



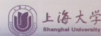
Real-time Dynamic Holographic Display in Super-fast Liquid Crystals to Future Holographic 3D TV

Hongyue Gao (高洪跃) Ph.D. Associate Professor

School of Mechatronic Engineering and Automation,

Shanghai University, China

E-mail: gaohylet@i.shu.edu.cn, gaohongyuehit@sohu.com



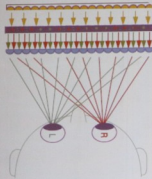
上海大学
Shanghai University

Outlines

1. Review on 3D video display
2. Real-time dynamic optical holographic 3D display
3. Holographic 3D projection
4. Holographic 3D Television

3D Display

Stereoscopic 3D display



Stereoscopic 3D display



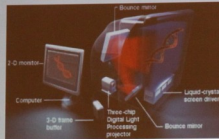
Stereoscopic 3D display based on glasses



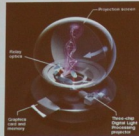
Stereoscopic 3D display without glasses

3D Display

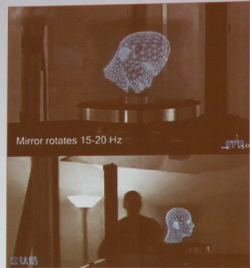
Volumetric 3D Display



DepthCube 3D Display



Perspecta 3D Display



USC Centers for Creative Technologies
Fakespace Labs Sony Corporation
USC School of Cinematic Arts
Shanghai University

3D Display

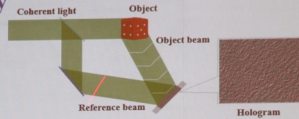
Holographic 3D Display



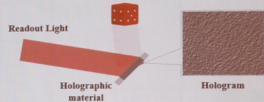
Intensity Information



Phase Information



Holographic recording



Holographic reconstruction

3D Display

Holographic 3D Display

Static holographic 3D display by materials



Dynamic holographic 3D display

Optoelectronic holographic display by SLM



New modulator made by MIT
(D. E. Smalley et al. *Nature* 2013)

Optical holographic display by materials



Dynamic near-real-time holographic display
(P.-A. Blanche, *et al*, *Nature* 2010)

Real-time dynamic holographic 3D display

Large-size **Static** Holographic 3D Display

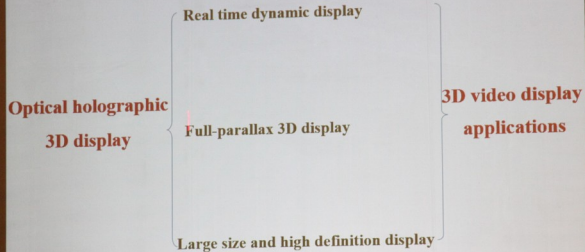


3D Hologram of Shanghai City
(designed by our group and
produced by Zebra Imaging)

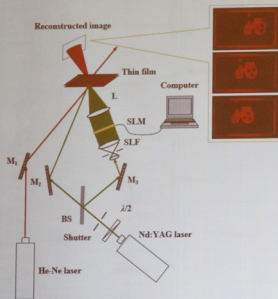


3D Hologram
(produced by Zebra Imaging)

Real-time dynamic holographic 3D display

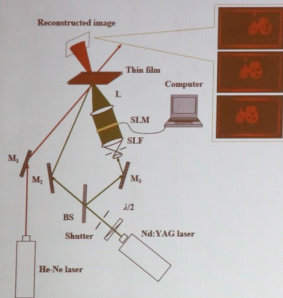


Real-time dynamic holographic 3D display



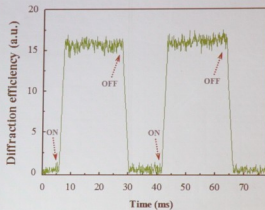
Experimental setup for holographic display

Real-time dynamic holographic 3D display



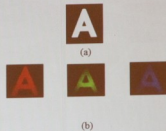
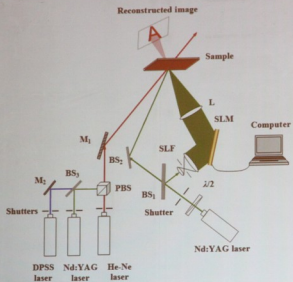
Experimental setup for holographic display

Refresh time: ~ 2 ms



Hologram formation and self-erasure processes:
"ON" and "OFF" denote the writing light is turned on
and off, respectively.

Real-time dynamic holographic 3D display



Experimental setup for R/G/B holographic display

R/G/B holographic display videos

Real-time dynamic holographic 3D display

Society for Information Display Symposium
2012 Technical Highlights



SID SYMPOSIUM 2012 TECHNICAL HIGHLIGHTS

The Society for Information Display's annual Symposium of Display Week is the premier international forum for technical presentations on displays. This year's 73 sessions include a total of 206 oral presentations and an additional 136 papers that will be presented at a poster session. Topics include 3D, flexible electronics and printed display, green technology, solid state lighting, LCDs, OLEDs, plasma, display manufacturing, human factors, and more. A complete symposium program is available www.sid.org.

21.2 A 86-inch FHD OLED TV Employing True Tandem OLEDs
by Cheng Zhang, Han, et al., LG Display

36.1 Encapsulating Light Field Ecosystem
by Kurt Healey, LEDZ

14.1 A 13.3-inch 200-dpi Flexible Bioholographic Display On-chip by ODT
Manufactured Using High-resolution Off-set Printing
by Guoliang He, et al., Sony Corp.

