Dr Fangcheng Zhong

Computational 3D Displays

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Outline

- Computational 3D displays
  - Stereoscopic displays
    - Varifocal displays
    - Multifocal displays
    - Optical see-through displays
  - Volumetric displays
    - Holographic displays
    - Light field displays
    - Voxel-based displays

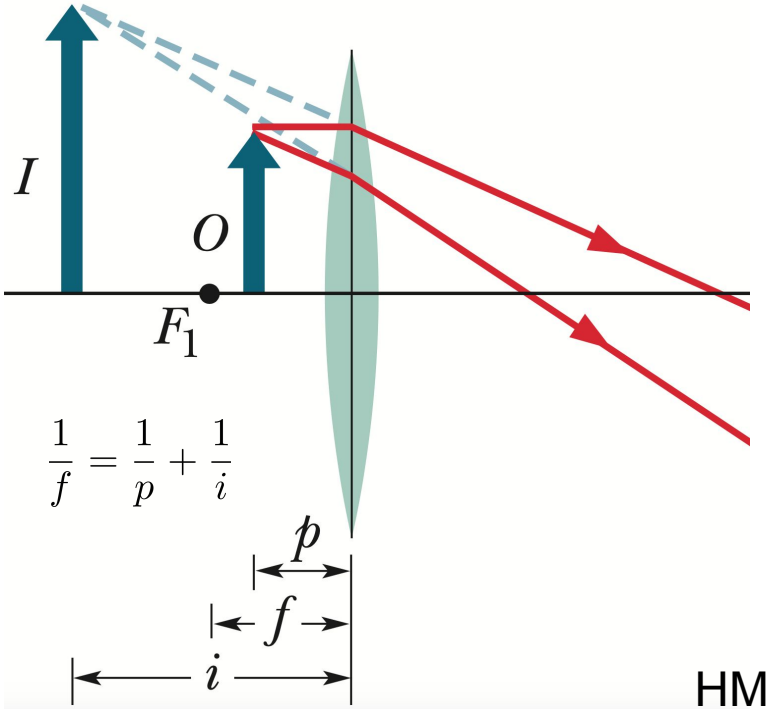
Stereoscopic Displays

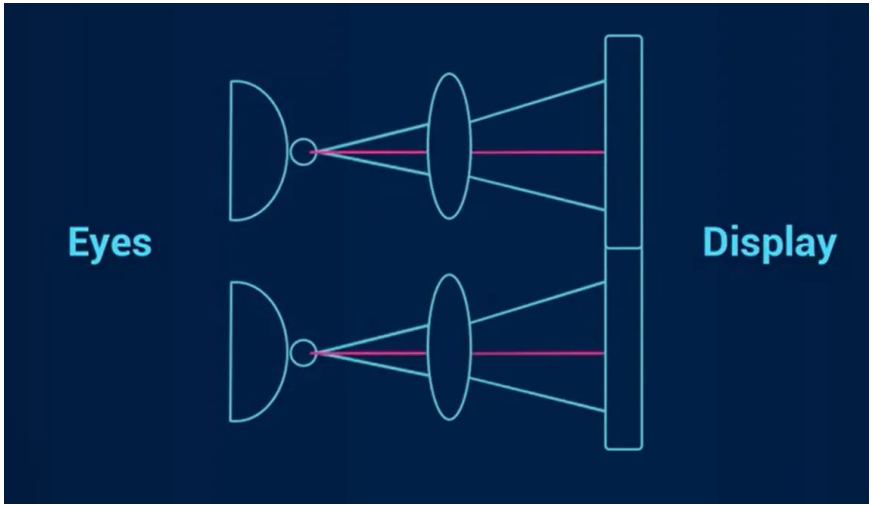
polarized glasses / 3D movies

Stereoscopic Displays

Head-Mounted VR Displays (HMDs)

