Application of 3D LED Display for School Wisdom Education

- China National Expert with Outstanding Achievements
- Distinguished Professor of Wuhan University of Science and Technology

Member of:

- Technical Committee of China Radio, Movie & TV Association (Director)
- 3D Imaging Technology Professional Committee of China Society of Image & Graphics (Senior Advisor)
- Society of Motion Picture and Television Engineers (SMPTE)
- Institute of Electrical and Electronics Engineers (IEEE)
- Society for Information Display (SID)
- 3D Technology Professional Committee of China Institute of Electronics
- Technical Group of China Optics & Optoelectronics Manufacturers Association LED Division

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Next Generation of Display ---
HD + 3D

Return us the Real Visual World!
This is the final target for that scientists doing efforts for more than 100 years!

The World's 1st Shutter Mode LED 3D Display

(CCDL, 1997 38m^2)

First Naked-eye Mode LED 3D Display

(2009, 2010 1 mm and 2 mm two series)

The World‘s 1st DCHD Polarizing LED 3D Display

（DCHD, Double-Channel High Definition）

3D Technology Passing Technical Approval

Polarizing LED Stereoscopic Movie System

The bankruptcy of Kodak will change a lot of things

First Outdoor LED 3D Movie System in Zhengzhou

The World's 1st LED Stereoscopic Movie System in Zhengzhou

LED Stereoscopic Movie System

(Zhengzhou International Conference and Exhibition Center)

Dayin Opera House, Beijing

(Famous Dancing Terra-Cotta Warriors opened by 10, Aug 2014, 96 m2)

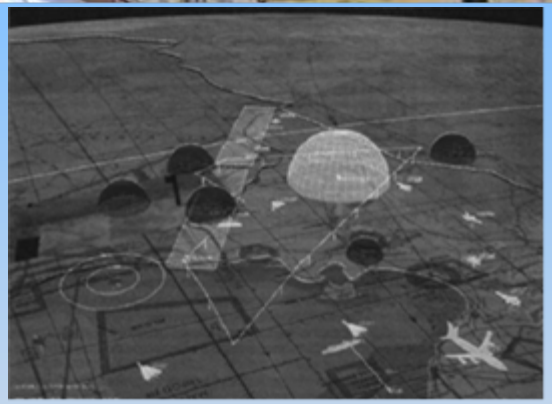
LED 3D Screen in Hong Kong

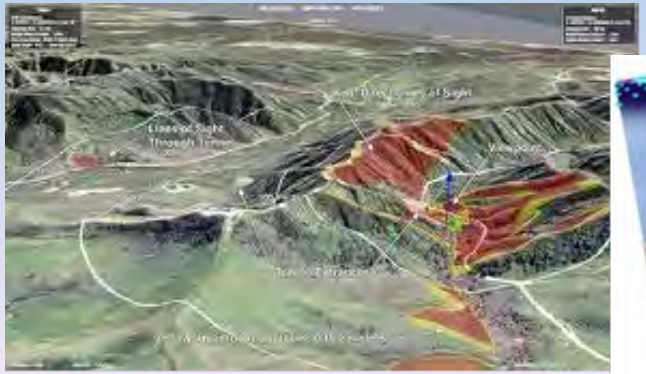
(Kwai Tsing Theatre in Hong Kong)

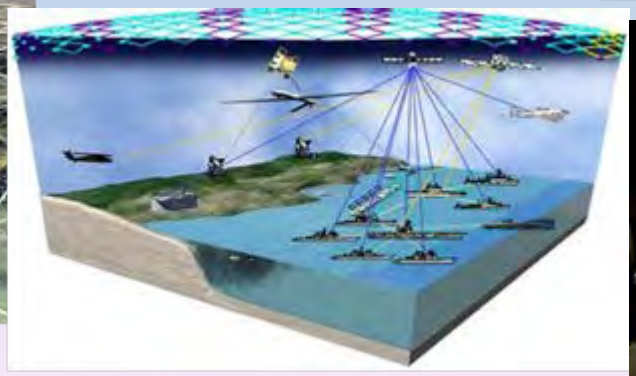
Opera House in Denver University

How can a dove fly from the screen to my face?

Military Application of LED 3D Display







3D Education Origin

3D Education started in India and developed in Europe and the US..

3D Education is to use 3D technologies to convert the complicated, abstract and inflexible 2D contents into 3D video or models and so, to let students to learn when viewing 3D videos.

CCDL 中原显示

The Target of 3D Education

To excite students interests.
To let students imagination riched.
To change abstract into particular. To let the students understand easily.
To open the students brains.
To increase the scores of students.

CCDL

中原显示

英国BBC的电视报道

A study of the impact of 3D in the classroom has found that it improves test results by an average of 17%.
Increasingly schools are using 3D projectors and learning resources to add a new dimension to learning.
The research, conducted in seven schools across Europe, found that 3D-enabled learning tools helped children concentrate more. It also led shy children to speak up in class discussions.
Only a handful of schools in the UK use the technology, which requires a 3D-enabled projector as well as 3D glasses for all pupils and a set of bespoke learning resources.
Image caption3D provides a wow factor in class but it has longer lasting effects, research says. The study, conducted by researchers from the International Research Agency on behalf of Texas Instruments, assessed 740 students in schools across France, Germany, Italy, Netherlands, Turkey, the UK and Sweden.
Students were tested before and after the lessons with a control group learning with traditional resources only.
On average, 86% of pupils in 3D classrooms improved in test results, compared to 52% of children using traditional teaching methods.
It also found that attention levels soared - with 92% of the class paying attention during 3D lessons compared to 46% in the traditional learning environment.
"It grabbed children's attention and this carried on beyond the 3D episode, it seemed to trigger an interest in learning that maintained through the rest of the lesson," said Prof Anne Bamford, who led the study.
"The level of questioning also increased and anecdotally teachers reported that the children asking questions were those that wouldn't normally engage in class," she told the BBC.
Researchers observed a series of biology lessons, in which children learned about the functions of the body.
"Children can see how things function. Instead of learning about the heart statically they can see it in a solid way, literally see blood passing through the valves, see exchange of oxygen, rotate it, tilt it and zoom in," said Prof Bamford.

Application of LED 3D Screen in School Education

Europe and America

Abbey girl school in UK

Abbey girl school in UK

3D Education in America

The impact of 3D on academic results – by Prof. Anne Bamford

The results of the research indicate a marked positive effect of the use of 3D animations on learning, recall and performance in tests. Under experimental conditions, 86% of pupils improved from the pre-test to the post-test in the 3D classes, compared to only 52% who improved in the 2D classes. Within the individuals who improved, the rate of improvement was also much greater in the classes with the 3D. Individuals improved test scores by an average of 17% in the 3D classes, compared to only an 8% improvement in the 2D classes between pre-test and post-test.

Special Teaching–way by Debby Heerkens, a teacher of the Netherlands

This is a teacher very devoting to work. Her purpose is to cover the shortage of the projector very low brightness. However, if she has an LED 3D screen, she will have no need to take off her clothes one by one.

