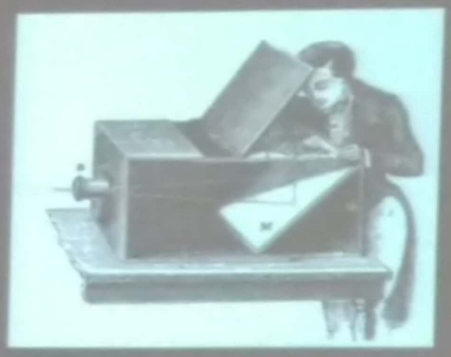
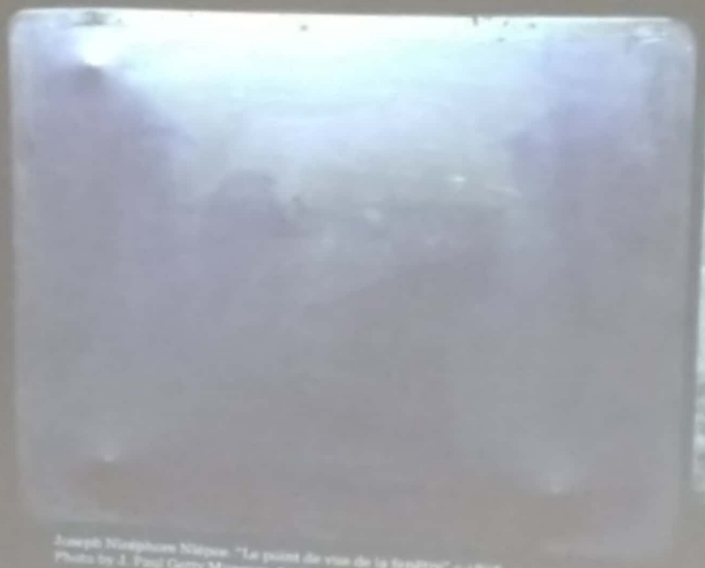
Camera Obscura (18th century)



Earliest Surviving Photograph (c.1826)



Joseph Nicéphore Niépce. "Le point de vue de la fenêtre" c.1826.
Photo by J. Paul Getty Museum, from

Joseph Nicéphore Niépce. "Le point de vue de la fenêtre" c.1826.
Enhanced by Helmut Gernsheim, c. 1952
public domain

Digital Imaging

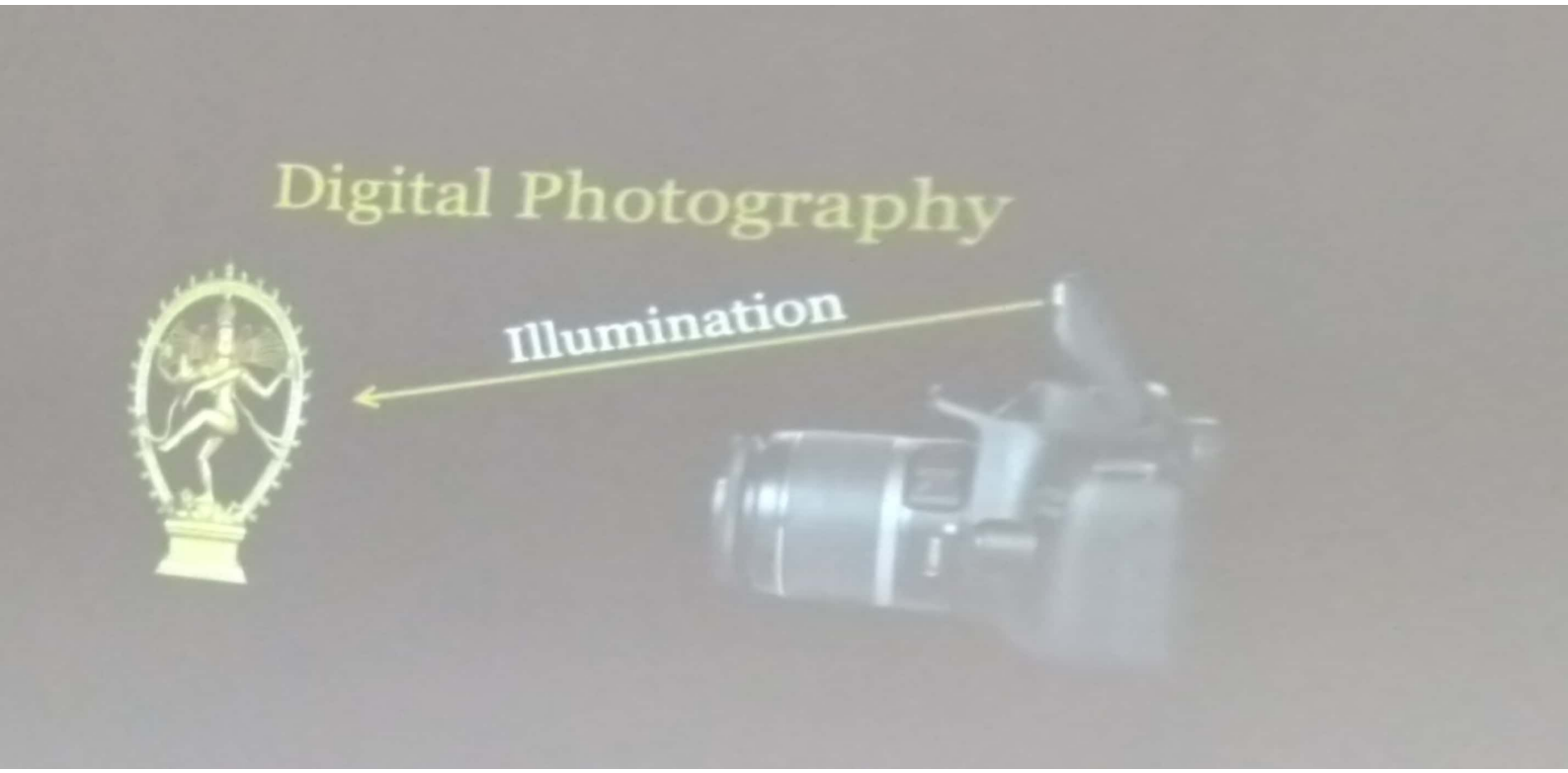
First Digital Photograph (1957)

