



# **Trends in Laser Light Sources for Projection Display**

International Display Workshop, Session LAD2-2

Gregory T. Niven

Executive Vice President of Marketing, Novalux, Inc.

This talk answers the following key questions:

What are the target markets for lasers?

What is a laser and why do I want one in my MD TV?

How do lasers & MD work together to maximize the HDTV experience?

How do lasers penetrate HDTV and expand MD?

## Home Theater

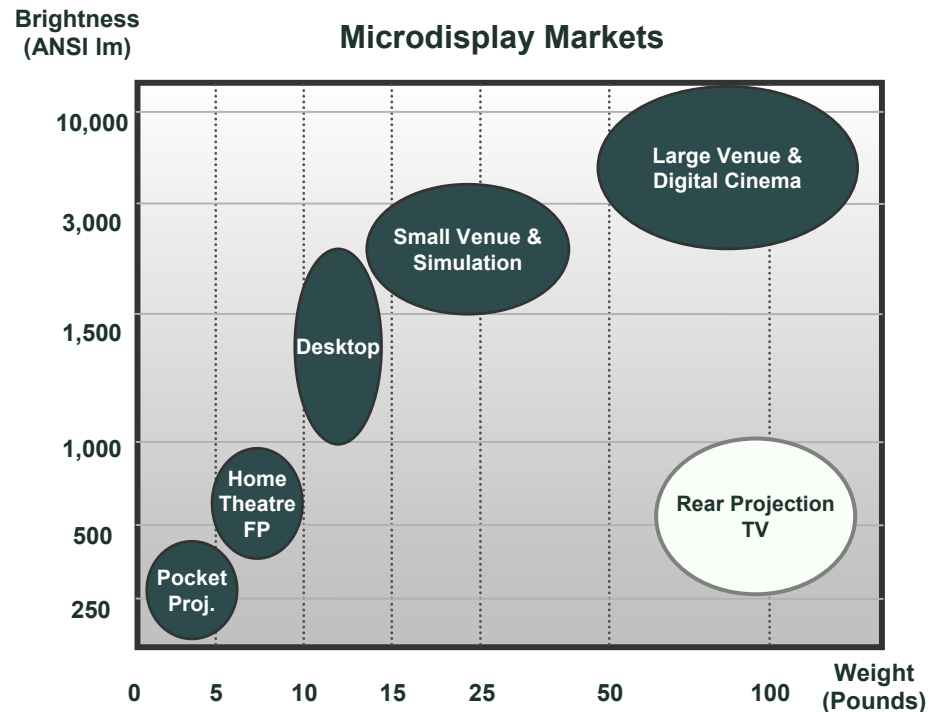
**1<sup>st</sup> Phase: 50" – 70" TV & 2D MEMS Scanning "Pico" Projection**

**2<sup>nd</sup> Phase: < 50" TV ?**

## Front Projection

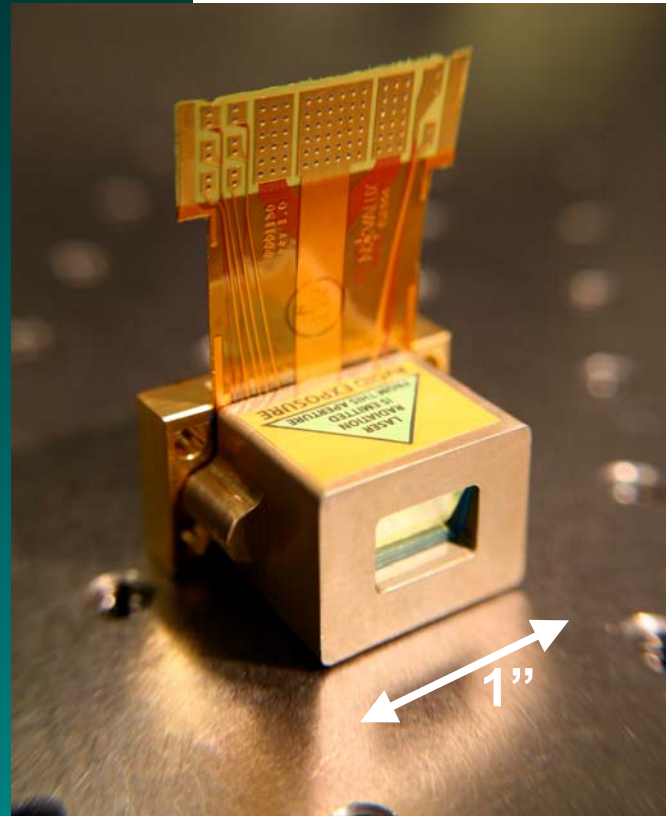
**1<sup>st</sup> Phase: Professional & High-End Home Theater**

