

The Hype Cycle for Metamaterials

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metamaterial.com

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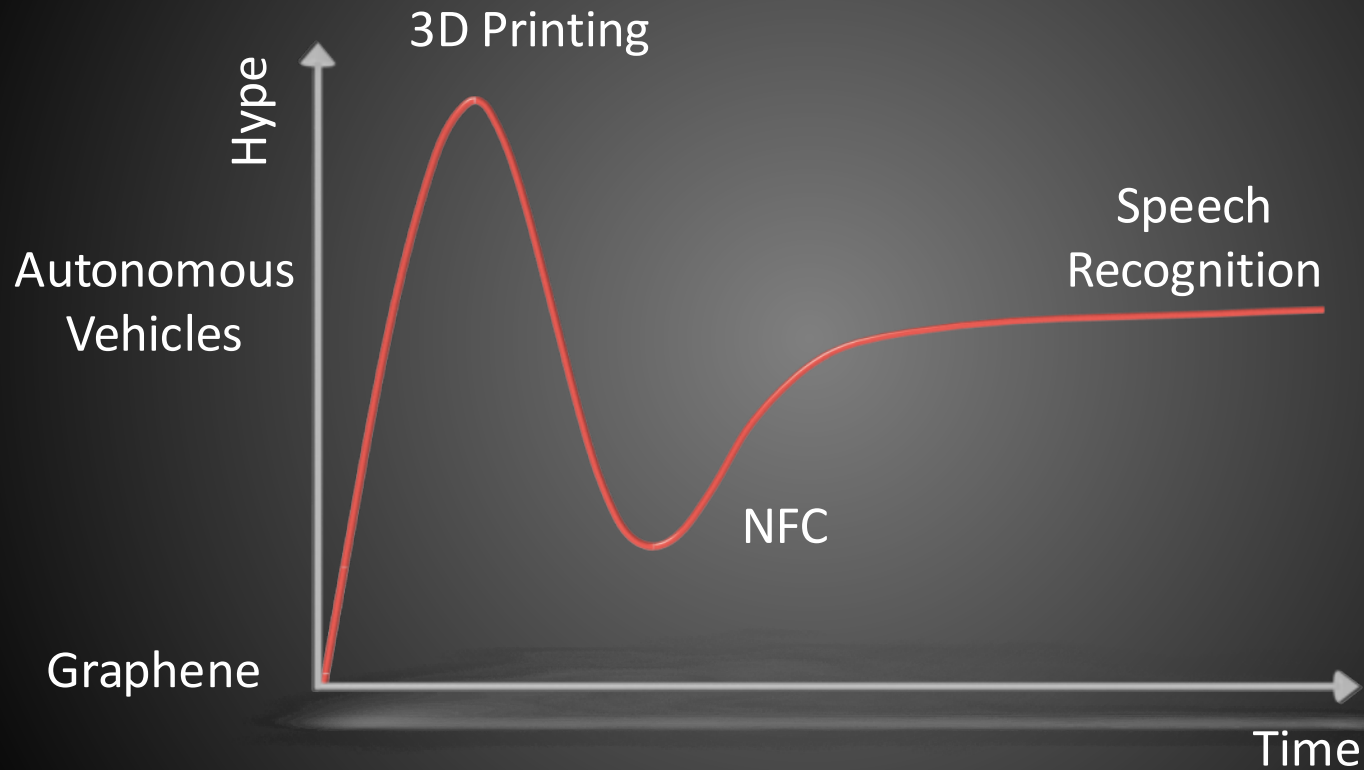
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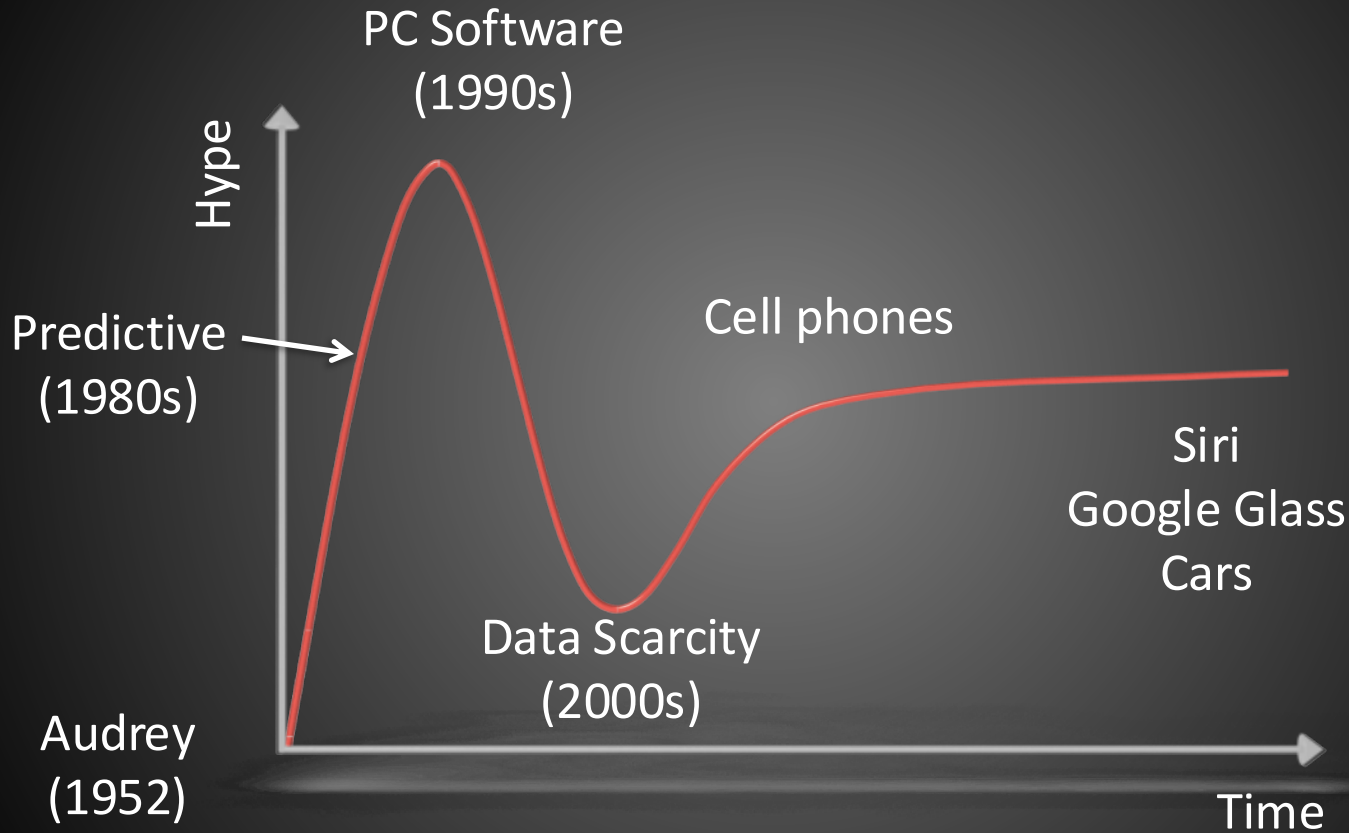
The Hype Cycle