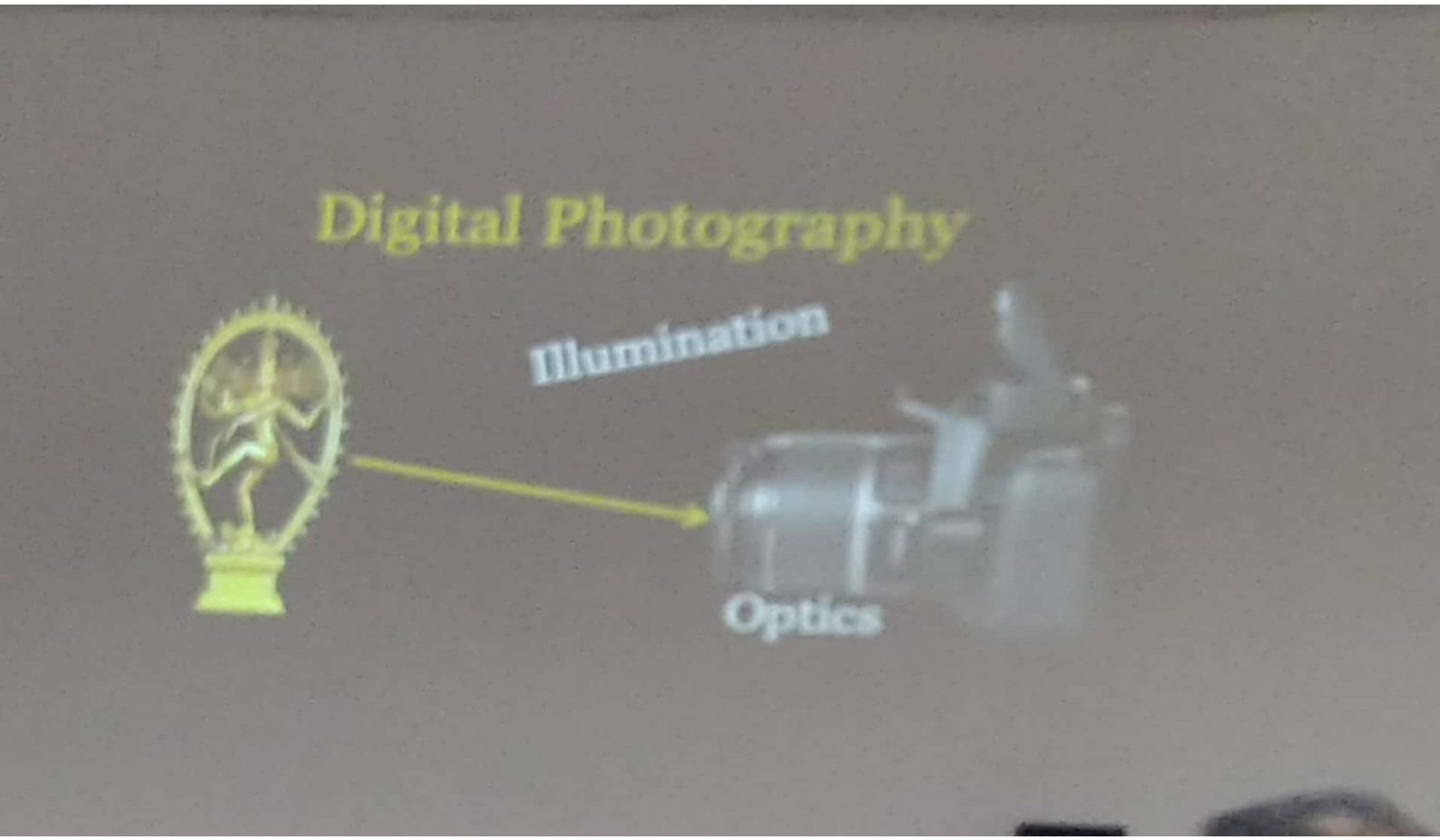
Resolution: 176x176,

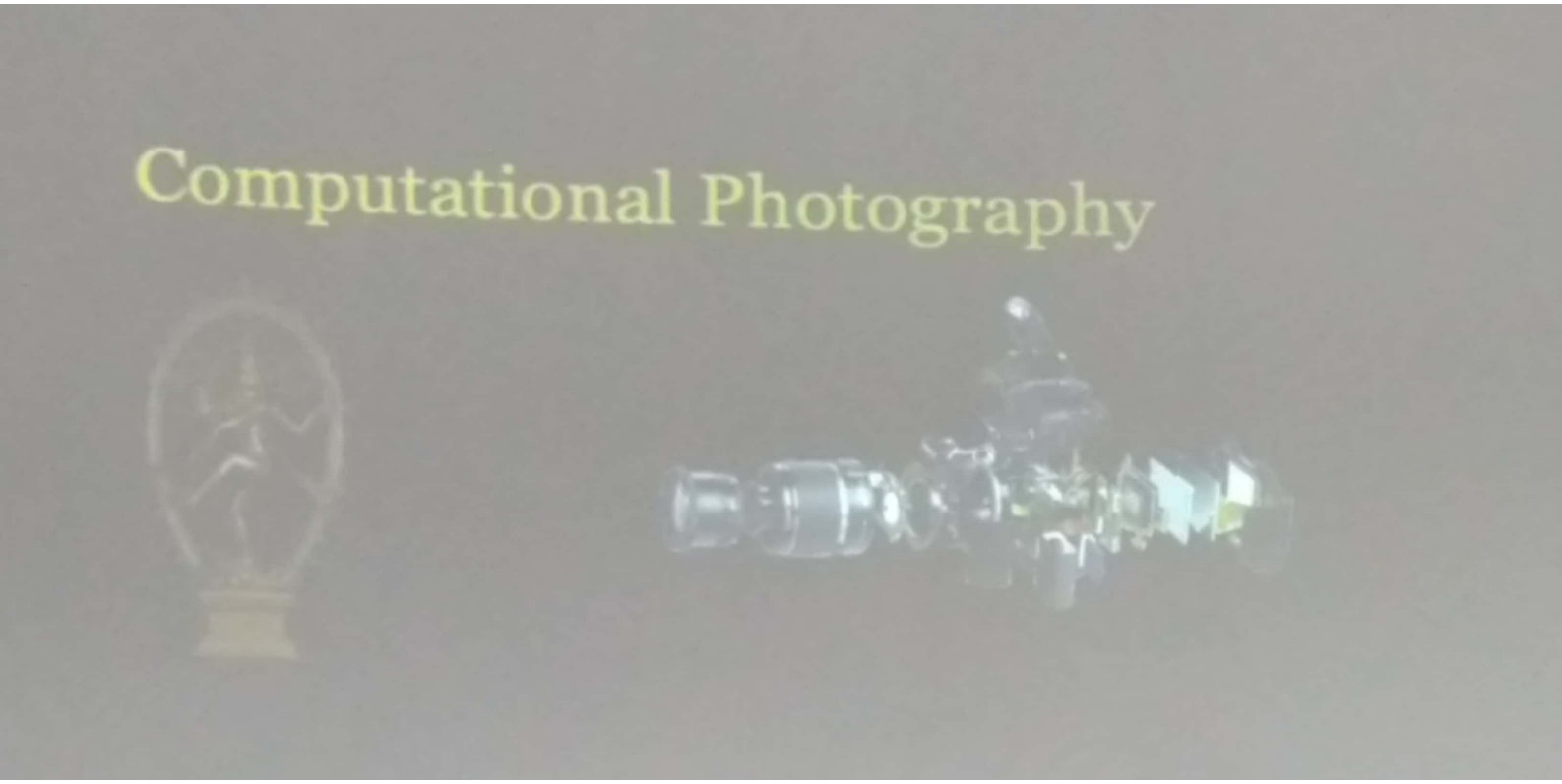
Russell Kirsch, "Walden", 1957, from petapixel

First Digital Camera (1975)

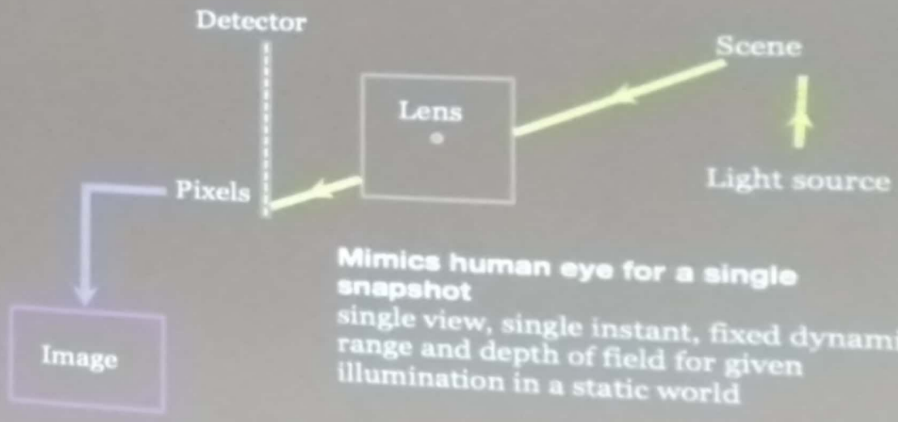
Steve Sasson, Eastman Kodak. Photo credit: Eastman Kodak