刘延东在国际教育信息化大会上的致辞

Speech by Liu Yandong, vice premier of State Council on International Educational Informationization Conference

（2015年5月23日）

摘要：

——教育信息化突破了“时空限制”

——教育信息化推动了教与学的“双重革命”

——教育信息化打造了“没有围墙的学校”

——教育信息化汇聚了“海量知识资源”。

刘延东：提出四点倡议：

第一，顺应大势，更加重视教育信息化的作用和地位。

第二，以人为本，推动信息技术与教育教学的深度融合。

第三，共建共享，不断扩大优质教育资源的覆盖面。

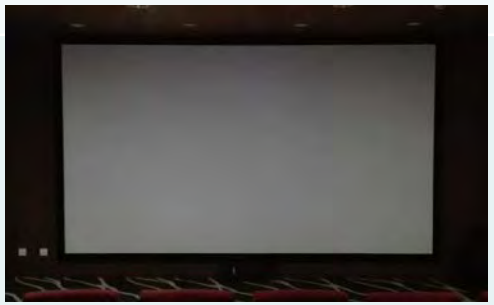
第四，互学互鉴，开创人类文明传承发展的新境界。

“LED 3D Education System” installed at Information Center of Haidian Education Committee, Beijing

Electronic Education Class Room of No. 101 Middle School

Taiwan and HK Student Delegation visit

Planned 3D projects in August 1 School

序号	项目名称	宽（米）	高（米）	面积（㎡）	
1	北京市八一学校初中部学科三维学习体验系统	6.4	3.84	24.576	
2	北京市八一学校高中部学科三维学习体验系统	6.4	2.88	18.432	
3	北京市八一学校虚拟现实系统项目	6.4	3.584	22.9376	尚未建成此楼，此楼为节能展示楼
4	北京市八一学校礼堂三维技术与教育教学深度融合系统项目	11.52	6.78	78.1056	
5	北京市八一学校校史馆三维技术演示系统项目	11.52	4.352	50.13504	

Comparison between Projector System and LED 3D System

No	Name	Digital Projector	3D LED Display
1	Rays and Light	Both	Only light, no rays
2	Brightness	Low	Very high, can be used outdoor conditionally
3	Contrast	Low	Very high
4	Defocusing	Very Bad	No Defocusing
5	Misconvergence	Very Bad	No Misconvergence
6	Reflection by screen and Glare by lens	Bad	No Reflection No Glare
7	Refresh frequency	Low and cannot be controlled	High, can be controlled
8	Life	Short	Can be up to 100,000 hours
9	2D/3D Compatibility	Not apply	Compatible
10	3D TV program	No	100% compatible
11	Not comfortable physiological stimulating	Bad	No such a problem
12	Color attenuation	Bad	Almost no change
13	Projection room	Occupies a big space. There must be an individual projecting room at the back of a cinema.	Can set up more seats and very importantly gather all playing machines for all movie halls of one movie city into one control room to make centralizing control.
14	Efficiency	Low	Much higher
15	3D Vertigo Syndrome	Yes	Almost No
16	Separation rate of left and right	95% or less	99% or higher
17	3D Vertigo Syndrome	Very bad	Almost No

1 Rays and Light

The figure shows that a digital projector rays light onto a screen with beams and that affects the audience at the rear of the theater a lot. Unlike a digital projector, an LED 3D display has no beams of light to distract viewers.

2 Brightness

- Digital projectors are not as bright as 3D LED displays. When using a digital projector it is helpful to close shade windows, close doors and dim lights. Because a 3D LED display is much brighter, it is no need to control indoor lighting in order to attain a superior image.
- A 3D LED display the screen brightness is about 30 times of a digital projector system. It can be effective even in many outdoor settings conditionally. From the technical approval of the LED system, and from research, And furthermore see the below "*Not Comfortable Physiological Stimulating*".

3 Contrast

- A digital projector has a lower contrast ratio than a 3D LED display. There are several reasons for this including variable projection screens, projector technology limitations and lighting conditions. Simply speaking, a projector system is of low brightness with white background. But an LED system is of high brightness with dark background. By practical testing, the contrast is will be dozens times of a digital projector at a certain condition.

4 Switch of Data Sources

- Input Source switching is superior and more advanced in 3D LED displays versus digital projectors. And that is very easy to switch to any data source.

5 Compatibility of Data Format

The data format to a projector is limited. However, the data format to an LED screen is not limited. It accepts any electronic format, if and only if it can be played on a computer or a server.

6 Defocusing

Defocusing is a very obvious weakness of digital projectors. Even at the finest adjustment of focus, the focus is always imperfect. The focus imperfections of digital projectors increase with screen size and projection distance. In a 3D LED system there is absolutely no such a problem.

7 Misconvergence

Digital Projectors have a problem with consistent convergence of RGB. Imperfect convergence is demonstrated in the following figure. In a 3D LED system there is absolutely no such a problem.

8 Reflection by Screen and Glare by Lens

- A digital projector shines light onto a projection screen that can reflect light back into the eyes of the viewer. This reflection can be very distracting at different angles. The lens of projector will produce multiple reflections and that will bring glare. These do not happen with a 3D LED display.

9 Refreshment

- Refreshment of a projector system should be 48 Hz or 60 Hz and it is not adjustable. So sometimes it will flicker. In an LED system the refreshment can be preset as 300 Hz or even higher such as 900 Hz, and that can be set at any time conditionally. There is no flicker in an LED system. This is good for children.

10 Life

- It is said that life of a good quality lamp of a digital projector are at most 20,000 hours. Sometimes of a normal projector system the lamp could have to replace in just one month, at low rank cinemas. Life of an LED system can be up to 100,000 hours.

11 Compatibility for 2D and 3D

- An LED 3D system can play either 2D or 3D movies without any change for the systems

12 3D Broadcasting TV

- The LED 3D cinema can play without any loss. It is easy to switch to a local TV to play 3D TV to any audience. But a projector cannot.
- So far there are 6 3D TV programme channels opened in China.

13 Uncomfortable Physiological Stimulating

A person going to a movie theater experiences a “dark adaptation” when entering the theater and then a “bright adaptation” upon leaving. Medical research suggests that the latter of these adaptations may cause vision fatigue and possible long term damage. These adaptations can be eliminated by using 3D LED displays. This is very easy to understand. But on the other hand, for a digital system the screen brightness could be only 20 cd/m^2 after polarizing, but by writer’s experience, the brightness of that could be even lower. At least in China, the practical brightness in many, many cinemas is around 16 cd/m^2 and even lower. For many dark scenes of a movie say, as an example many sceneries of movie “Avatar”, must be very low say, lower than 3 cd/m^2. When the peak brightness of the silver screen is lower than 20 cd/m^2, the low brightness of dark sceneries could be lower than 1 cd/m^2 and that must be even lower after polarizing glasses to the eyes. As by the principle, when the brightness is as low as between 0.01 cd/m^2 to 3 cd/m^2, the Pyramidal cells and Pillar cells of human’s eyes will exchange very actively and that must be harmful for human’s eyes.