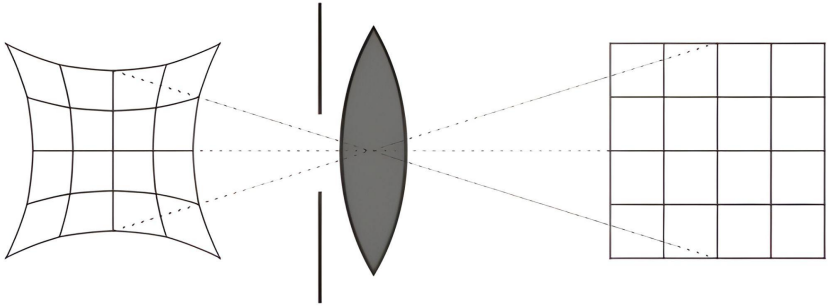
Head-Mounted Displays



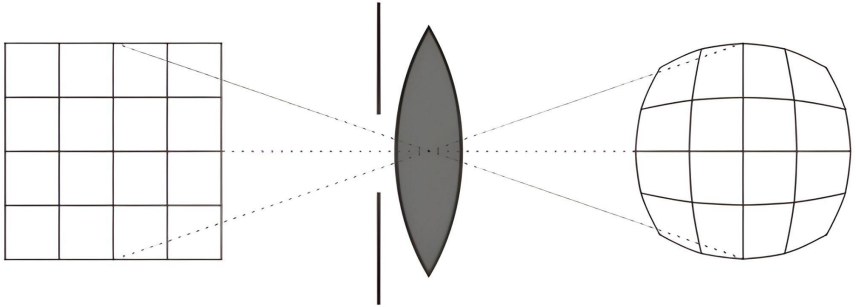


HMD Optics

Head-Mounted Displays

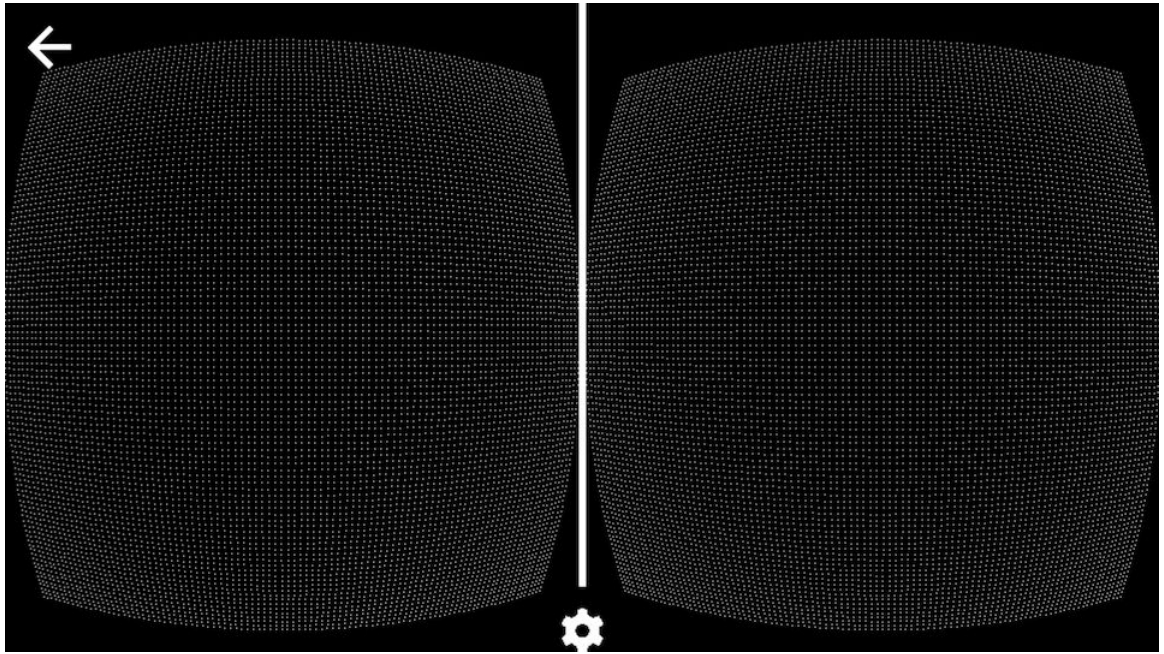


pincushion lens distortion



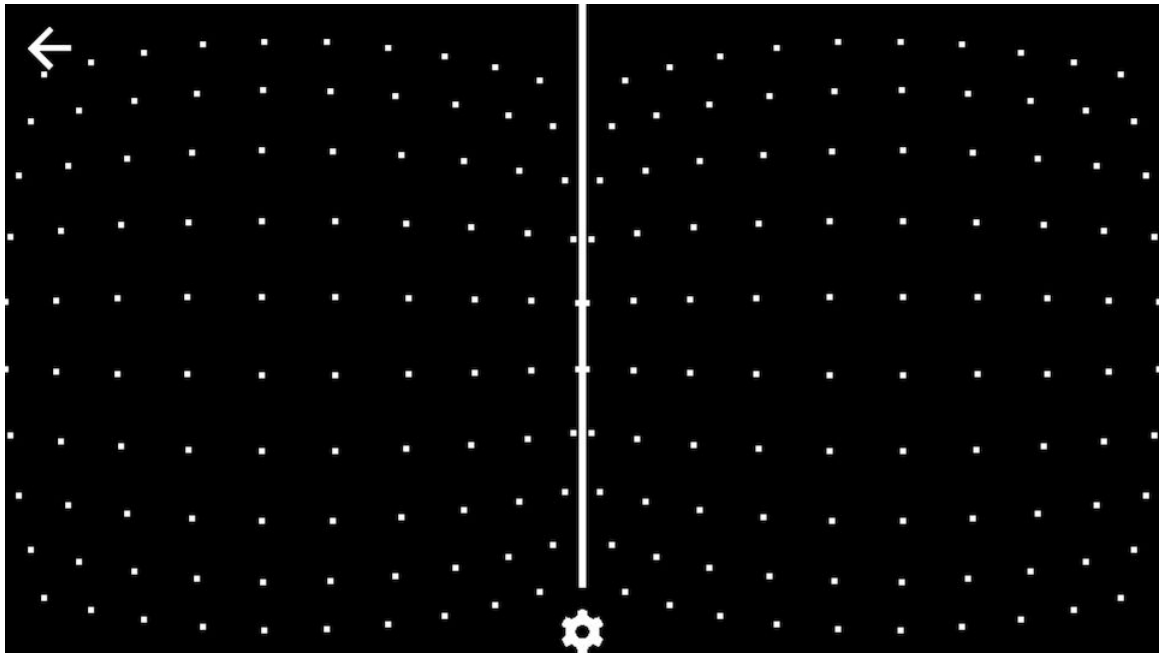
correction with a barrel distortion

Head-Mounted Displays



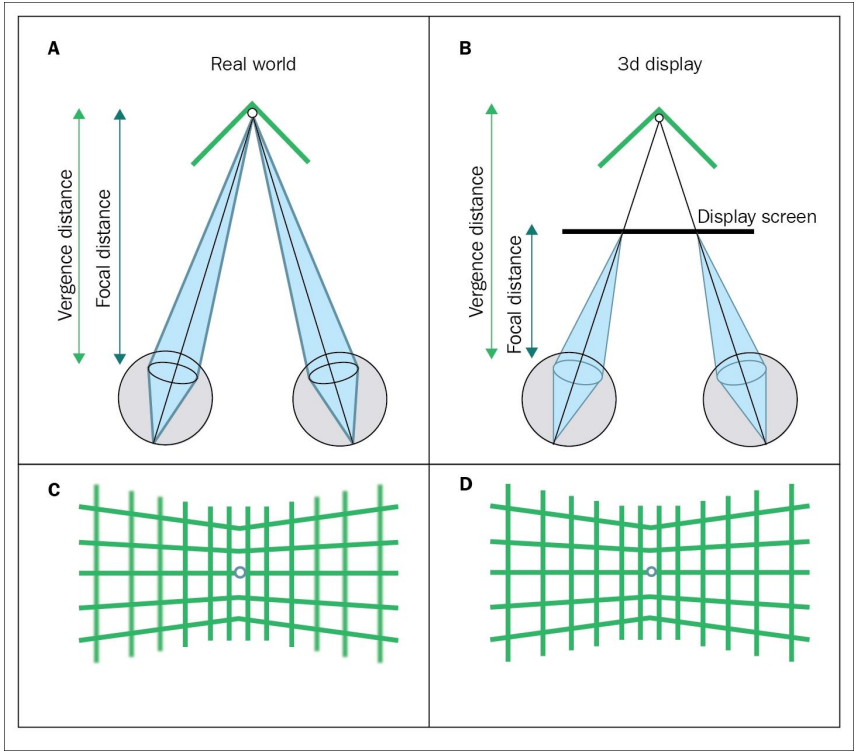
two-pass rendering