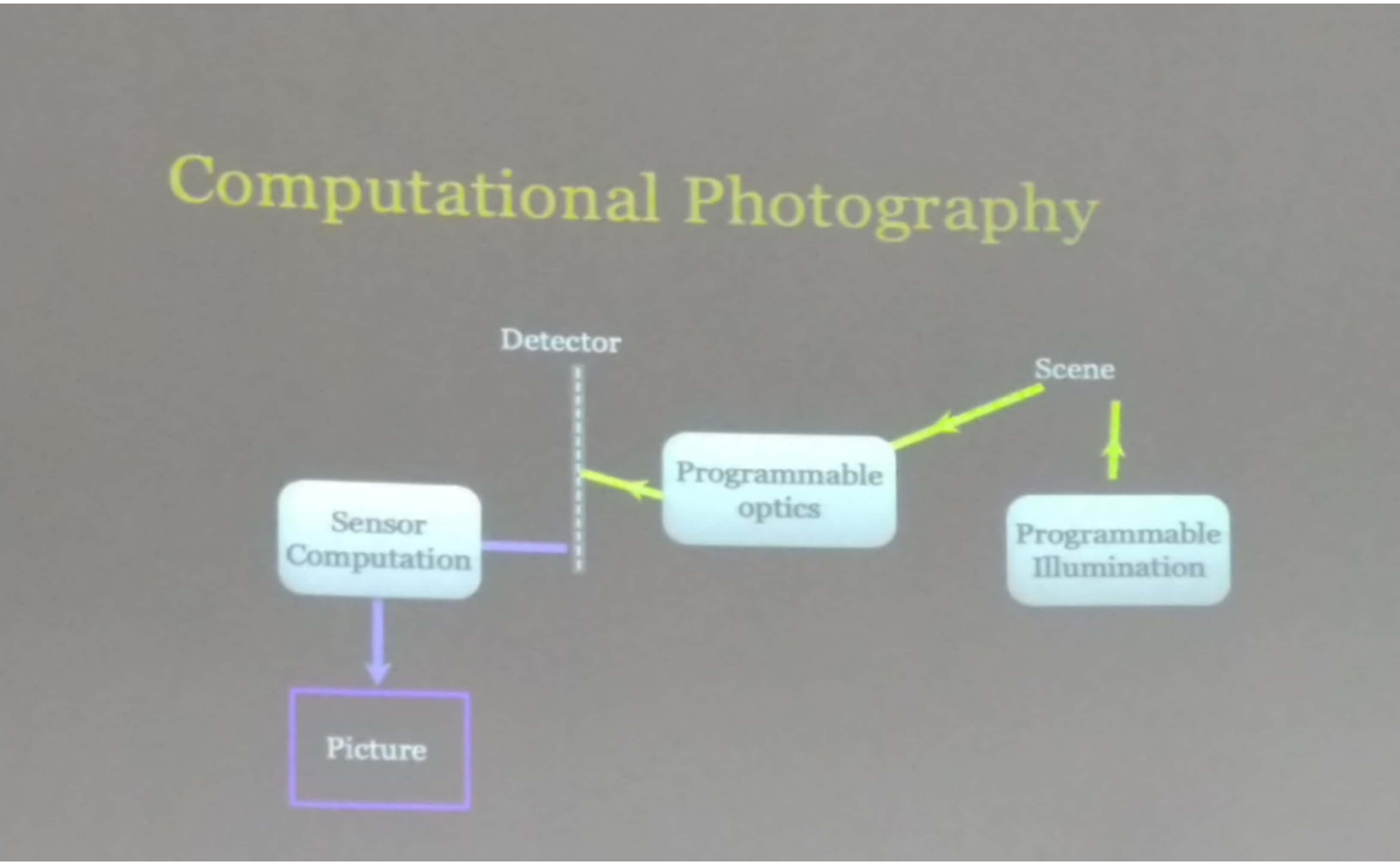


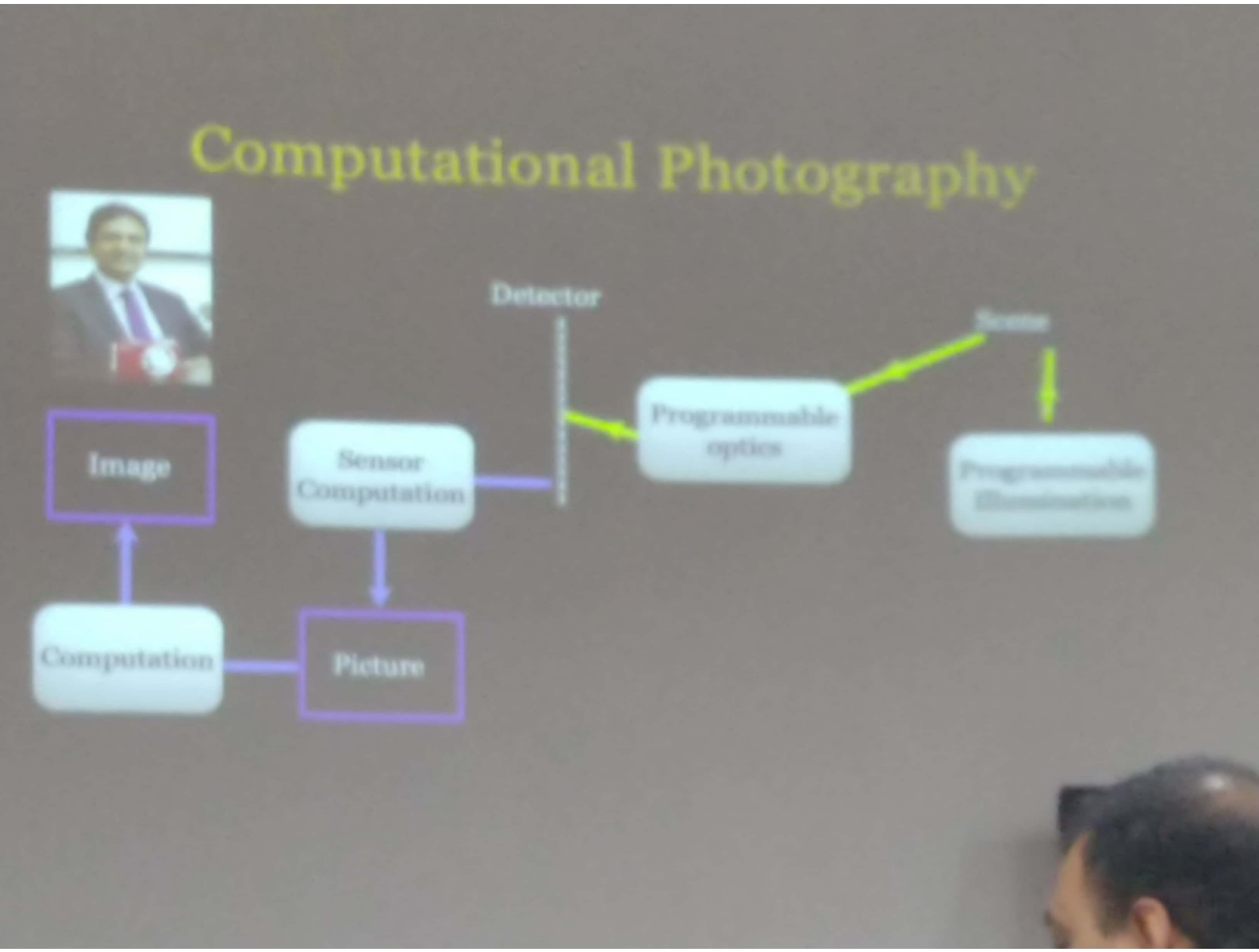
Traditional, "film-like" Photography



Mimics human eye for a single snapshot

single view, single instant, fixed dynamic range and depth of field for given illumination in a static world