50.1 Development of Super Hi-Vision 8Kx4K Direct-View LCD by
Nissan Corporation
by Takashi Saitoh, et al., SHARP Corporation

50.4: Real-time Dynamic Holographic Display
Based on a Liquid-Crystal Thin Film
by Hongyue Guo, et al.

A real time holographic display is achieved with a holographic response time of ~1ms in a liquid crystal film without any applied electric field.

Invited Talk at OSA Digital Holography and
3D Imaging 2013 in USA

OSA
Science Technology Light

Digital Holography and 3D Imaging (DHI)
19-21 August 2013, The Sheraton Grand, Miami Beach, Florida, USA

Invited Speakers

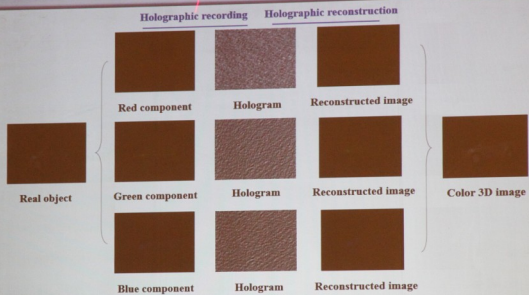
Hongyue Guo
Real-time Holographic Display Based on a Super Hi-Vision Liquid-Crystal Thin Film

Robert M. Waymouth
Computer Tomography: A Review of the State of the Art

Plenary Talks and Invited Talks at 8 International
Conferences in 2013-2014

Invitations from 10 international Journals

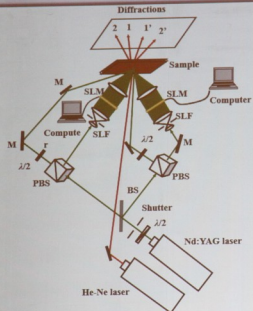
Multiplexed holographic display



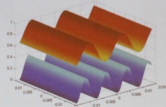
RGB-model color holography

Multiplexed holographic display → Color holographic display

Multiplexed holographic display



Experimental setup for multiplexed holographic display

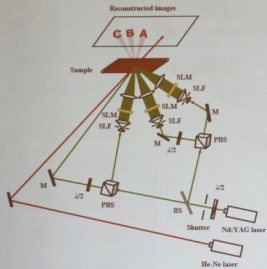


Two multiplexed holograms

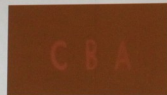


Two multiplexed hologram display

Multiplexed holographic display



Experimental setup for three multiplexed hologram display

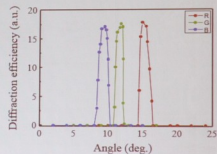
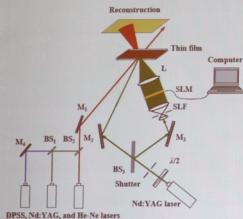


Three multiplexed hologram display

Color holographic 3D display



RGB images

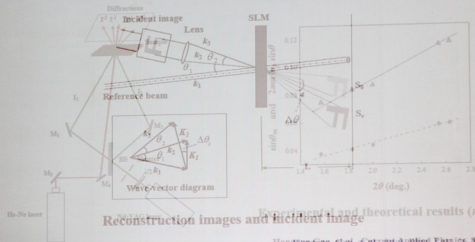


Color holographic 3D display

Size of R/G/B images

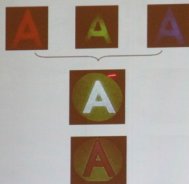
Size of incident image: $S_0 = f_0 \left[\tan\left(\theta_m + \frac{\theta_2}{2}\right) - \tan\left(\frac{\theta_2}{2}\right) \right]$ $m = 1, 2, 3 \dots$

Size of reconstruction image: $S_r = f_r \left[\tan\left(\theta_1 + \frac{\theta_2}{2} + \Delta\theta\right) - \tan\left(\frac{\theta_2}{2}\right) \right]$

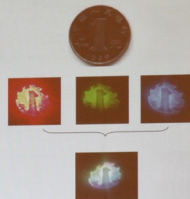


Color holographic 3D display

Color formed by R/G/B primary colors

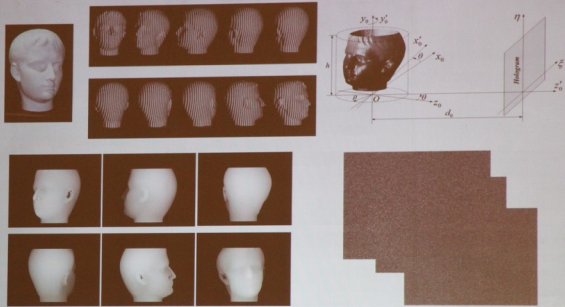


Color holographic image in RGB model



Color holographic 3D display

Holographic 3D projection



Images from different angles

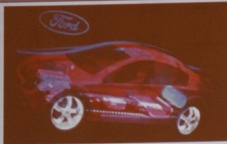
Computer generated holograms

Holographic 3D projection

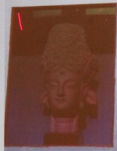


Holographic 3D projection

Holographic 3D TV



Hologram by Zebra Imaging



Hologram by Hans Bjelkhagen



Hologram by Hellenic Institute of Holography in MIT museum



**~100 Scientist attending OSA Digital Holography
and 3-D Imaging Meeting visited our lab**

**We welcome you to our lab to see our Holographic
3D TV and Holographic 3D Projector!**