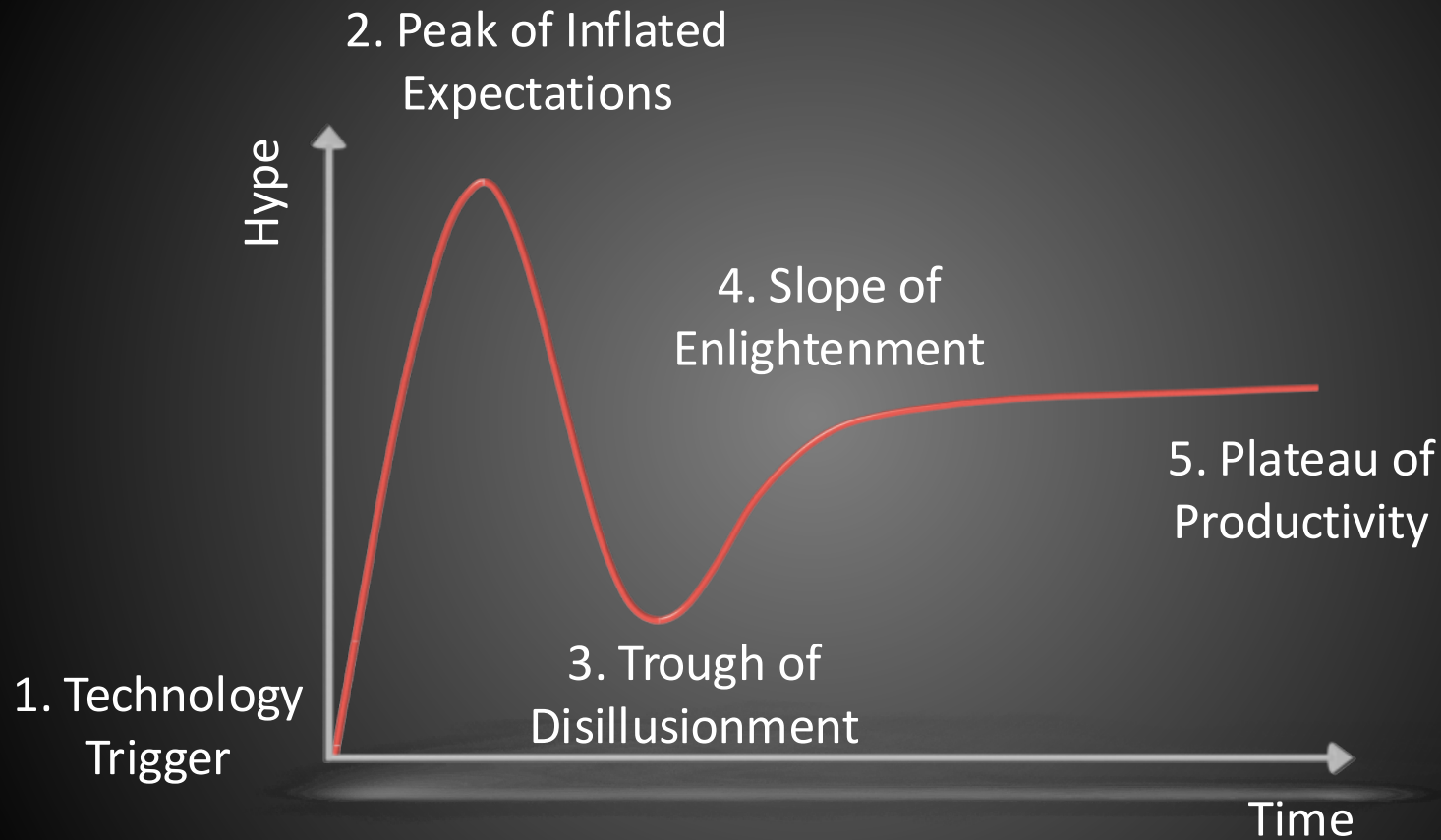
The Hype Cycle



The Hype Cycle – Speech Recognition



What about Metamaterials?





About us

About MTI & MediWise



- Launched in 2010
- HQ in Halifax, Canada
- 4 patent families
(15 applications)

Laser filters
LEDs
Solar Cells

- Launched in 2010
- HQ in London, UK
- 2 patent families
(3 applications)

Non-invasive glucose sensing
Microwave cancer imaging
Implantable Sensors