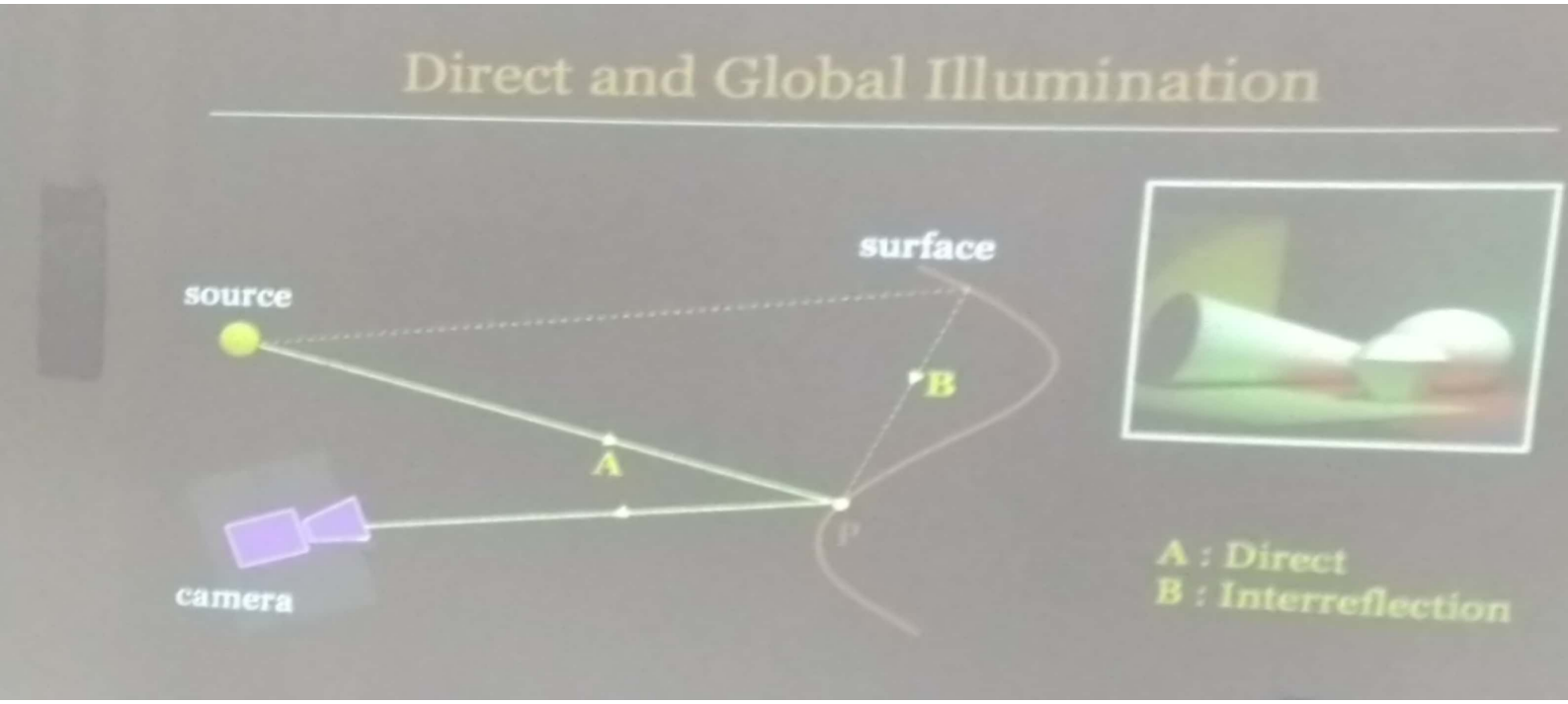


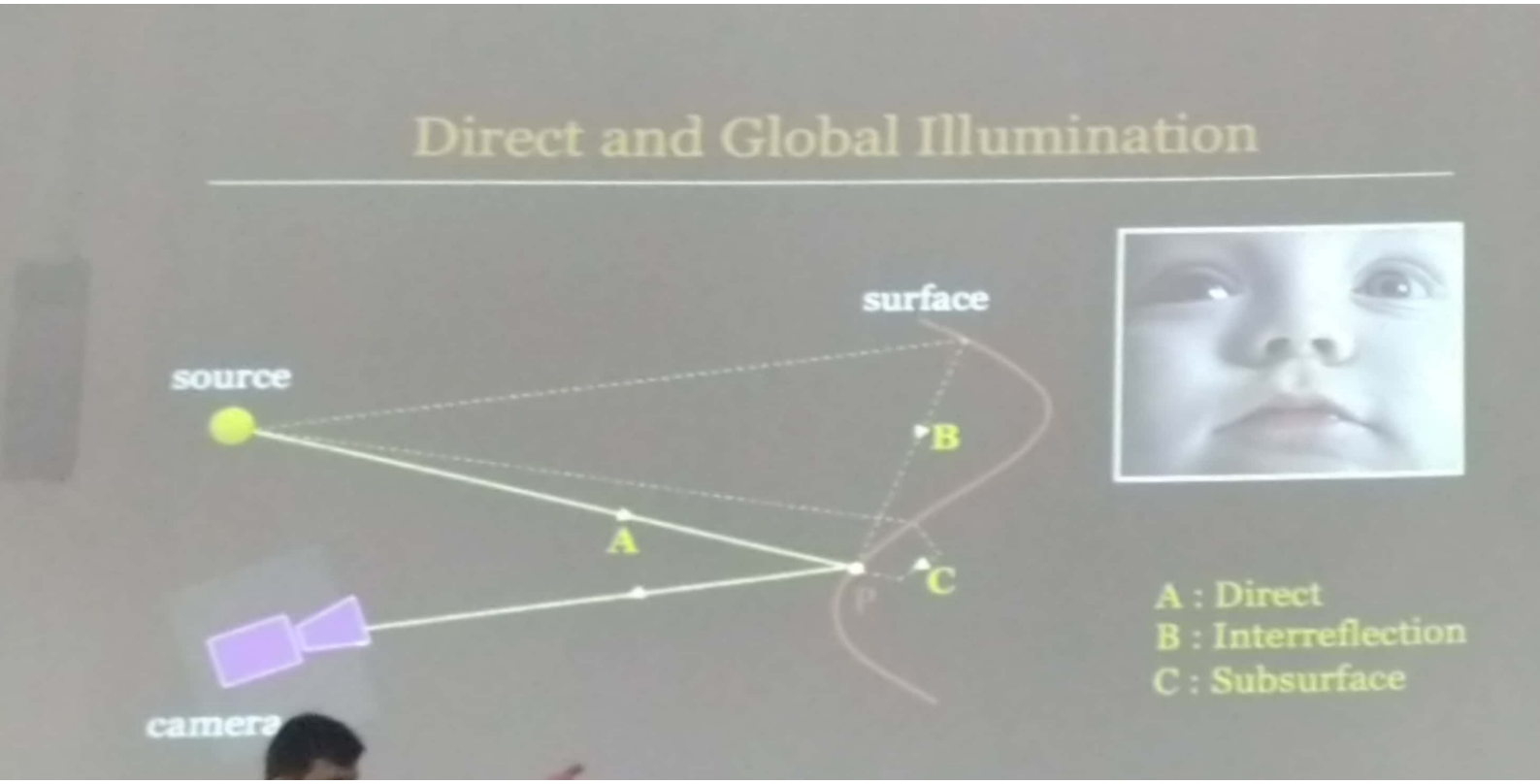


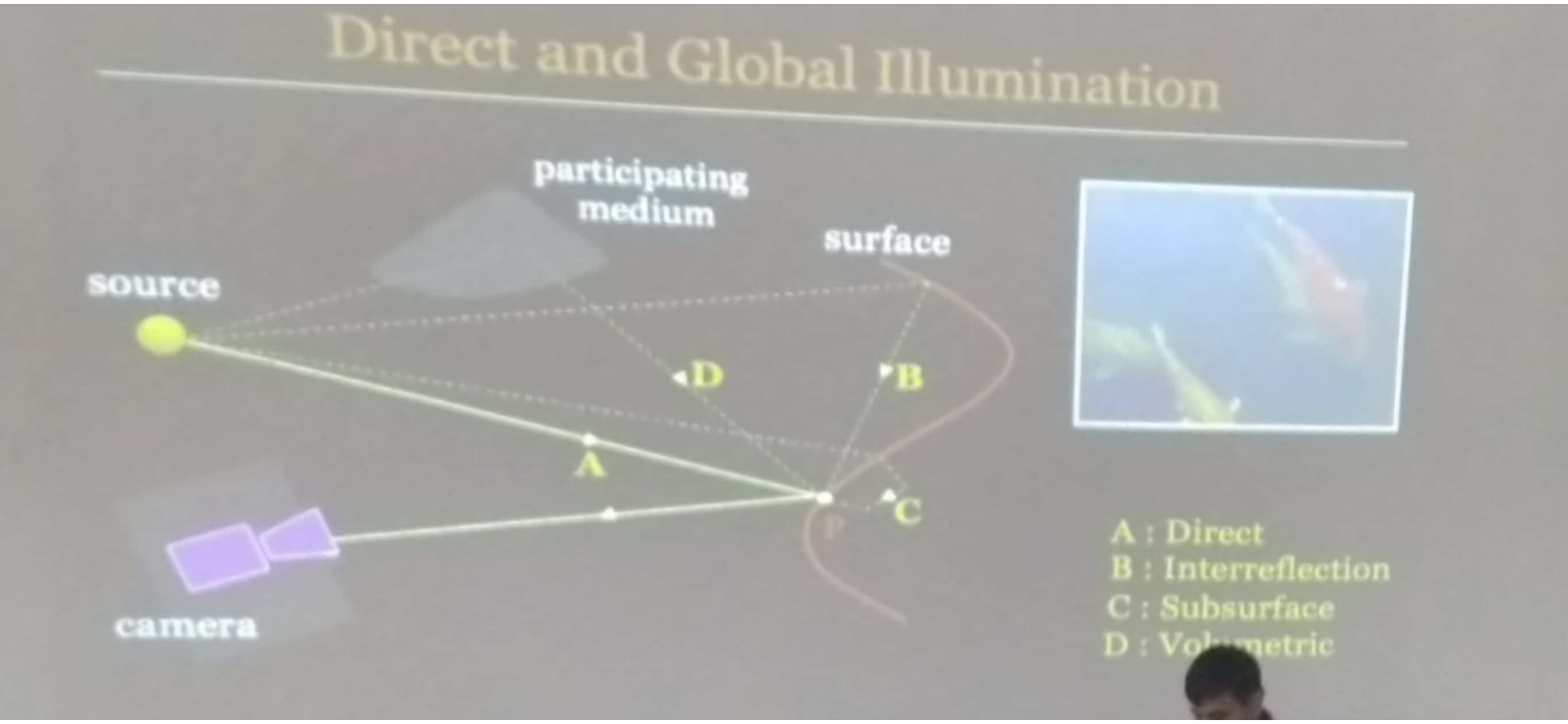
Separating Direct and Global Light

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.