Head-Mounted Displays



vertex displacement

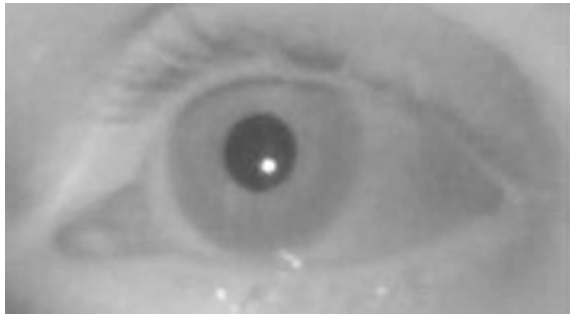
Vergence-Accommodation Conflits



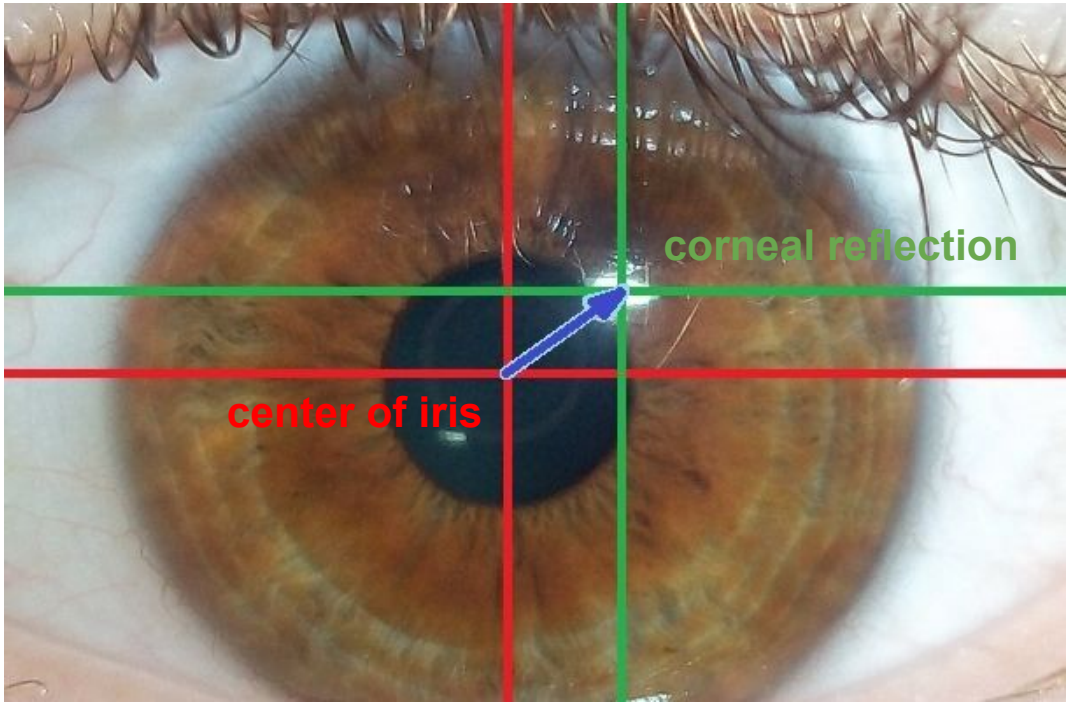
Varifocal Display

D. Dunn et al., "Wide Field Of View Varifocal Near-Eye Display Using See-Through Deformable Membrane Mirrors," in IEEE Transactions on Visualization and Computer Graphics, vol. 23, no. 4, pp. 1322-1331, April 2017

