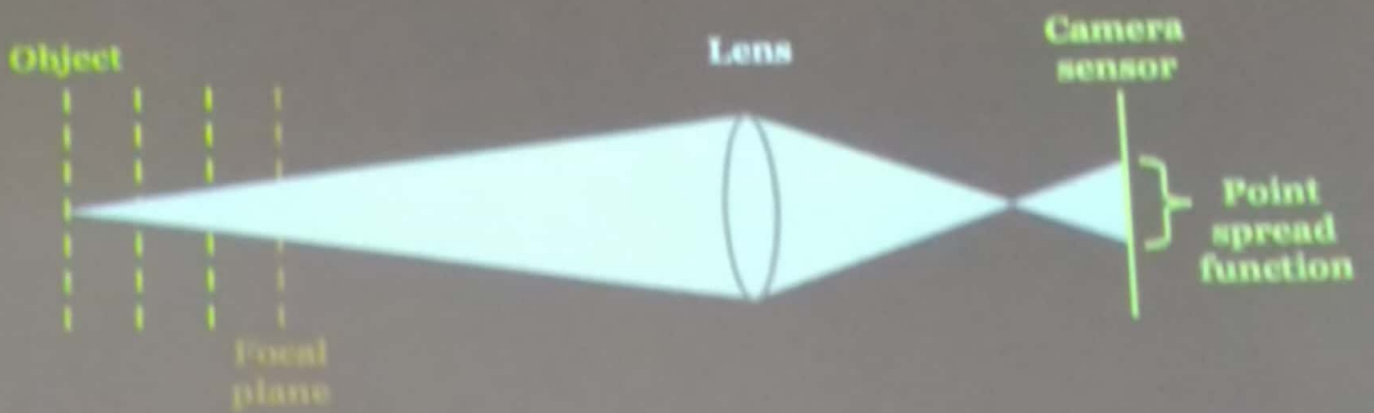
global

Coded Aperture Imaging

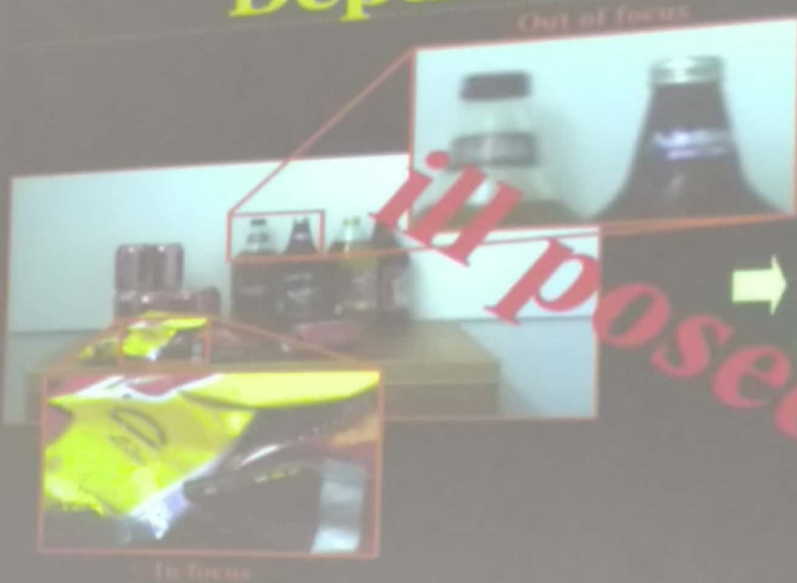
Anat Levin, Rob Fergus, Frédo Durand, Bill Freeman,
“Image and Depth from a Conventional Camera with a
Coded Aperture”, SIGGRAPH 2007.