**2<sup>nd</sup> Phase: Data, Business, and Pocket**



## Lasers are a unique light source

Lasers are an extremely bright, reliable, efficient, small, and cost effective source of light



Light  
Amplification by  
Stimulated  
Emission of  
Radiation

Displays companies have wanted lasers for a long, long time ...

What does a laser facility look like ... ?



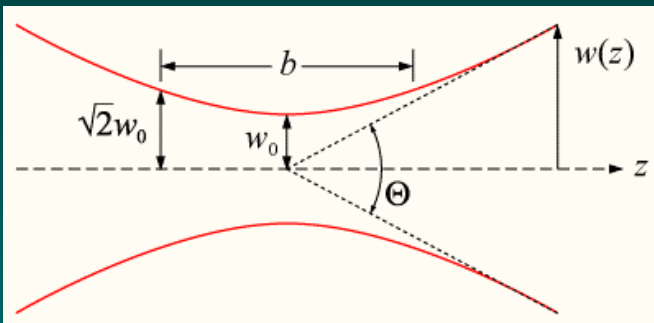
Customers don't have to pay to depreciate a \$2B facility ...





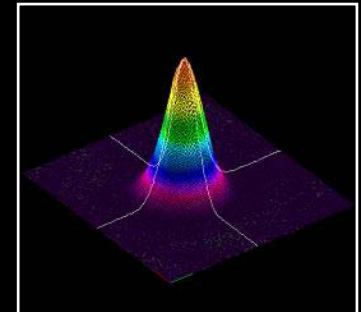
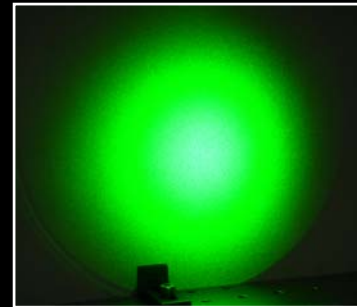
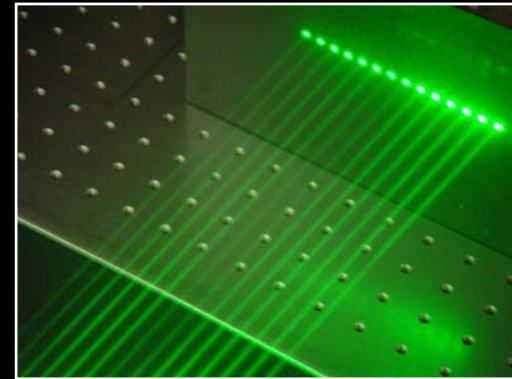
# LASER DESIGN CONSIDERATIONS

## Gaussian beams



Geometry and behavior defined by a few key parameters:

- 1.) beam waist ( $w_0$ )
- 2.) beam divergence ( $\theta$ )
- 3.) waist location ( $z$ )



Completely different than lamps or LEDs ...