14 Color Revivification

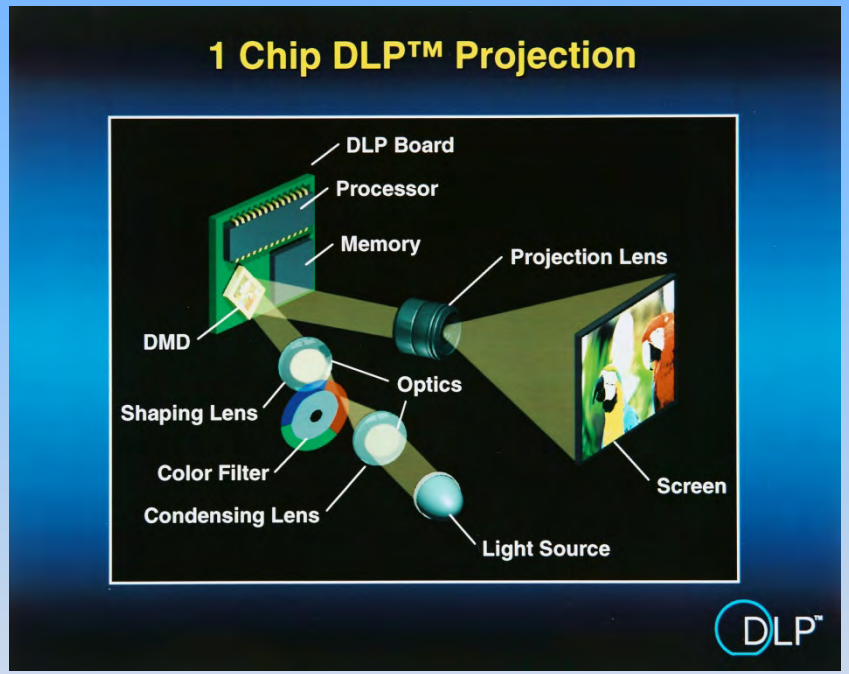
LED effect

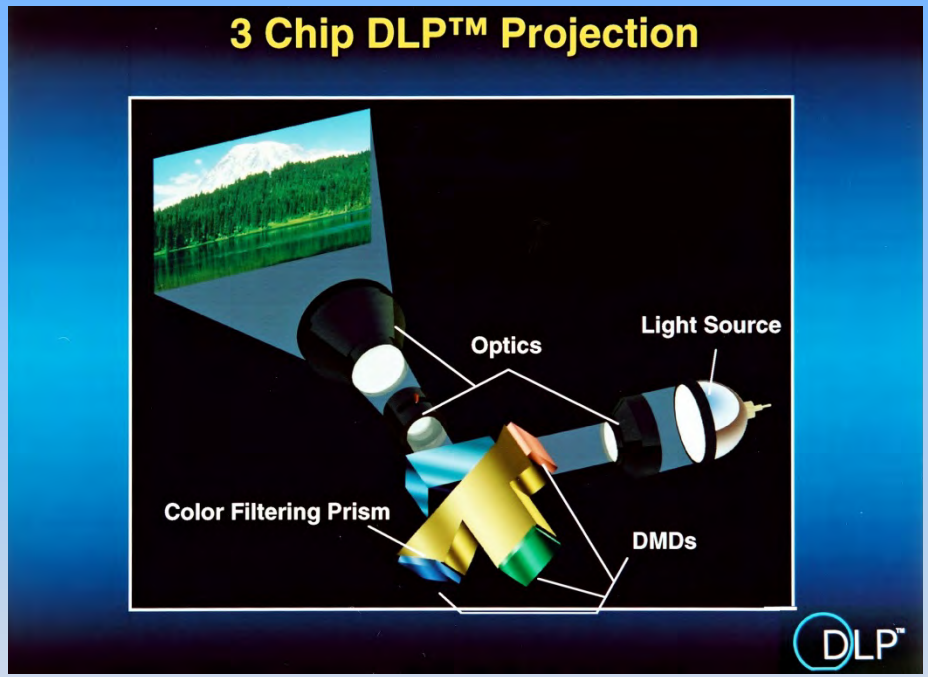
Digital projector effect

Example of Color Revivification

DLP Colour Attenuation

Color Filter for 1-chip DMD and Color Filtering Prisms for 3-chip DMD

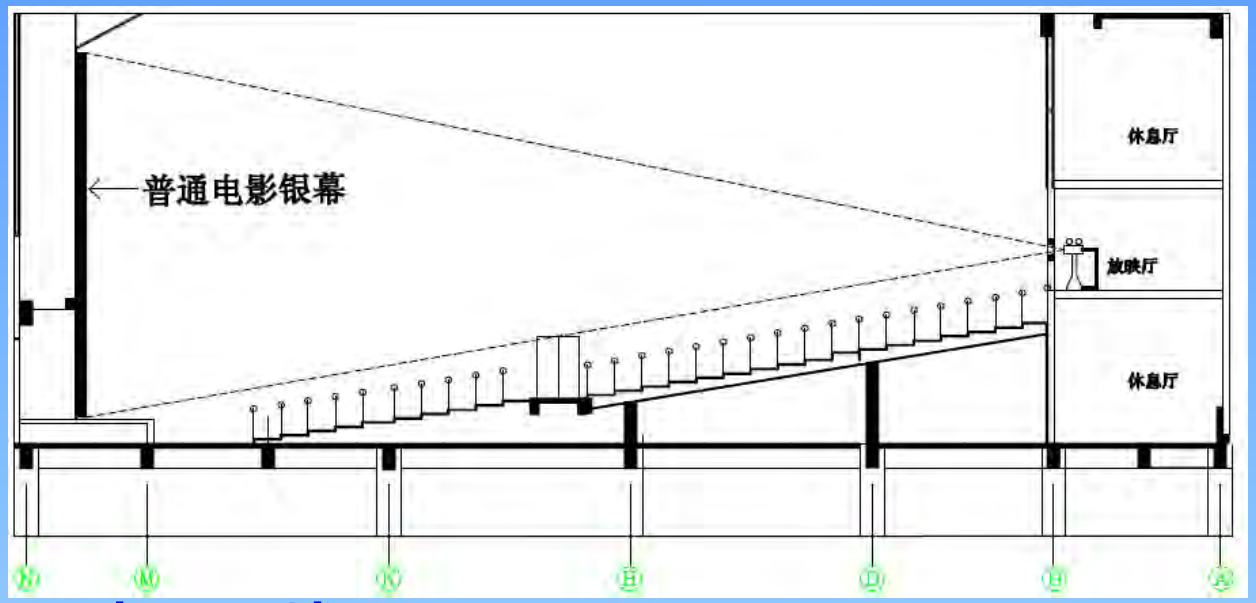




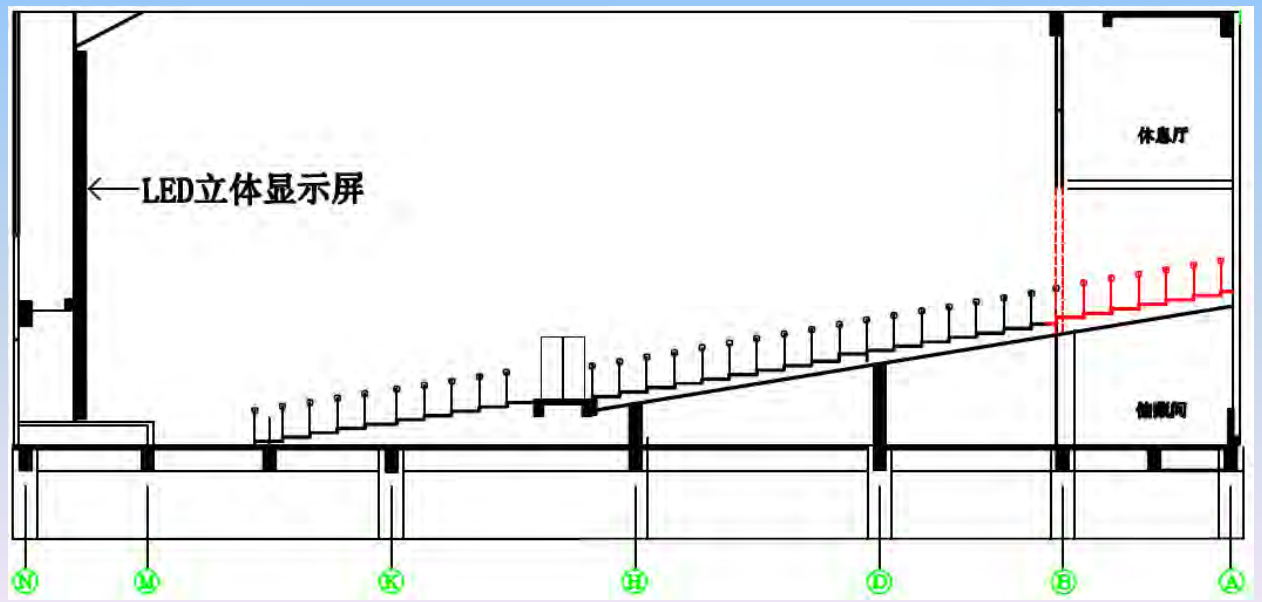
Single DMD

3 DMD

15 Projection Room

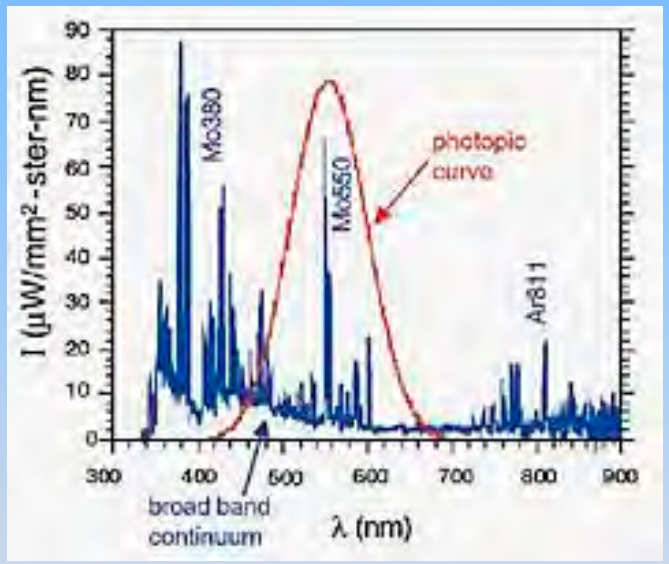


Projector Cinema

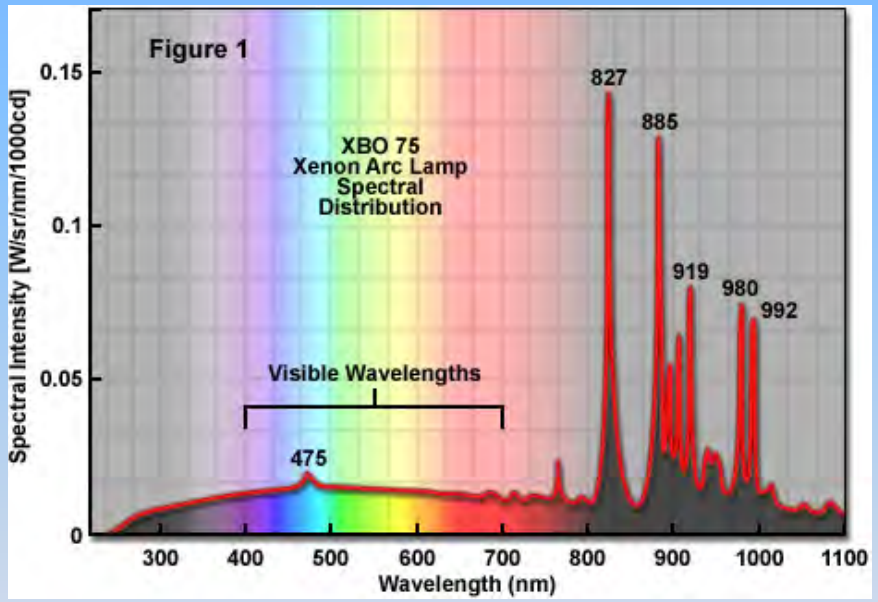


LED Screen Cinema

16 Most Spectrum Energy of a Modern Projector Lamp is outside Visible Wavelength



Spectrum of a halogen lamp



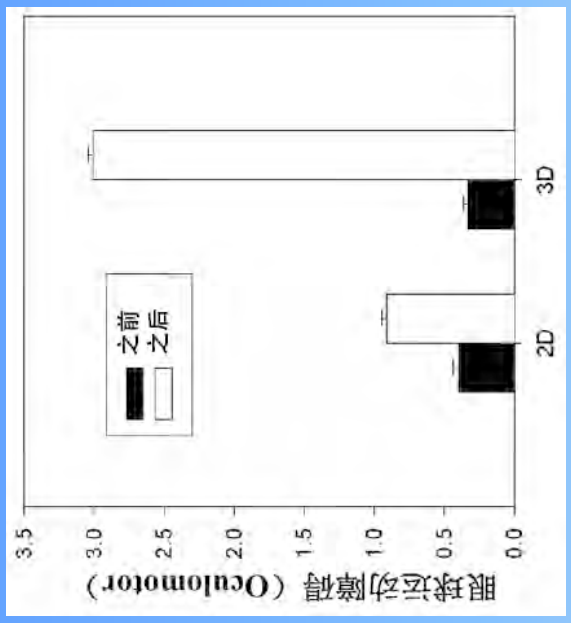
Spectrum of a modern xenon lamp

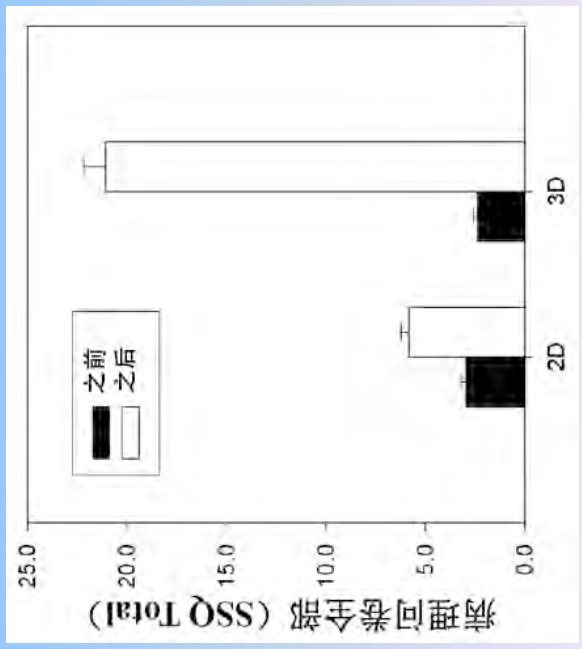
3D vertigo syndrome

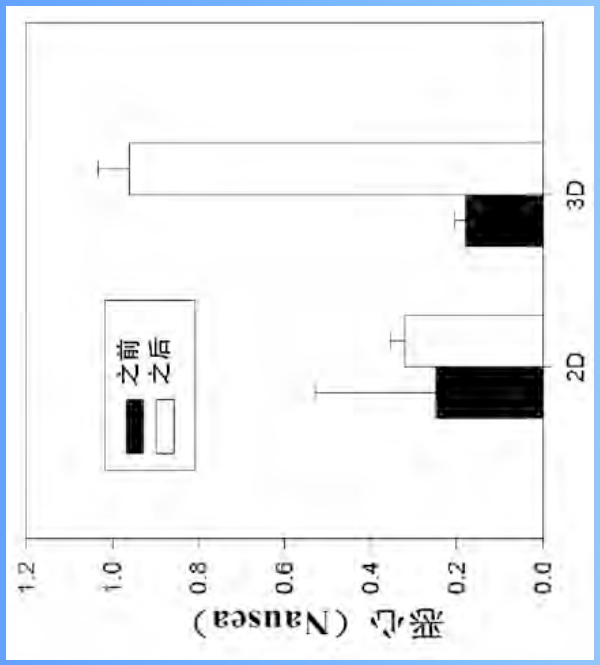
Prof. Angelo G. Solimini

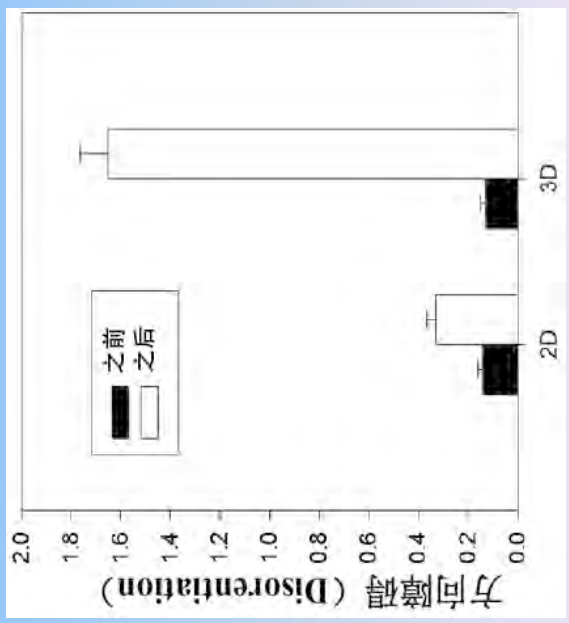
Department of Public Health and Infectious Diseases, Sapienza University of Rome, Italy

萨皮恩扎大学--罗马--意大利









CCDL contribution and report of prospective carryover observational study by Prof. Angelo G. Solimini

1. Found the real reason why a shutter mode 3D will bring out the fatigue.