Lens and defocus



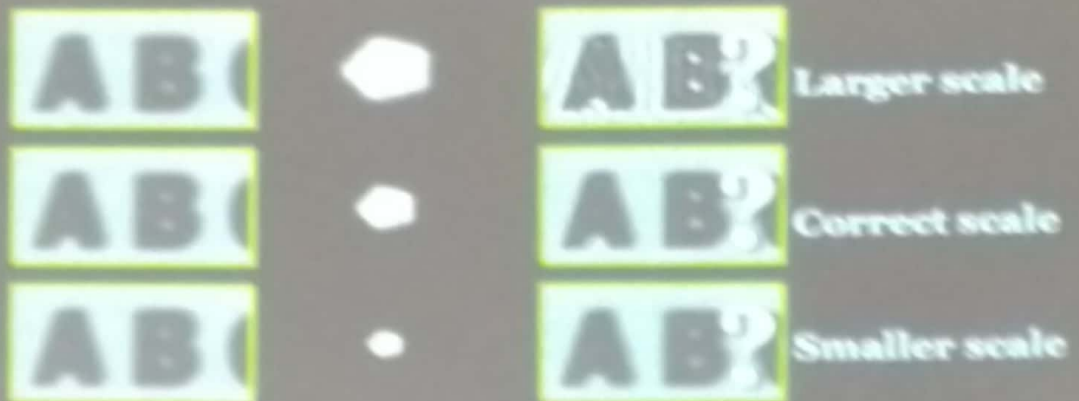
Depth and defocus



⇒ Depth from defocus:

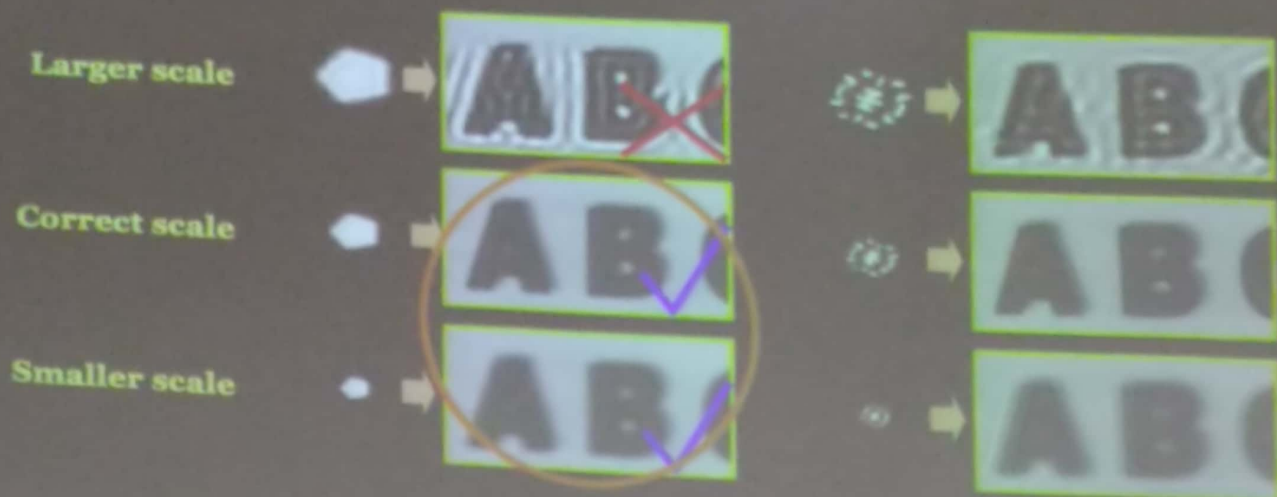
Overview

Try deconvolving local input windows with different scaled filters:



Why coded?

Coded aperture- reduce uncertainty in scale identification



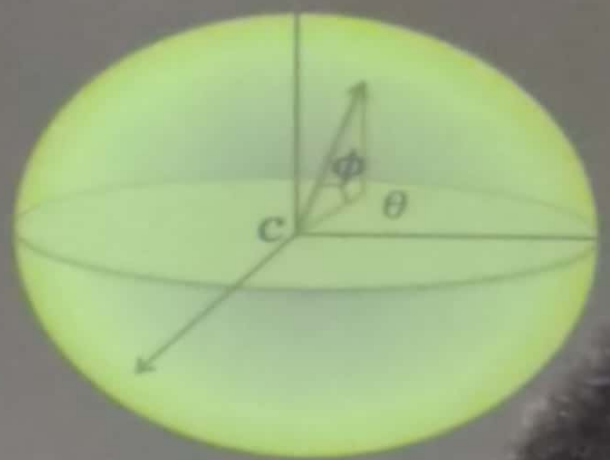


Light-field Cameras and Stereo Panoramic Imaging

Rajat Aggarwal, Amrisha Vohra, Anoop M. Namboodiri

Omnidirectional Image

- A 2-D function $I(\theta, \phi)$ in terms of the polar and azimuthal angles



Omnidirectional Stereo

- For every pair of points: $((\theta_i, \phi_i), (\theta_j, \phi_j))$ on a sphere, we need to capture a light ray