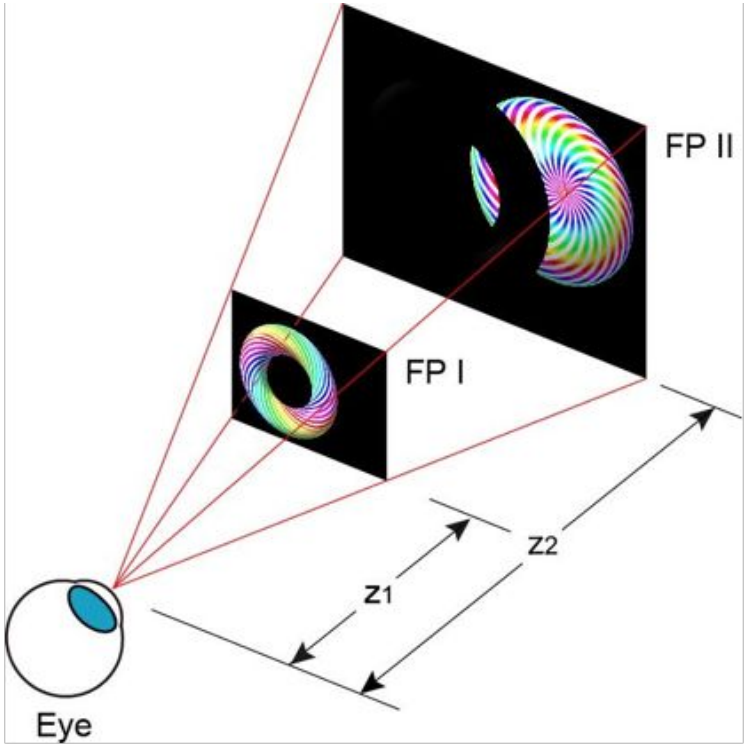
Gaze Tracking



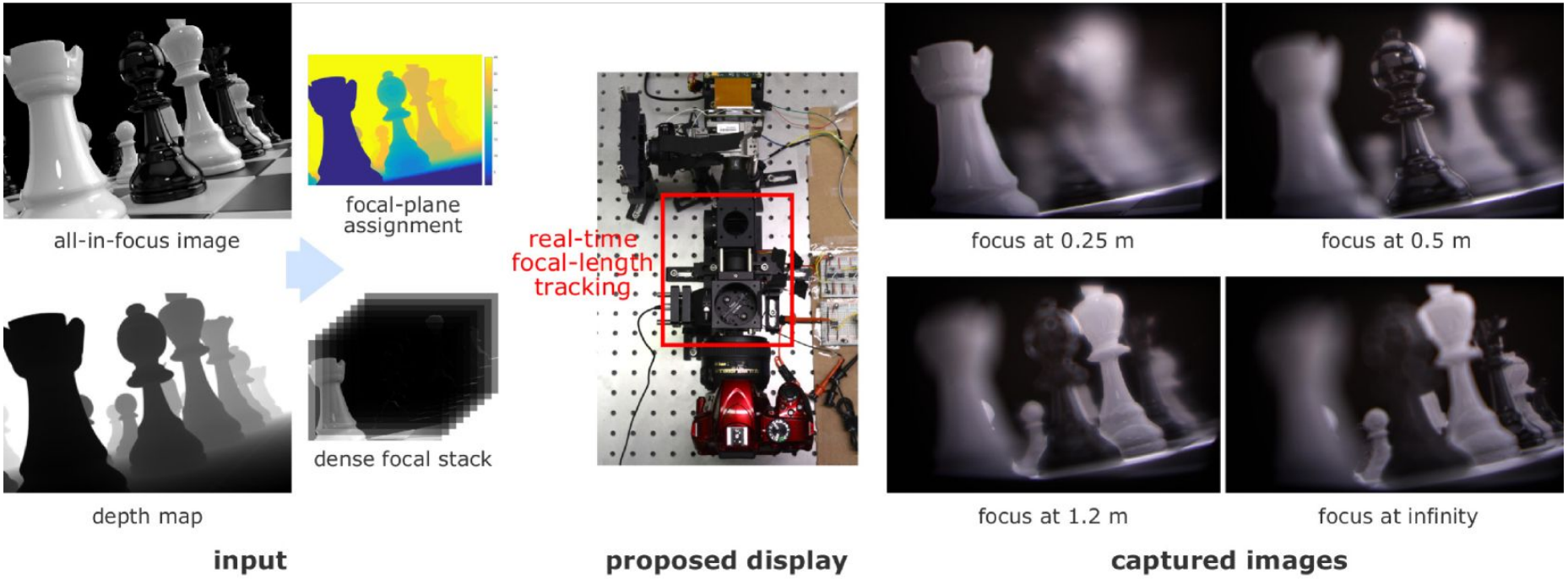
infrared light source



Multifocal Display



Multifocal Display



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Chang, Jen-Hao Rick, BVK Vijaya Kumar, and Aswin C. Sankaranarayanan. "Towards multifocal displays with dense focal stacks." ACM Transactions on Graphics (TOG) 37.6 (2018): 1-13.