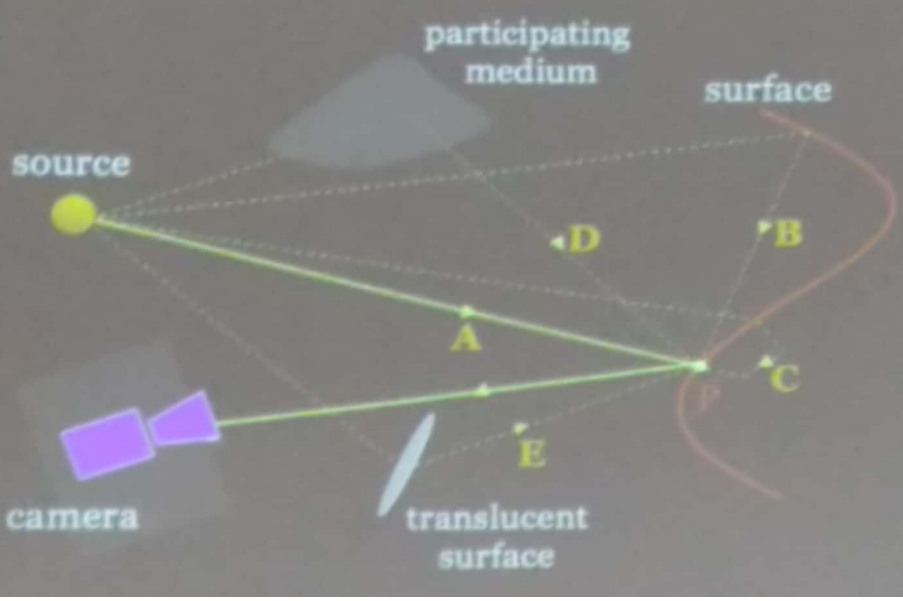


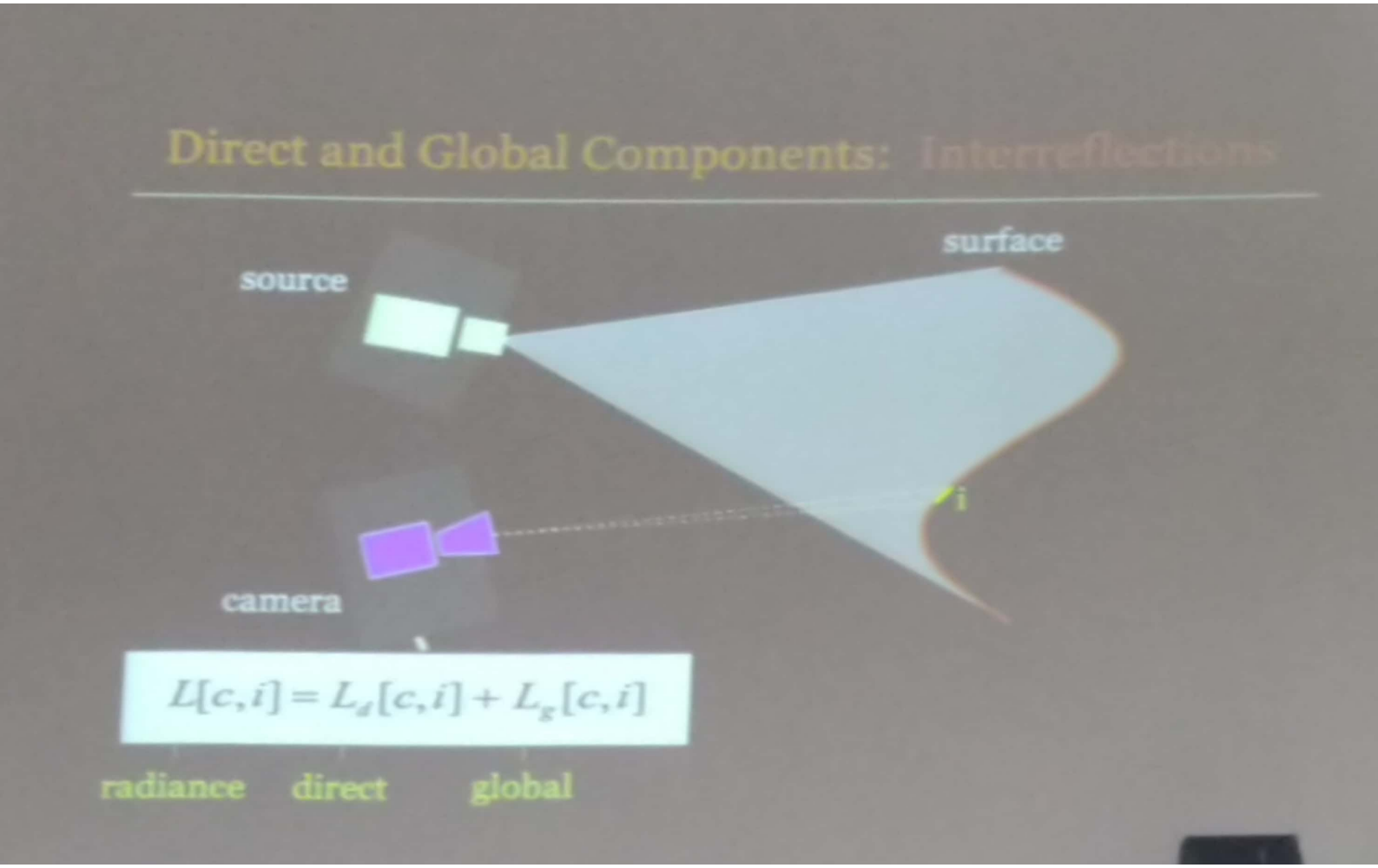


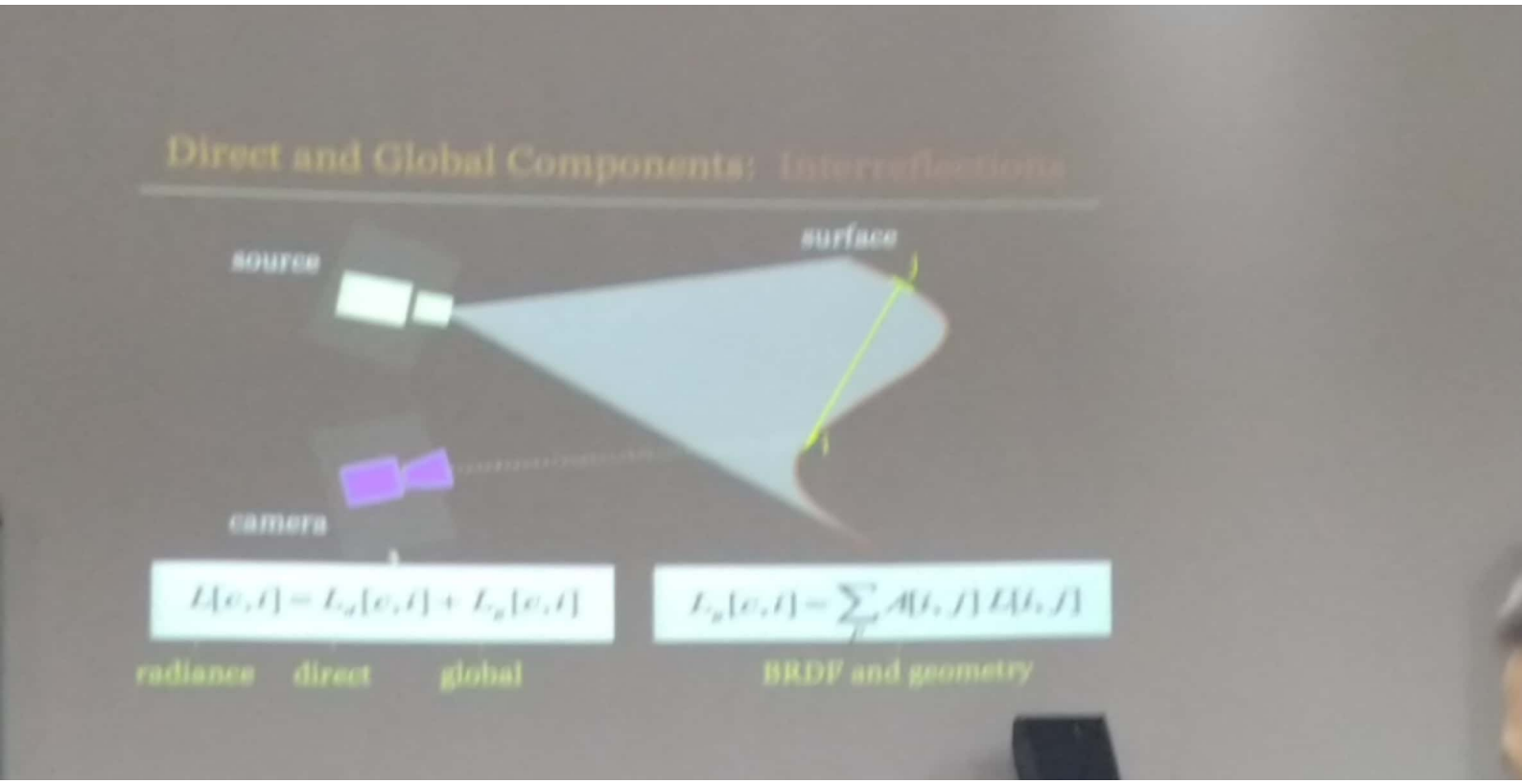


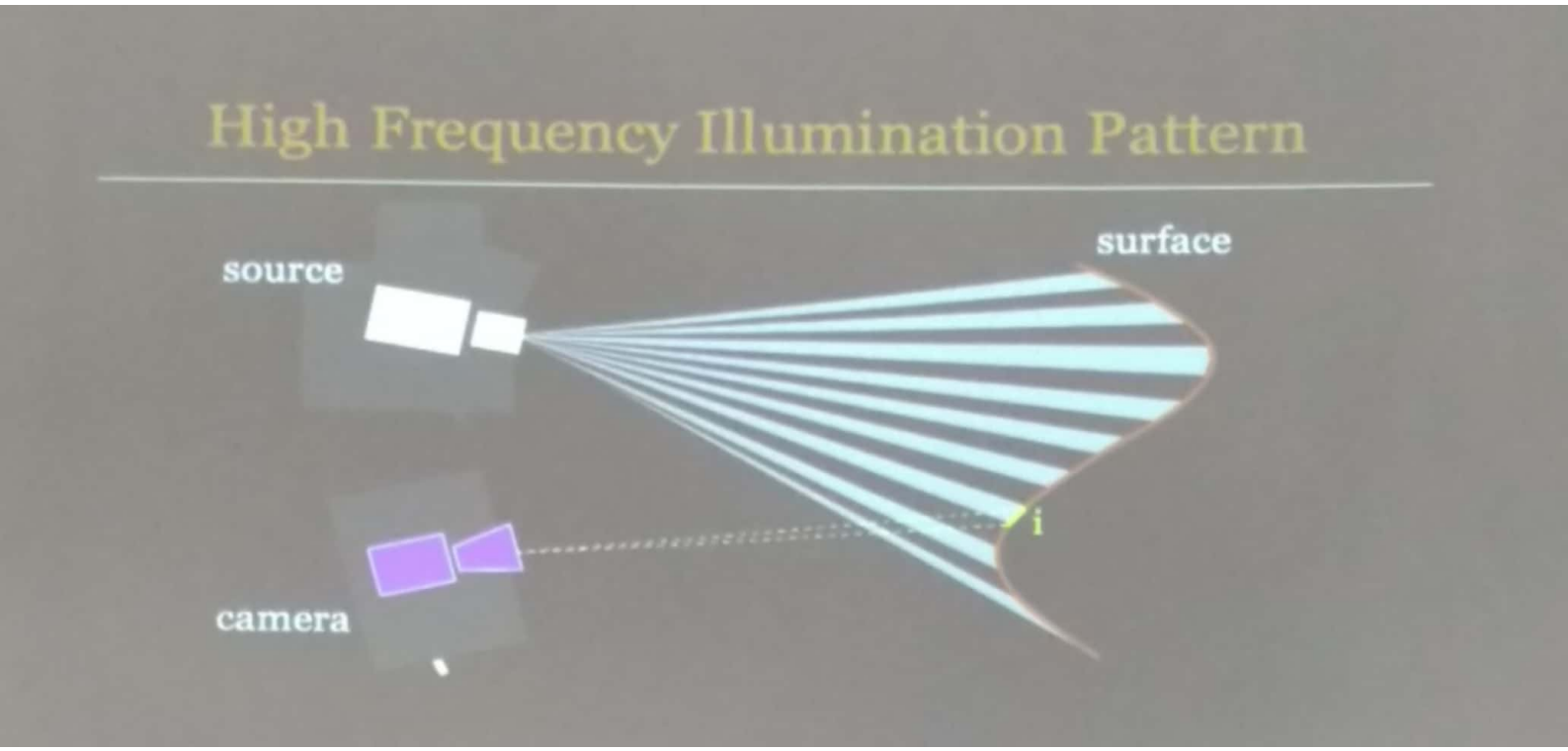
Direct and Global Illumination



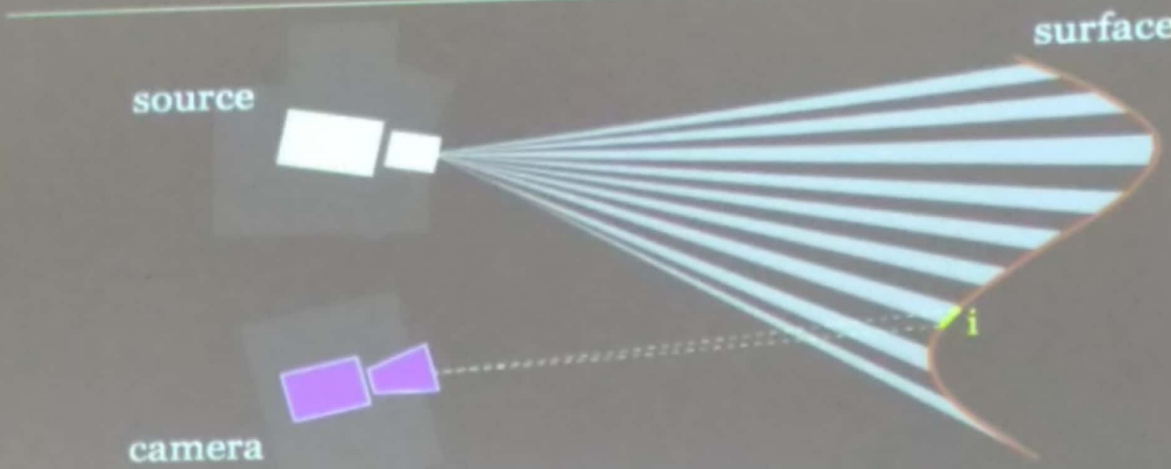
A : Direct
B : Interreflection
C : Subsurface
D : Volumetric
E : Diffusion