# LASER DESIGN CONSIDERATIONS

**Narrow spectral width ( $< 1 \text{ nm}$ )**

Predictable aberrations, use digital correction with cheap spherical optics

Enables thin designs (10:1 screen to thickness ratio)

**Extremely bright ( $> 10^5 \text{ W/mm}^2\text{str}$ )**

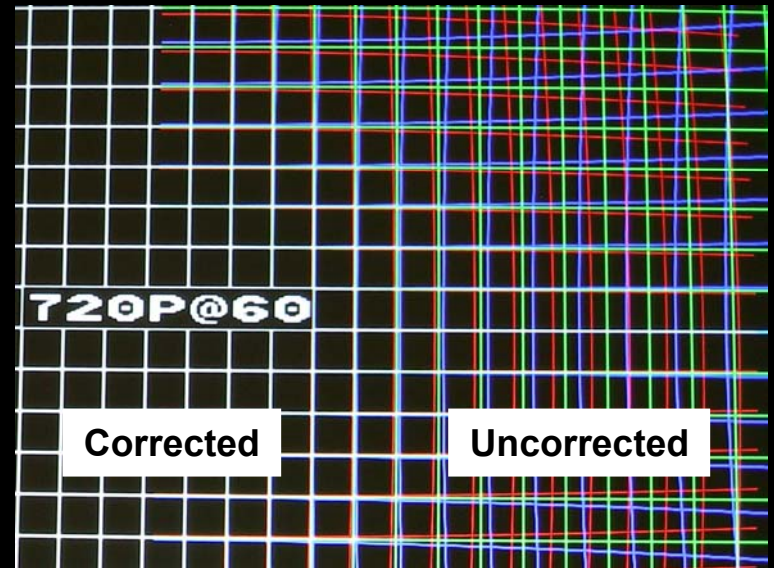
LED and Lamp  $< 1 \text{ W/mm}^2\text{str}$

**High quality beam ( $M^2 < 1.5$ )**

Small spots, efficient fiber-coupling

**Instant-On & Direct Modulation**

**Highly Polarized**



Lateral RGB spherical aberration correction using Silicon Optics GEO chip

Image courtesy of Silicon Optics

Completely different than lamps or LEDs ...





More and more reasons to adopt lasers quickly ...

Short term: Defensive position against plasma

UHP & LED do not compete

Long term: Offensive position for the future of HDTV

Laser TV is the ultimate HDTV



Laser TV will dramatically increase growth in the RPTV market

# BRANDING

The New Rallying Cry for  
MDTV Branding...

## Laser TV



Big Screen   Immersive   True High Definition   Thin Modern Look

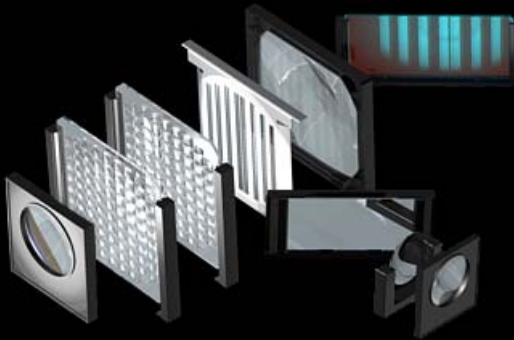
Unrivalled Picture Quality

# COST

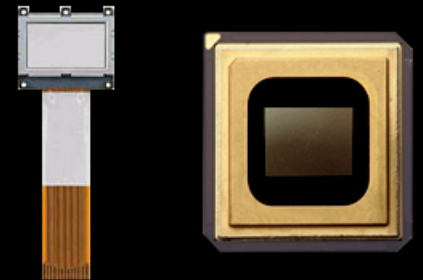
## What are the real **cost** problems in MDTVs?