Multifocal Display

HDR Multifocal Display

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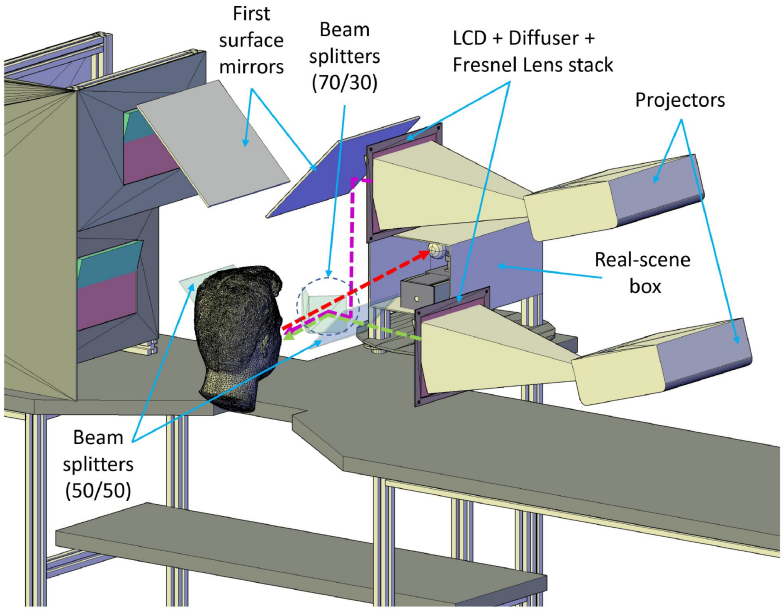
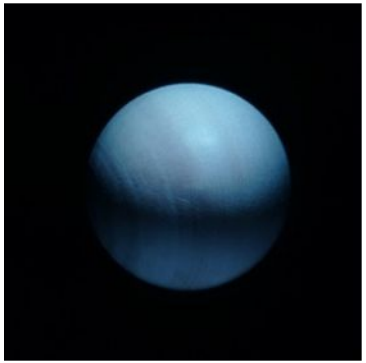
Fangcheng Zhong, Akshay Jindal, Ali Özgür Yöntem, Param Hanji, Simon J. Watt, and Rafał K. Mantiuk. 2021. Reproducing Reality with a High-Dynamic-Range Multi-Focal Stereo Display. ACM Transactions on Graphics (Proceedings of ACM SIGGRAPH Asia, Journal Track), 2021