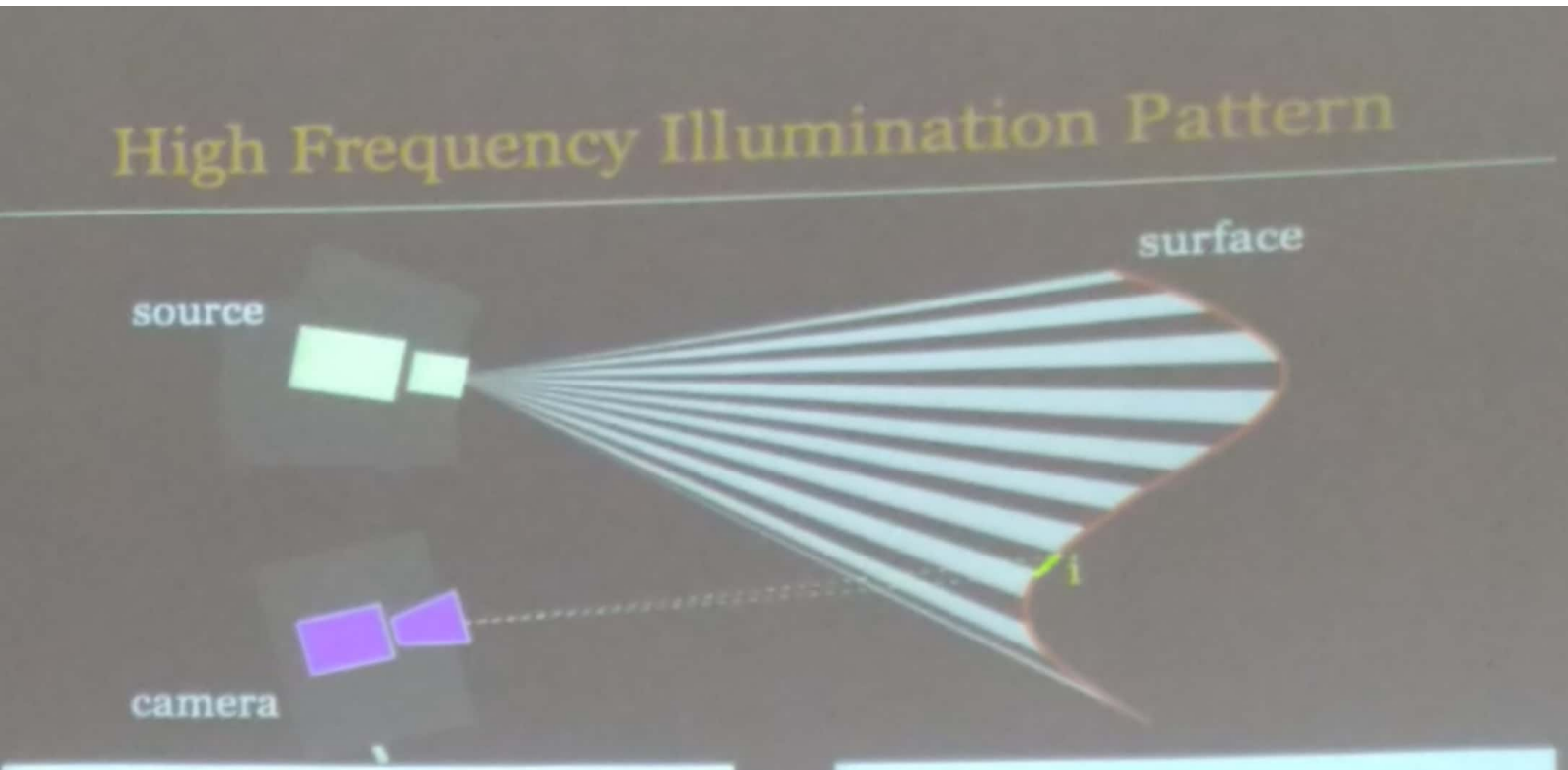
High Frequency Illumination Pattern



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

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

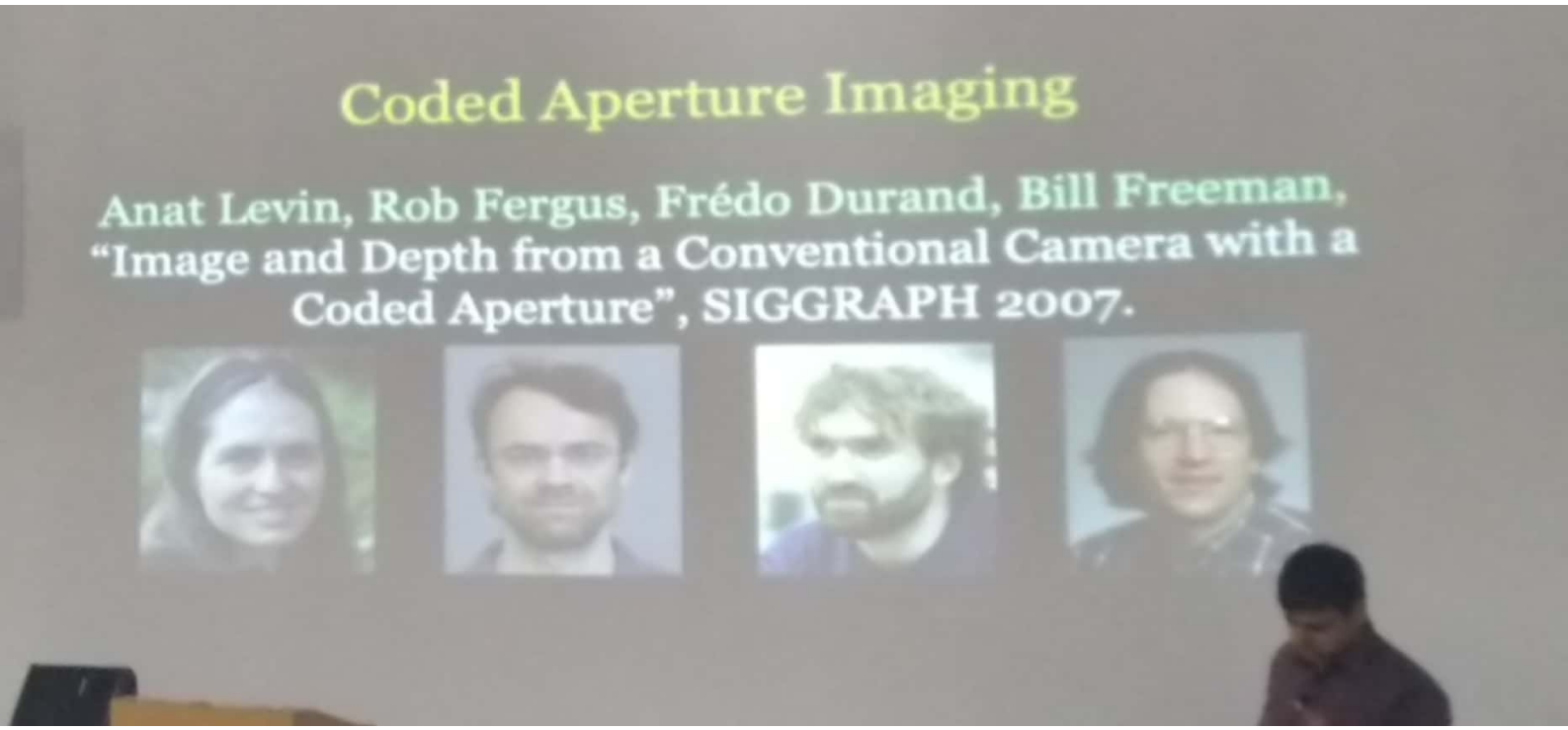
Separation from Two Images

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

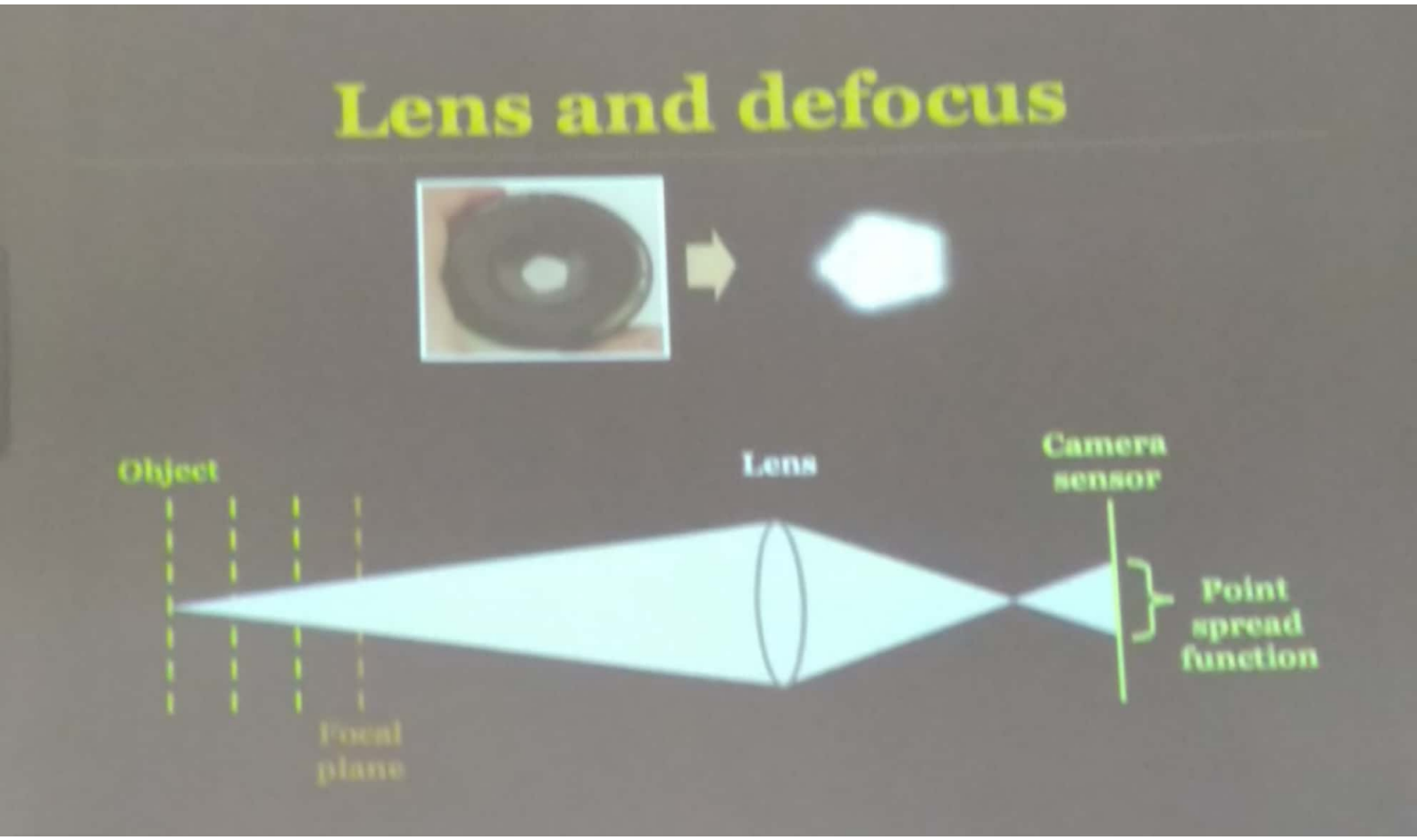
$$L_d = L_{\max} - L_{\min}, \quad L_g = 2L_{\min}$$