Lamp  
Replacement



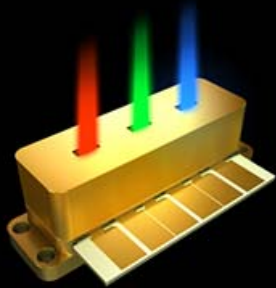
Optics



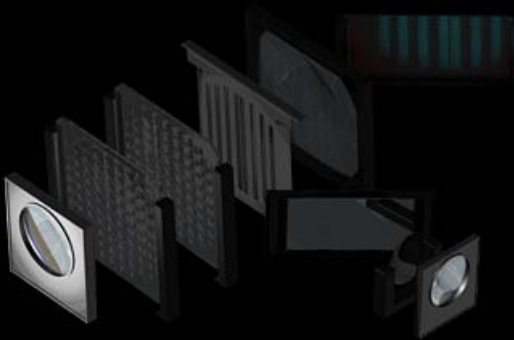
Microdisplays

# COST

## Lasers Provide Solutions



Never Needs  
Replacement



Fewer Optics



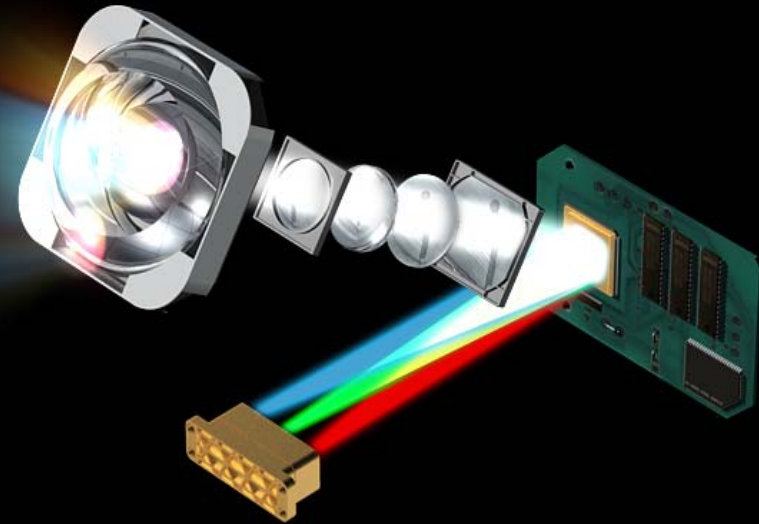
Smaller  
Microdisplays

# COST

Fewer Optics Makes  
Simpler Light  
Engines Possible

**Cost Decrease potential  
> 40%**

DLP, 3LCD, and LCOS

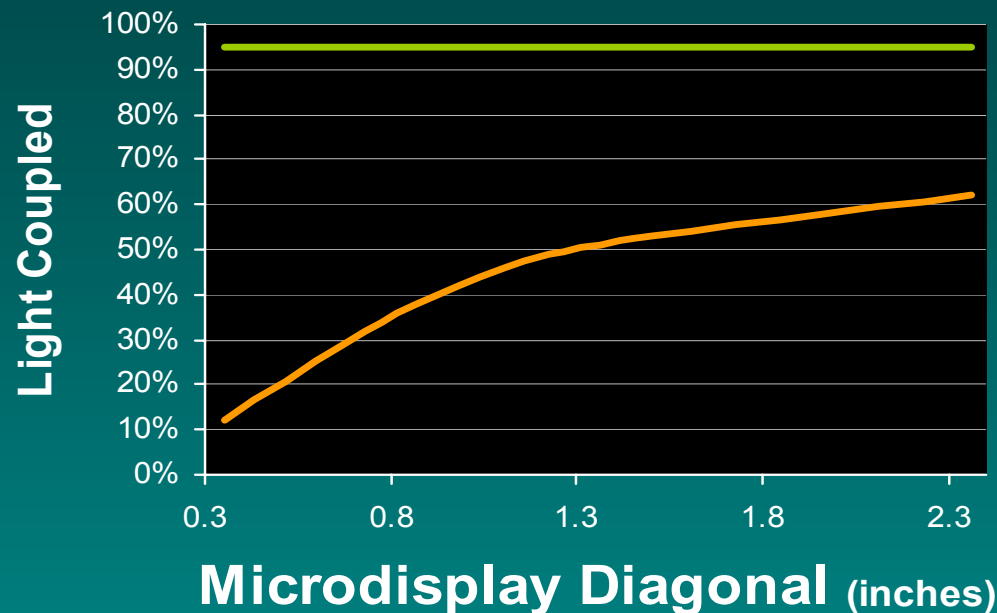


Reduces illumination optics, microdisplay, projection optics, & light source costs