Optical See-through Displays





HDR Multifocal Display

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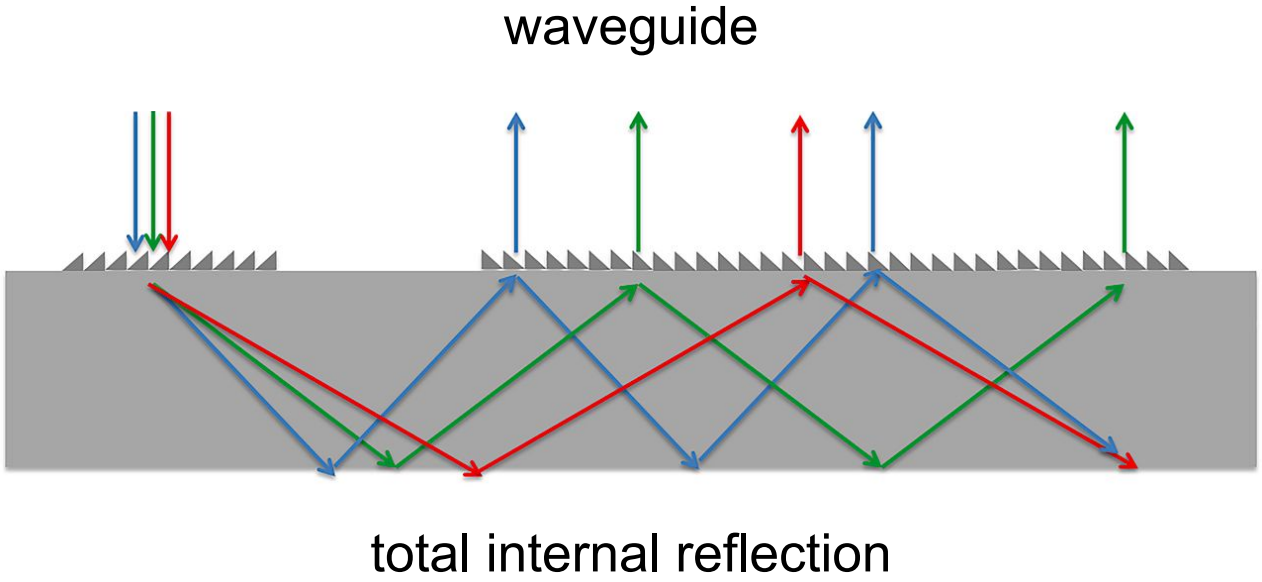
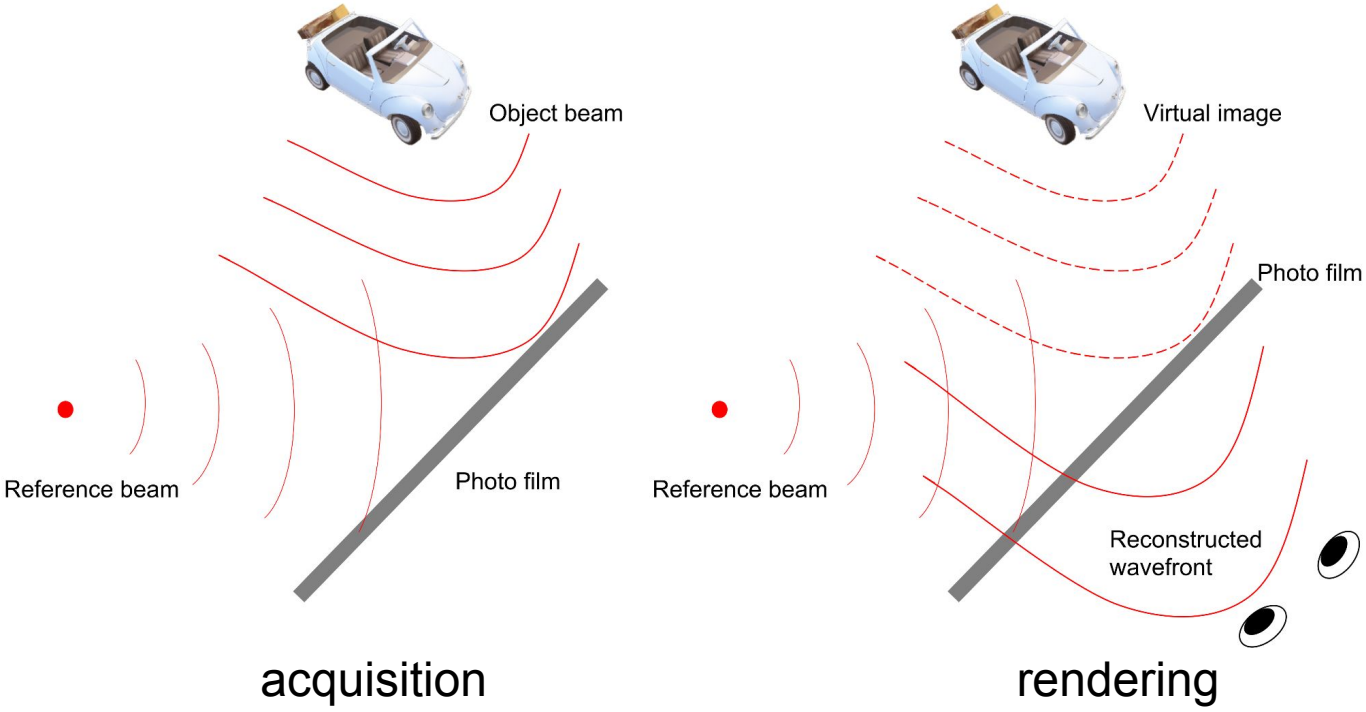
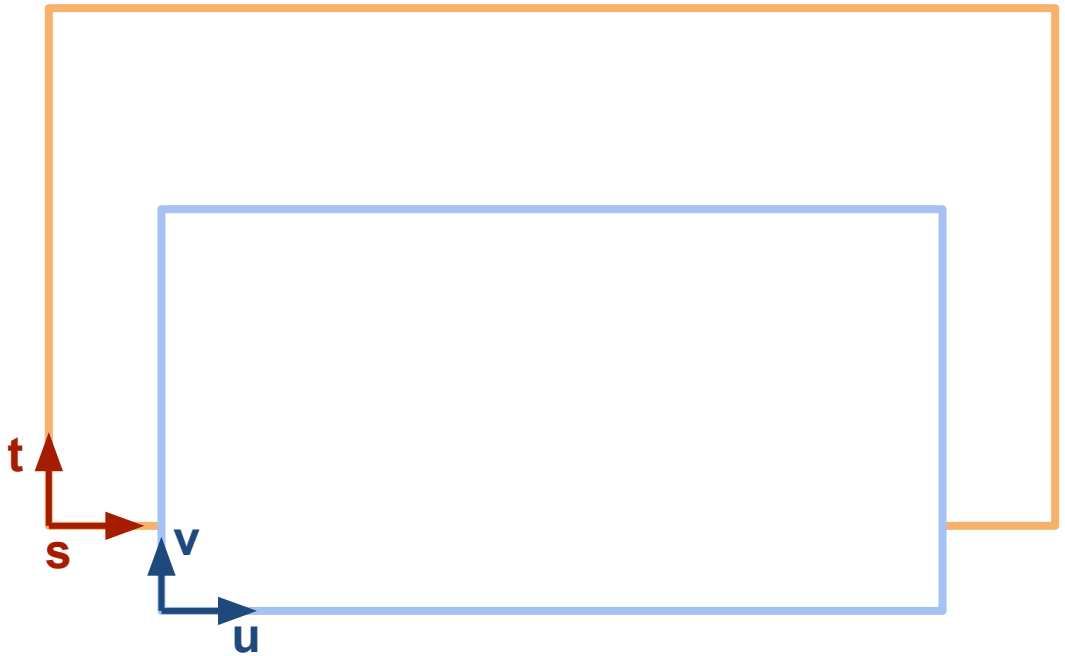
Optical See-through Displays