2. Concluded that the so said 20 ms staying time at human's retina is a thorough mistake, and that is the traditional theory of movie principle.
3. Found the real reason of "3D Vertigo Syndrome", and declared that CCDL 3D LED display almost no such a problem.

By report from Prof. Solimini, test result for projector movies			CCDL Test for LED 3D
After viewing	2D	3D	3D
Unwell	14.1%	54.8%	5-8%
Unwell strength	1	8.8 times (to 2D)	1
By 497 volunteers			No less than 2000 people

Professor Chao Li was invited to make lecture to publish the test result in Nanjing University: CCDL LED 3D Movie System won’t produce "3D vertigo syndrome“.

A special test: 40 people aged 60-65 to watch the famous 3D movie “Avatar” that started a Taiwan person died. None of them reported very bad unwell.

All the persons to watch CCDL 3D movie reported unwell are

(Total is about 5-8% but no extremely bad vertigo such as nausea and vomiting occurred)

1. Persons who feel vertigo even when they watch a 2D movie;
2. In daily life, who will feel vertigo when sees somebody makes strenuous exercise of brandishing a knife and sword;
3. Some who will feel unwell when even just ride a bus or a boat;
4. Who has never worn any glasses;
5. Before really watch who were thinking that there must be vertigo on 3D.

By our tests, of all the above, the 4 and 5 of above could become better in a certain time. But others cannot be suitable normally. However, during the whole test cases, there are no extremely bad cases such as vomit or so.

Application for Polarizing LED 3D Displays

1. To replace present projector systems in theater-chains or cinemas.
2. LED 3D Classroom Education systems in Primary Schools and Middle Schools.
3. LED 3D displays in Universities and relevant Institutes for high rank experimental rooms such as CAVE systems or so.
4. Youth Palace, Museum of science and technology.
5. Command Centers such as Space Industry or Military Command Centers.
6. Big enterprises, entertainments, shopping centers.
7. Application for 3D Broadcasting Television.

Problems of Shutter Mode 3D LED Display

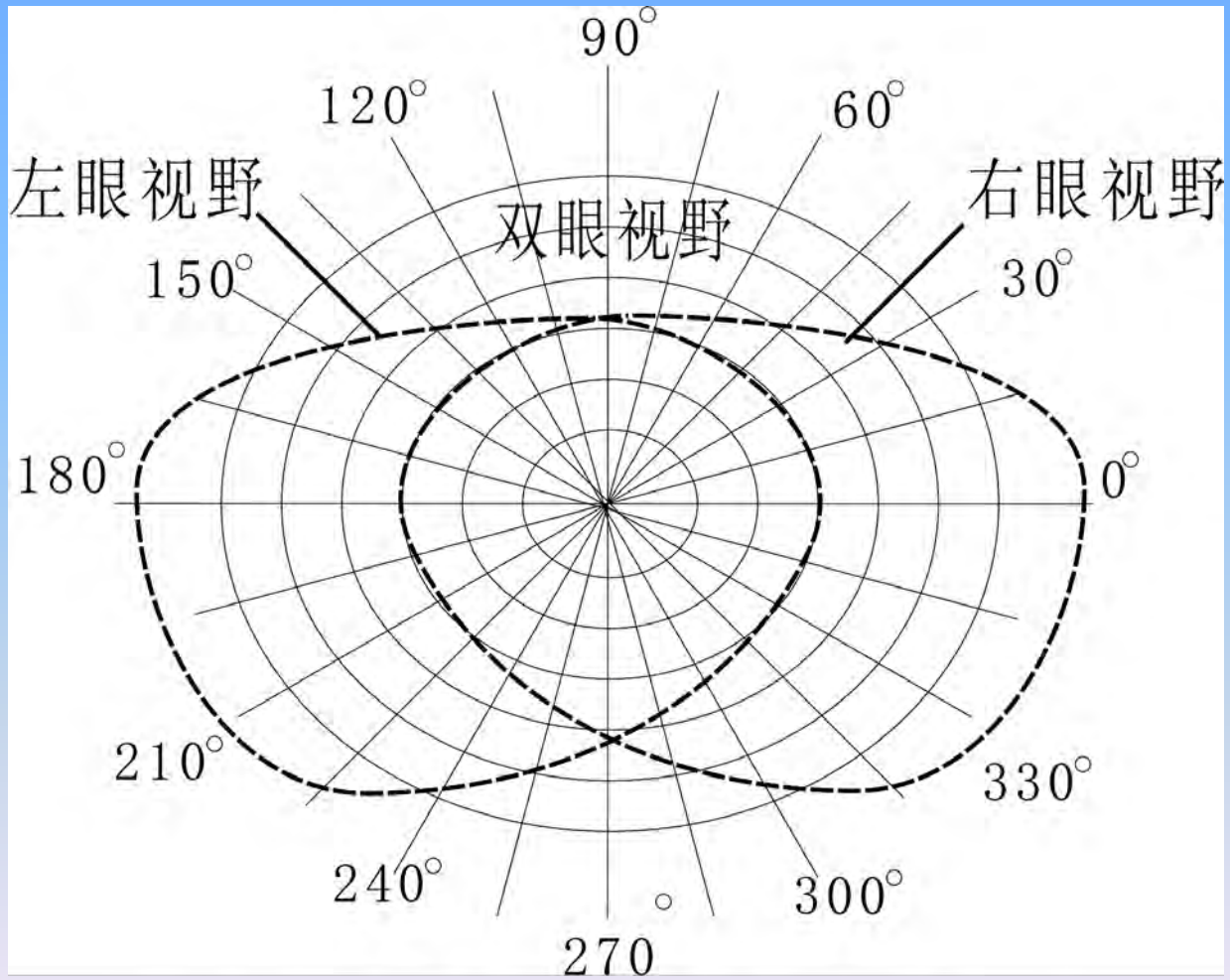
Advantage: The system is very simple as in fact it is a 2D screen

Disadvantages:

1. **严重视觉疲劳**
   Serious visual fatigue
2. **3D 分辨率降低**
   3D resolution becomes low
3. **3D 感觉错位**
   3D feeling wrong
4. **闪烁 （3D闪烁）**
   Flicker (3D Flicker)