# COST

## Lasers Enable Smaller Microdisplays While Maintaining Brightness



**Laser always > 95%**

**UHP lamp (and LED)  
drops dramatically  
with smaller panels**

# RELIABILITY

Three light sources for MDTV: UHP, LEDs, & Lasers

Reliability has a “life time” aspect:

**UHP Lamps** – “burn-out time” is 8,000 hours to 50% failure

**LEDs** – “fade time” is 20,000 hours to 50% power

**Lasers** – “life time” is the life of the TV at 100% original power

Reliability has an “endurance” aspect

Lasers have constant power and constant wavelength over time & temperature

For the first time ever, your TV picture will never change!

We've established that we want lasers for MDTV  
as the preferred light source ...

Branding, cost & reliability

How does Laser TV become the ultimate HDTV  
experience?

## BRIGHTNESS

Who wants a big screen with only **300 nits** and a **gain 5** screen??

Lasers provide unlimited lumens

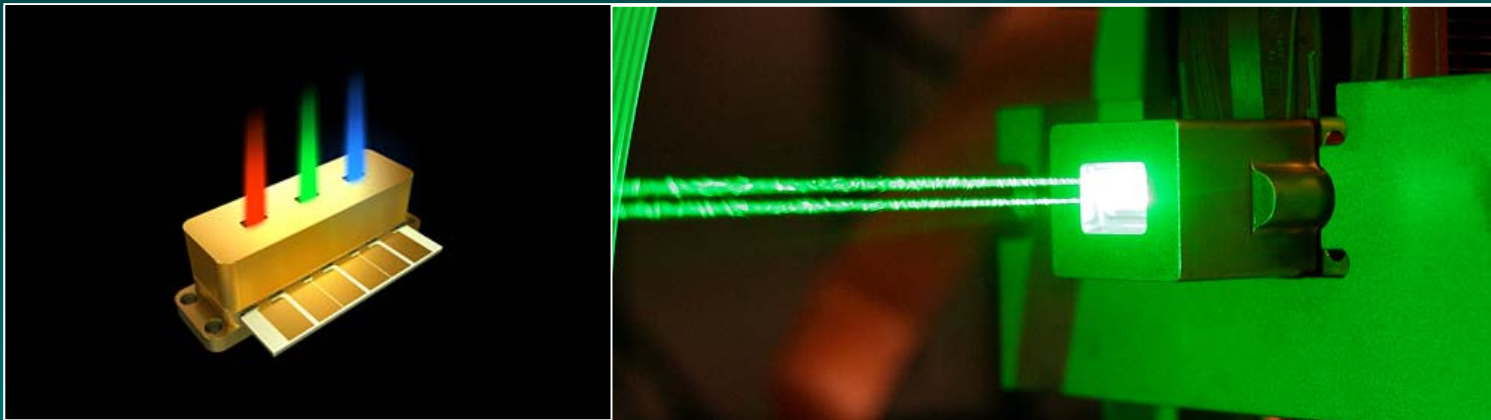
In particular, Novalux lasers are scalable arrays  
... if you need more power, use a bigger array

Any screen size can now have high brightness and low screen gain

**Major Opportunity:** Wider viewing angles will allow PTV to penetrate the signage market (airports, train stations, etc.)

# CONTRAST

## Contrast is Critical



The best possible contrast for LCOS, 3LCD, and DLP systems



What's the next big thing for TV?