Holographic Display

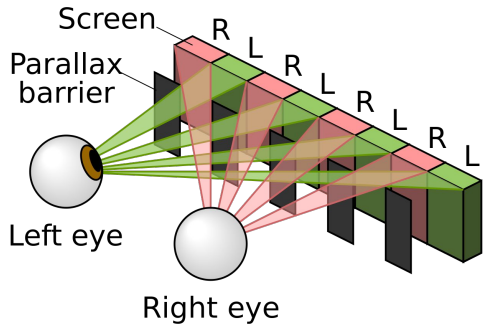


Light Field Displays

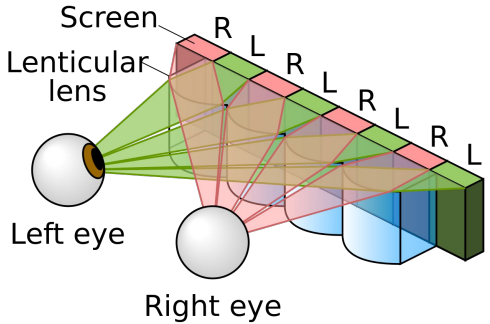


$f(u, v, s, t)$ position + directional light

Light Field Displays

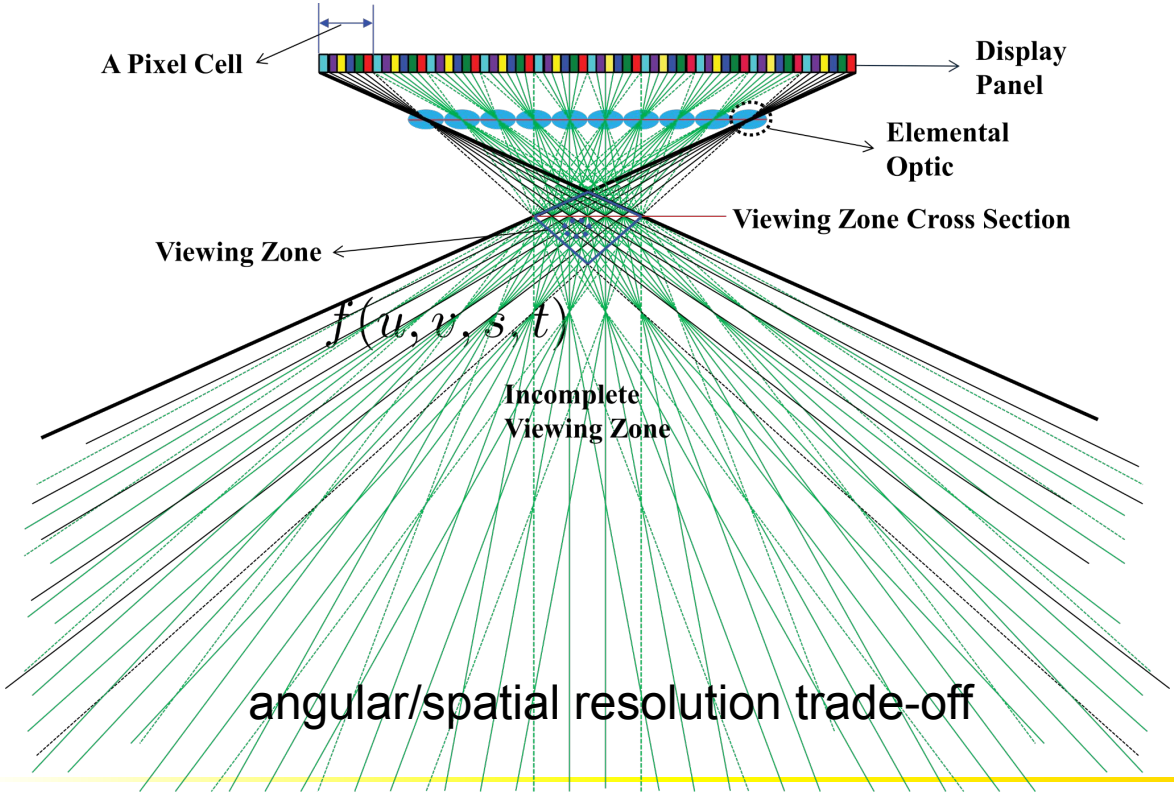


parallax barrier



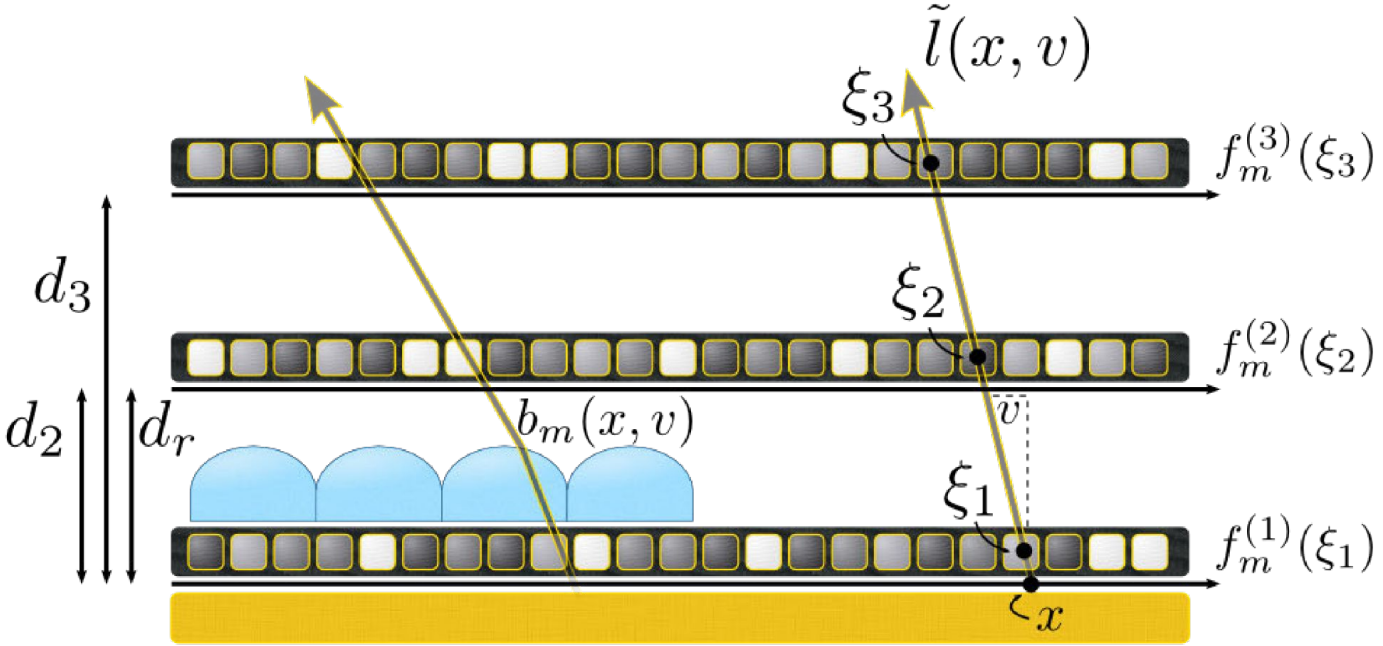
lenticular array

Light Field Displays



angular/spatial resolution trade-off

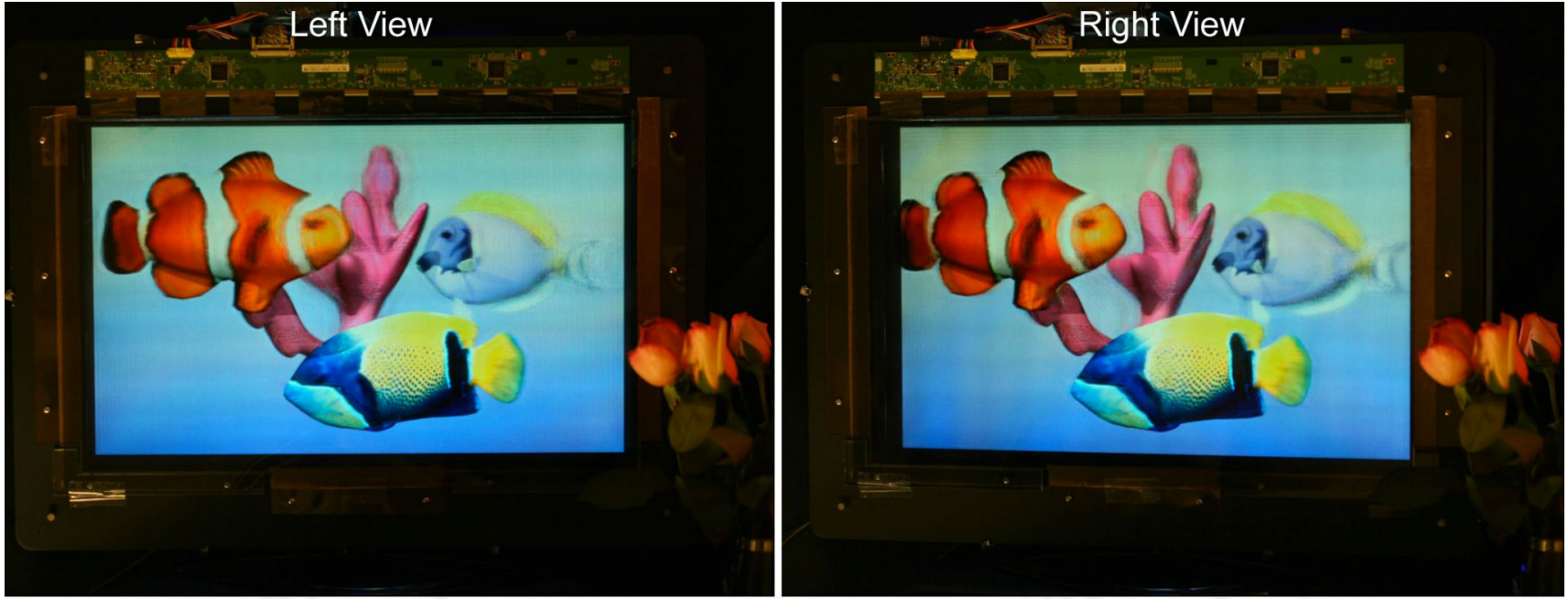
Light Field Displays



compressive light field displays