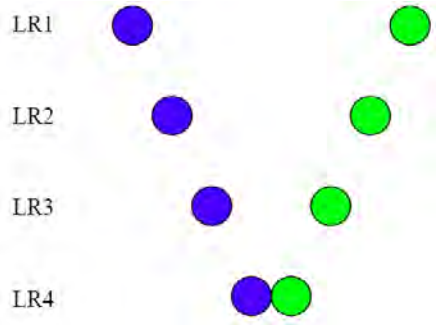
None movable disadvantage: Shutter glasses

Viewing Scope of double eyes

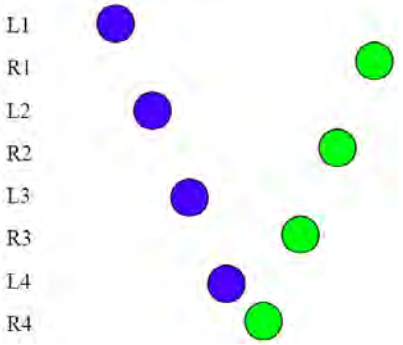


Comparison between polarizing mode and shutter mode 3D displays

blue and green mean left and right objects



a)



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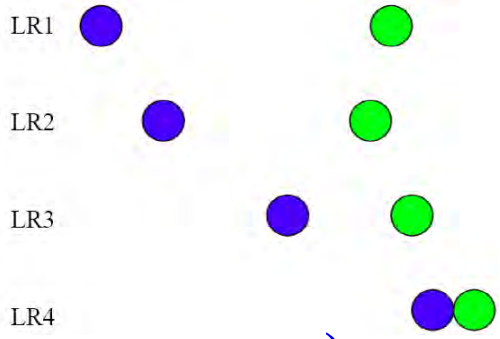

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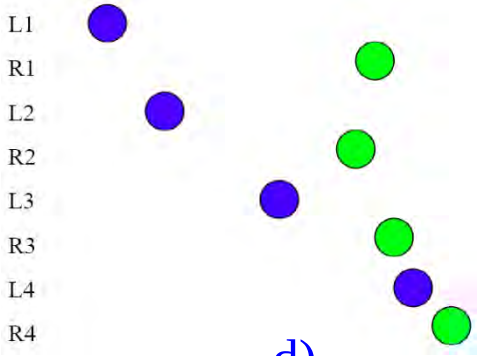
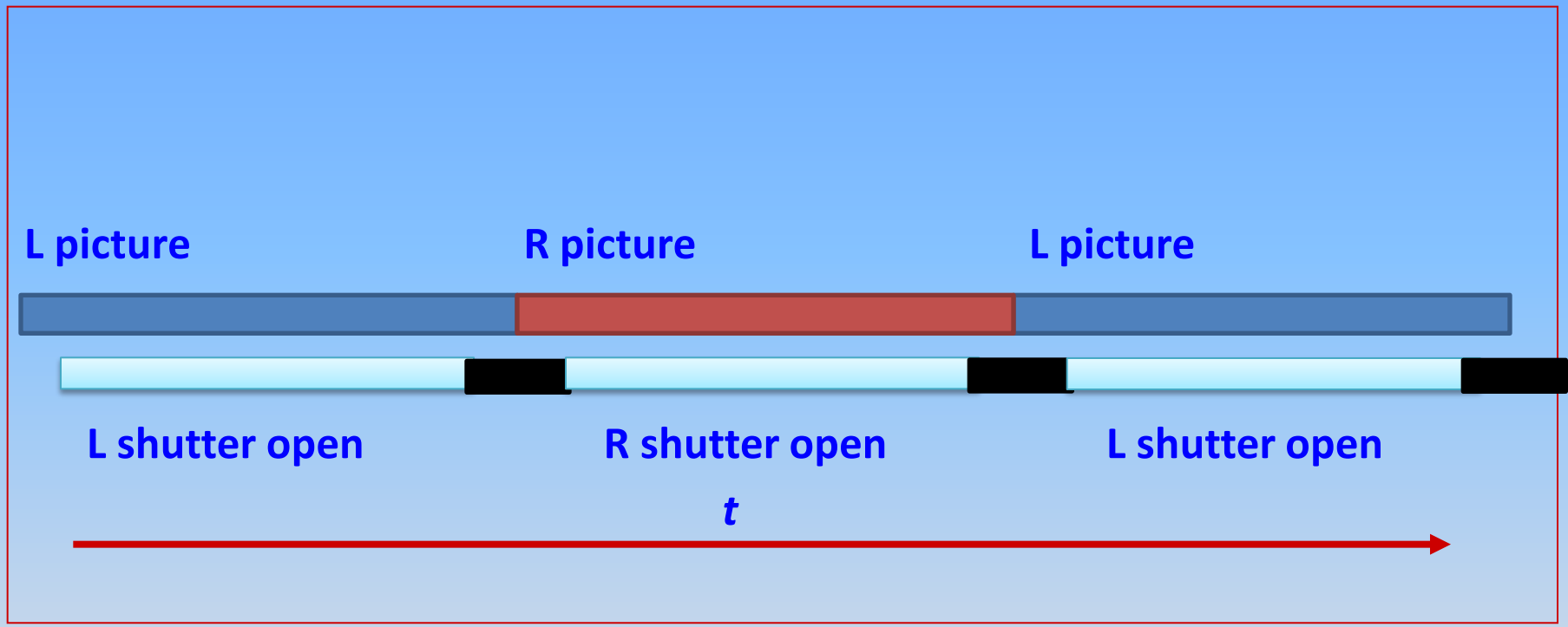


d)

a) Polarizing display with one-D movement object
b) Shutter display with one-D movement object
c) Polarizing display with two-D movement object
d) Shutter display with two-D movement object, the black should be at left forever but now the L4 is at right of R3 due to the time difference and that is a big mistake.

Relation between L and R Pictures and Shutter Glasses



The response of a pair of shutter glasses should be 1-2 ms. But the refreshment of a good LED screen should be 300-900 Hz. So the shutter response time cannot Be suitable with the picture refreshment.

Polarizing LED Syetem

The bankruptcy of Kodak will speed the development of Polarizing LED Systems

Dayin Opera House in Beijing

(The background screen is of polarizing LED 3D Video Display)

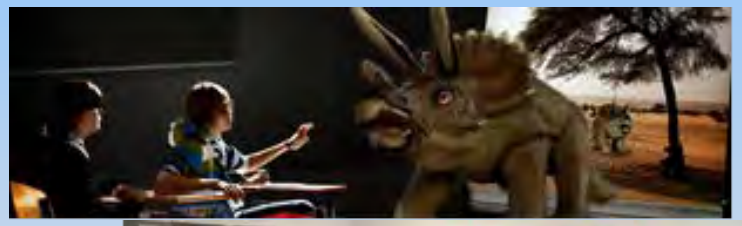
LED Stereoscopic Movie System Application in Hong Kong