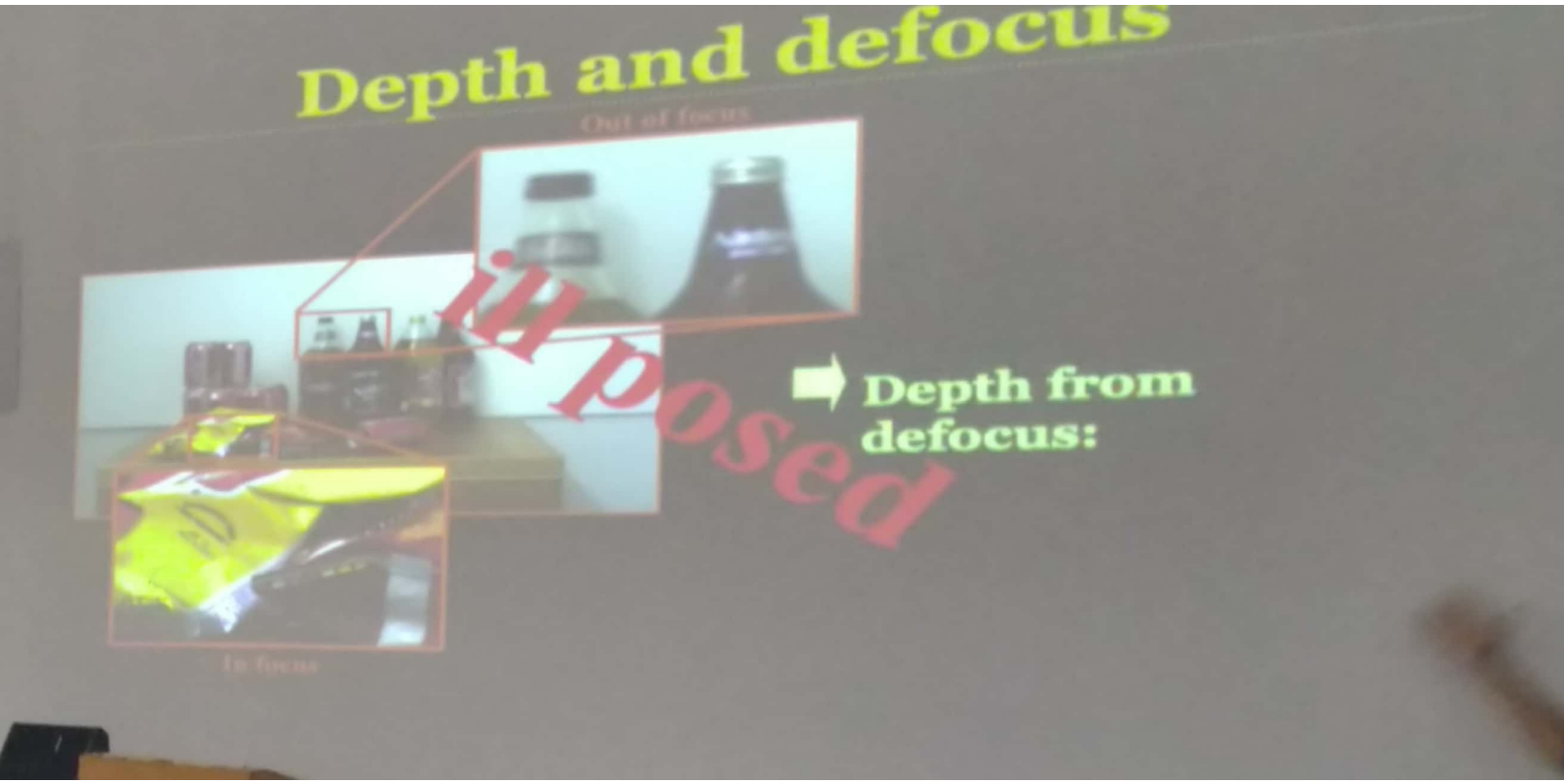
direct

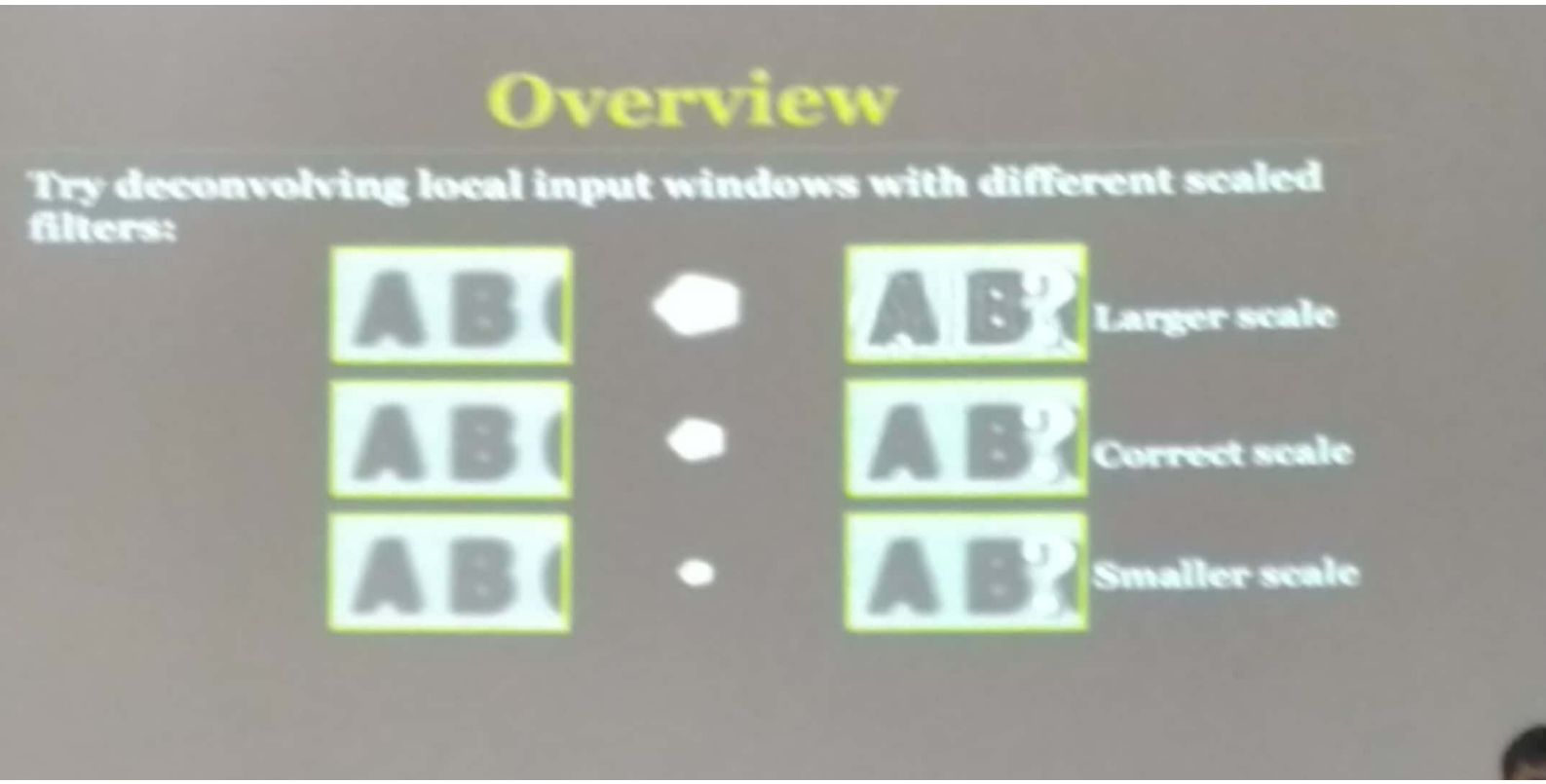
global

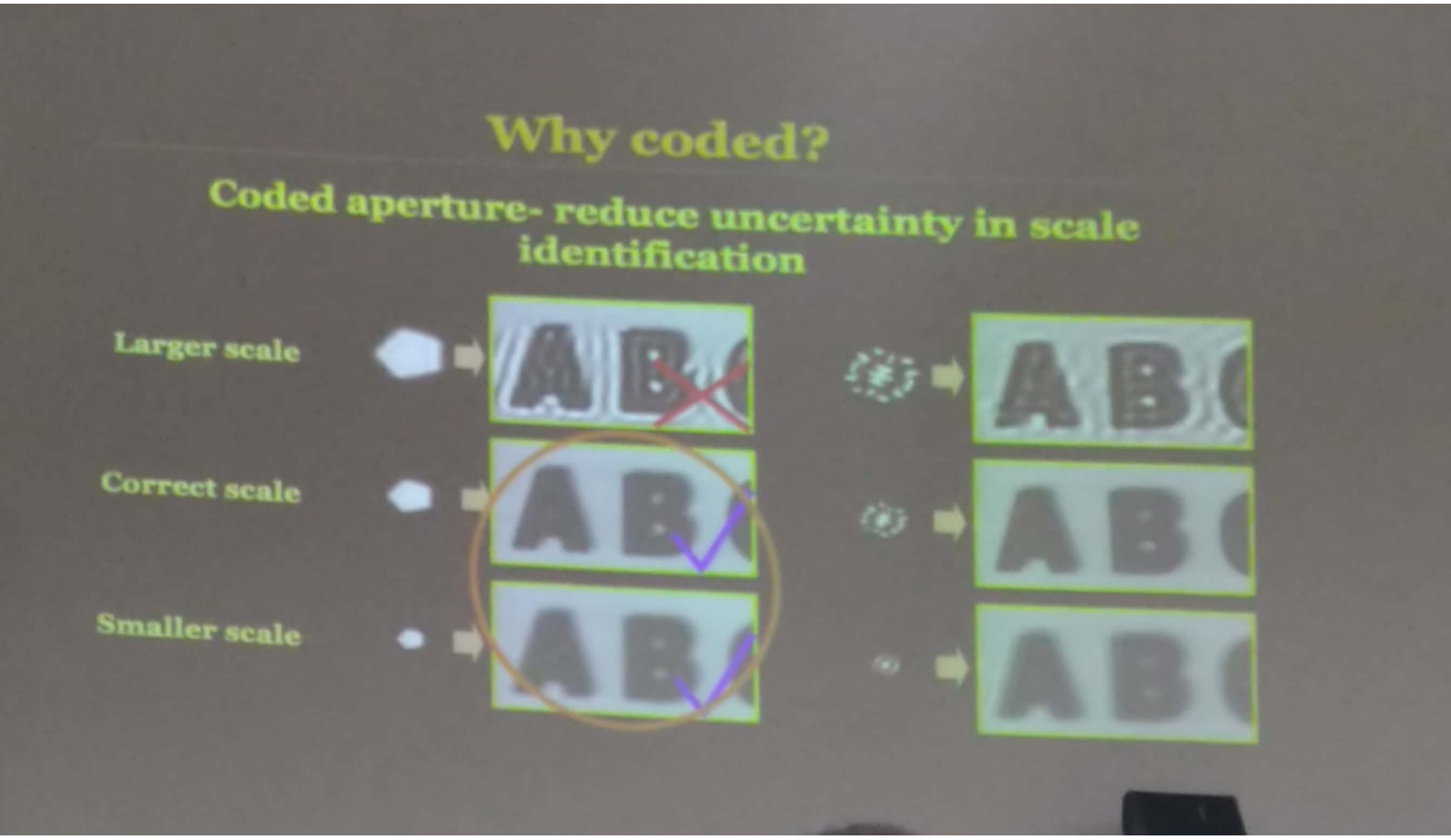


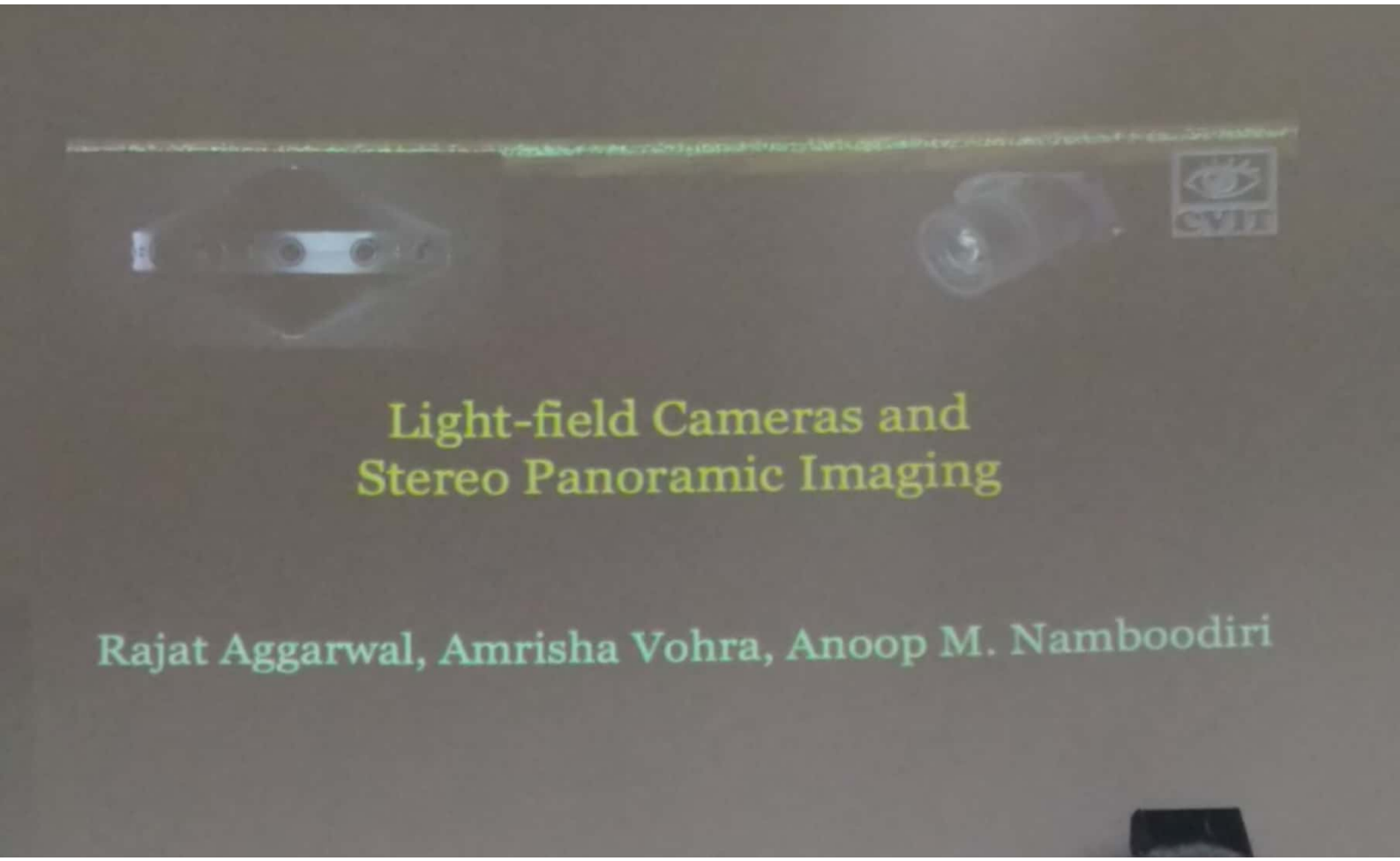
Lens and defocus





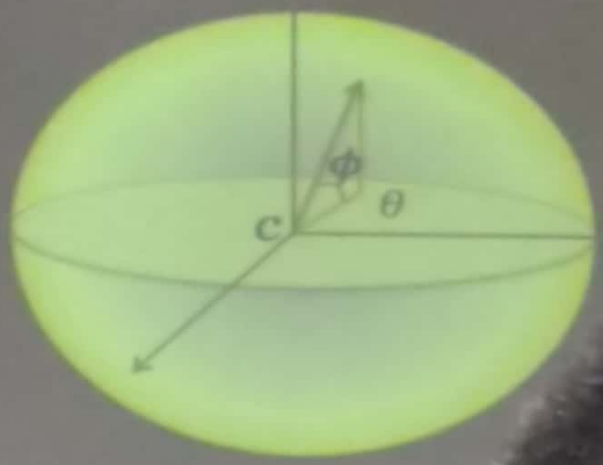






Omnidirectional Image

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



Omnidirectional Stereo

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