Wetzstein, Gordon, et al. "Tensor displays: compressive light field synthesis using multilayer displays with directional backlighting." (2012).

Light Field Displays



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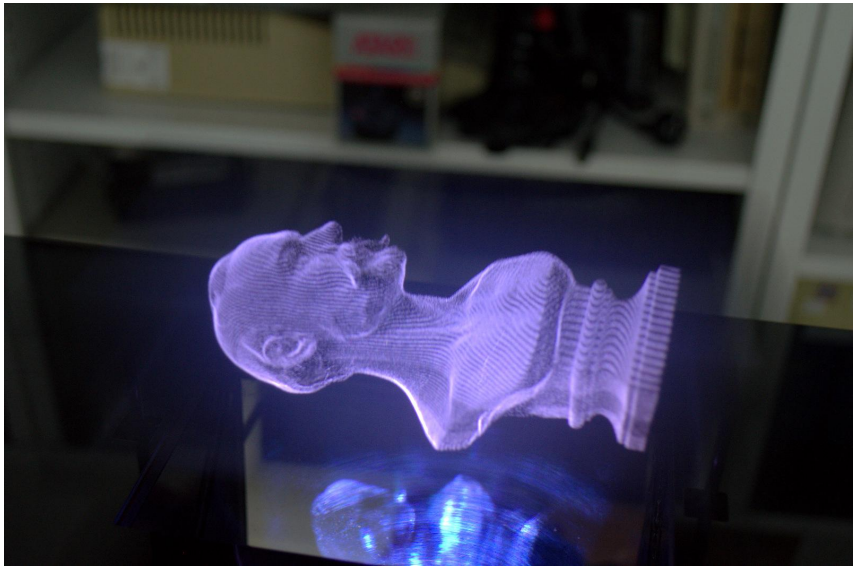
Wetzstein, Gordon, et al. "Tensor displays: compressive light field synthesis using multilayer displays with directional backlighting." (2012).

Voxel-based displays



- sweeping diffuser