Application in Beijing for Primary and Middle School Education

Application of LED 3D Screens in Primary and Middle School Education

In UK 3D demo for biology lesson in human thoracic

Biology Lesson in Abby Girl School



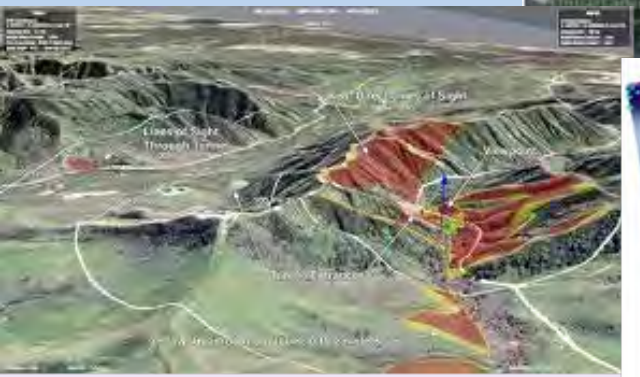
3D Education in America Primary Schools

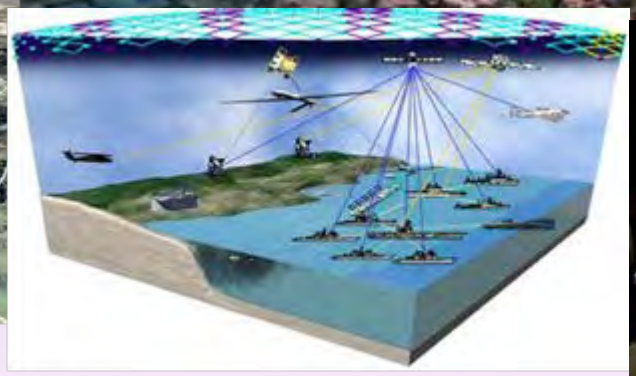
LED 3D Display in Military Application

3D Strikes needs 3D Displays

Old 3D Cave system

New LED 3D Cave system





Zhengzhou International Trade Fair for Intelligent Terminals (31 Oct. 2014)

The World's 1st Stereoscopic Movie System (92 m²)

Zhengzhou International Trade Fair for Intelligent Terminals

中国工程院院长周济、工信部部长苗圩、河北、山西、内蒙古、安徽、江西、湖北、湖南、陕西八省领导在河南省省长谢伏瞻以及中共河南省委常委、郑州市委书记吴天君陪同下视察了博览会，并对世界第一套“LED立体电影播映系统”表示肯定。

Zhengzhou International Trade Fair for Intelligent Terminals

吴天君书记向周院长、谢省长、苗部长介绍立体电影播映系统是郑州中原显示技术有限公司经过多年的研发完成的

苗部长对于显示效果给予高度称赞

其他八省领导都高度称赞了河南省的IT 产业的辉煌成果

Minister Wu: So good 3D result I Have never seen. Who made this?
Mayer of Zhengzhou: Prof. Chao Li and his CCDL team made this

Sample of DCHD LED 3D Stereoscopic Movie System in SMPTE Exhibition

郑州中显双路全高清LED立体电影播映系统参加好莱坞大展
这是好莱坞第一次邀请中国企业参加此最高技术水平的展览

SMPTE三位高级官员对于闻讯前来视察的中国驻洛杉矶总领事馆商务参赞刘海彦说希望郑州中显的“LED立体立体电影播映系统”尽快申请SMPTE标准，进一步在6大电影公司（迪斯尼，福克斯，派拉蒙，索尼影视，环球，华纳兄弟），然后推广，刘海彦参赞听了十分高兴。

目前，我们已经开始“LED立体电影播映系统”中国广电行标的起草工作，计划明年上半年开始做“LED立体电影播映系统”SMPTE标准的工作

刘参赞接见郑州中显全体参展人员

展会期间，美国数字电影院协会Digital Cinema Society总裁James Mathers先生两次来CCDL展台，向李超总裁表示热烈祝贺，称郑州中显的立体电影播映系统毫无疑问就是数字电影院的未来。多位NFL超级碗、NBA等体育赛事的服务提供商都对该系统表现出浓厚的兴趣，纷纷表达了强烈的合作意愿。

RealD--现代立体电影技术的发明者Lenny Lipton先生与公司总裁李超教授交流时表示，第一次看到这么震撼、逼真的立体显示效果，CCDL的立体显示技术将会促使现代立体电影技术得到大幅度提高，这样的话，看起来替代投影系统只是时间问题。

Sample of DCHD LED 3D Stereoscopic Movie System in ISE Exhibition Amsterdam

Sample of DCHD LED 3D Stereoscopic Movie System in SID Exhibition San Jose 2015

Patented Technologies

We have got a lot of Authorized Patents for both:

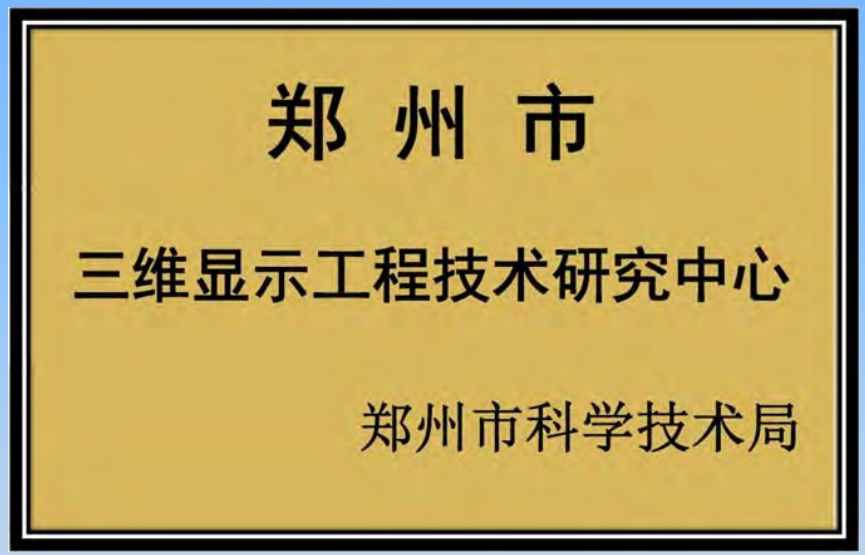
1. Polarizing System Technologies

2. Naked-eye 3D Display Technologies

3. Double-Channel High Definition (DCHD)

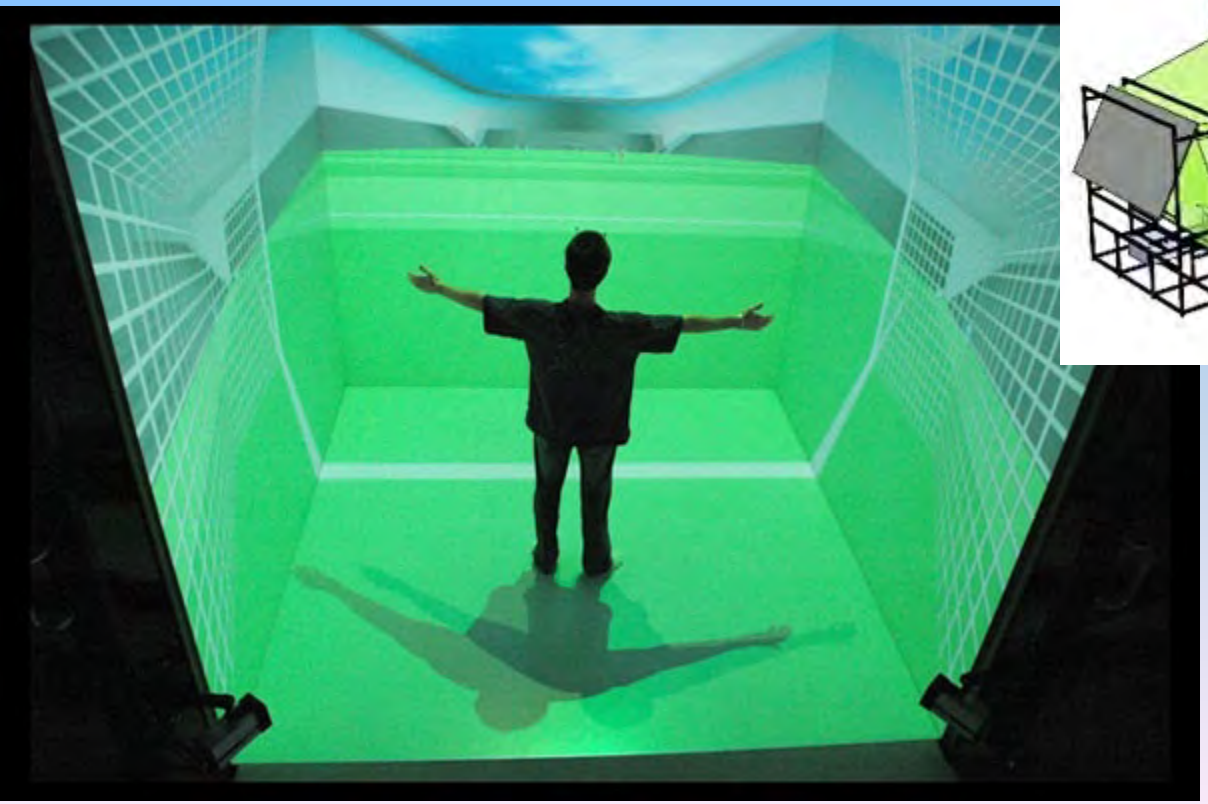
Government Support
(The world's only LED3D display Laboratories)