**COLOR**



xvYCC has arrived

— only Laser TV can display it and take it even further



Expanded gamut will provide “true color” for the first time

## WEIGHT



65" Plasma TV  
175 lbs



65" Laser TV  
85 lbs

Lasers offer substantial weight savings

# ELECTRICITY



65" Plasma TV  
850W



65" Laser TV  
200W

Get your Laser TV for free!! Save \$300/year of electricity

## CONSUMER COST



65" Plasma TV  
\$9999



65" Laser TV  
< \$2500

Laser TV has lowest cost for big screen & high resolution



## IMMERSIVE VIEWING

Bigger Screens +  
true HD (1080x1920)  
= immersive viewing



65" Laser TV  
< \$2500

Laser TV has lowest cost for big screen & high resolution



# THIN

Hang it on a wall



65" Laser TV  
< 8" depth

No more bulky rear projection architectures

We've established that we want lasers for MDTV as the preferred light source ...

Branding, cost & reliability

We've established that Laser TV will deliver the best possible HDTV experience ...

Brightness, contrast, color, weight, power consumption, cost, immersive, & thin

What will further drive Laser TV adoption and growth?

# The next generation...

High Definition with more color

## Game Consoles

HDMI 1.3 supports xvYCC with  
**broader, deeper color**

Also good for 3D gaming

Fast Adoption – immersive gaming in true color



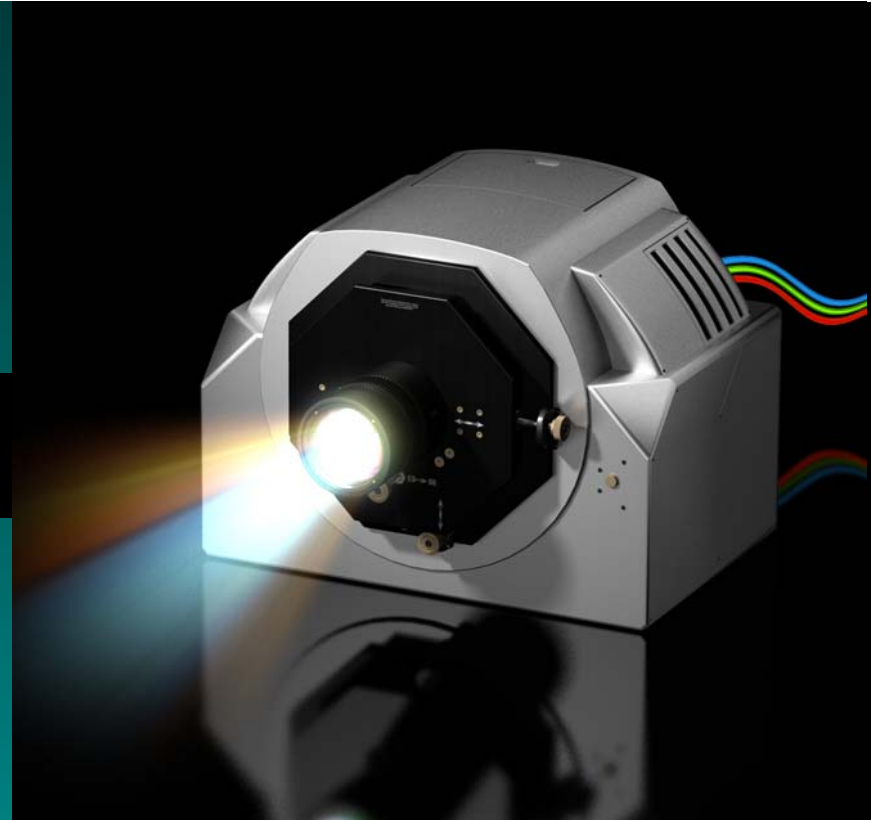
## Through the Cinema...