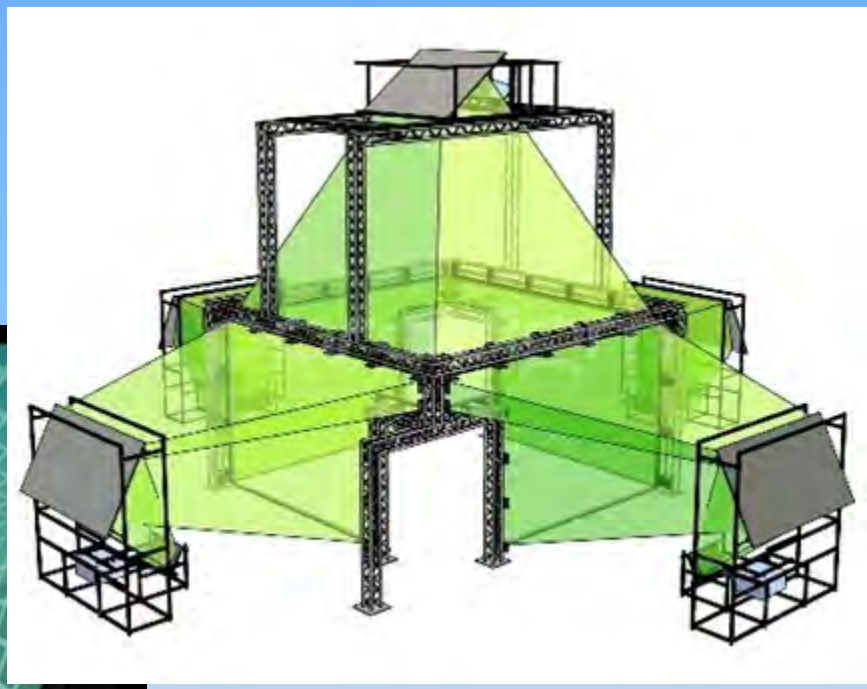
Henan Provincial
Research Center of 3D Display Technology
Bureau of Science & Technology Henan Province

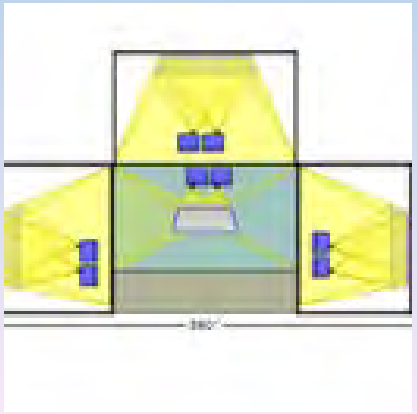


Zhengzhou Municipal
Research Center of 3D Display Technology
Bureau of Science & Technology Zhengzhou City

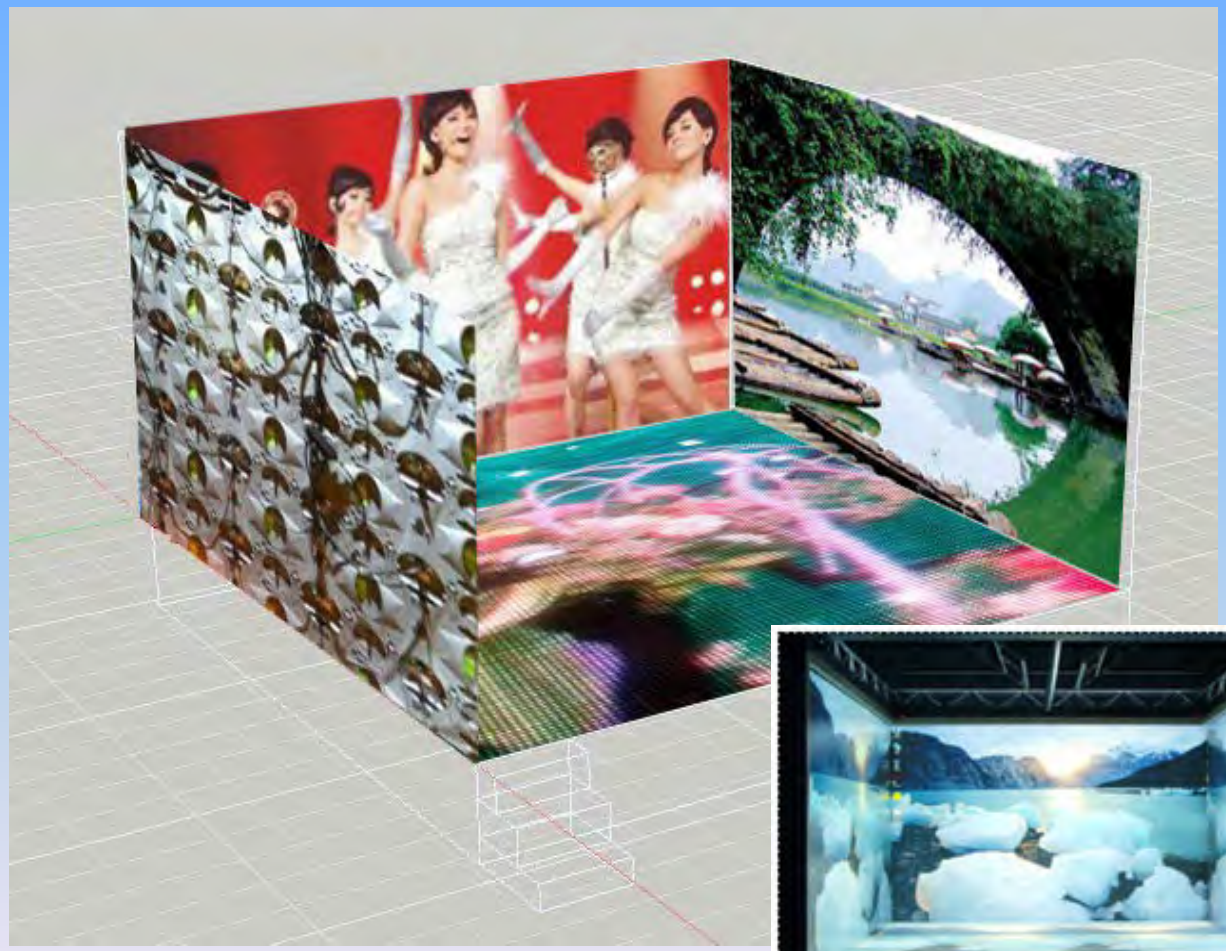
CAVE to use projectors







Cave to use LED 3D systems



Thank You!

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2015.12