What starts in the theater  
ends up in the home

## D-Cinema

Novalux is working with partner  
companies to convert Hollywood  
to expanded gamut content

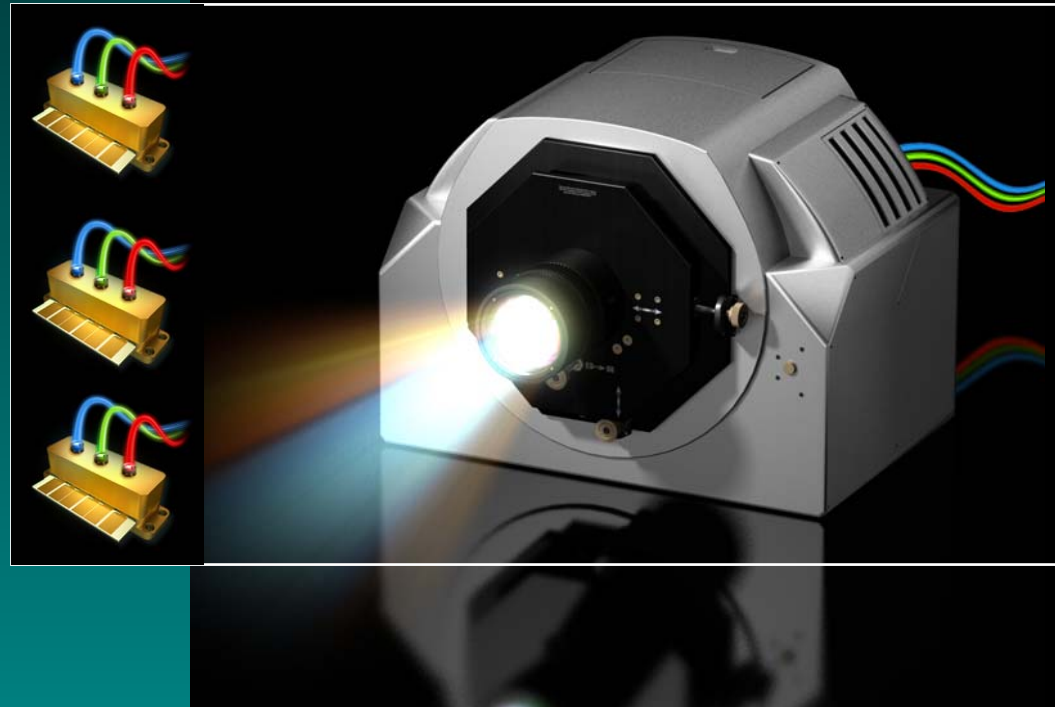
Provides the source material that only lasers can display



## Lasers Enable D-Cinema

Group lasers to get to 20,000 lumens

Solves business model problem



Fiber-coupling can only be done with laser light sources



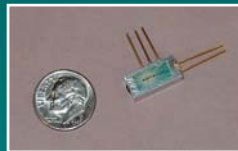
Through your gadgets ...

Project from your PDA ...

... or camcorder ... or phone

## Mobile Projection

On-the-go 2D MEMS scanning projection enables ubiquitous laser products



Lasers enable completely new lifestyle usages

## Lasers are a platform for all types of displays:

In your  
phone...



In the  
cinema...



In your  
pocket...



In your  
home...



In your  
car...



Lasers are the only viable, long-term MDTV light source

Lasers & microdisplays together are the ultimate source for a truly **immersive** and **affordable** HDTV experience

Expanded color gamut will reinforce this reality – Start branding Laser TV now!

Lasers will be the dominant light source by 2010, fueling dramatic growth in the RPTV segment





# Thank You!

[www.novalux.com](http://www.novalux.com)



**DISCOVER A NEW VIEW**  
Lasers are revolutionizing the display industry. Come see what lies ahead.

CES DEMO 2007

You are invited to experience laser television and projection by Necsel™ during the Consumer Electronics Show (CES) 2007 in Las Vegas.