About MTI



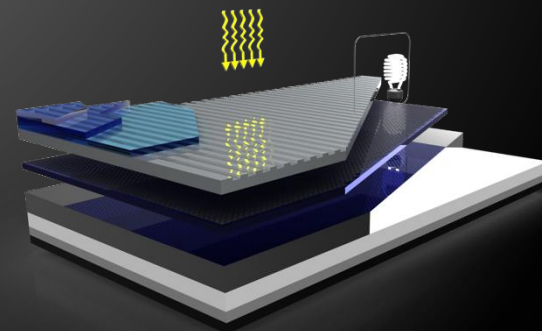
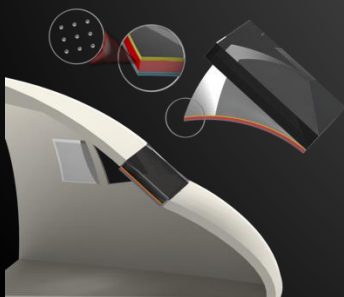
LAMDA GUARD



LAMDA LUX



LAMDA SOLAR



About Lamda Guard



LAMDA GUARD

Laser Attacks Against Aircraft



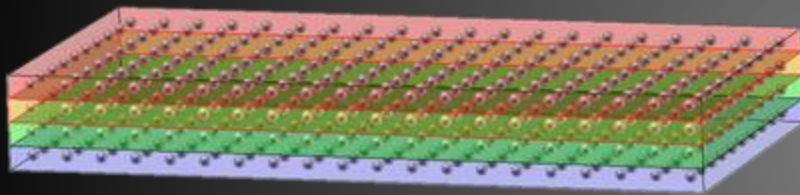
- 1 in every 200 flights
- 4000 US attacks per year

Egypt (July 2013)



Two Solutions

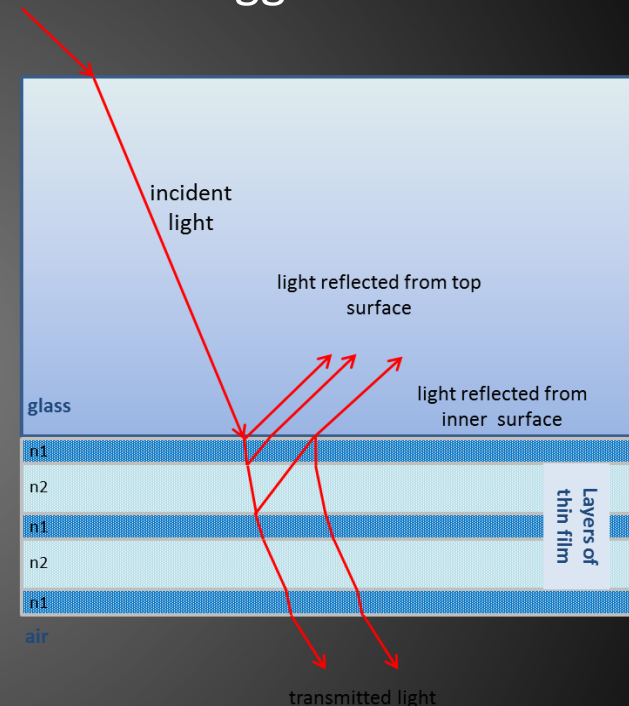
Multilayer
Plasmonic
Nanoparticles



Fabrication methods:

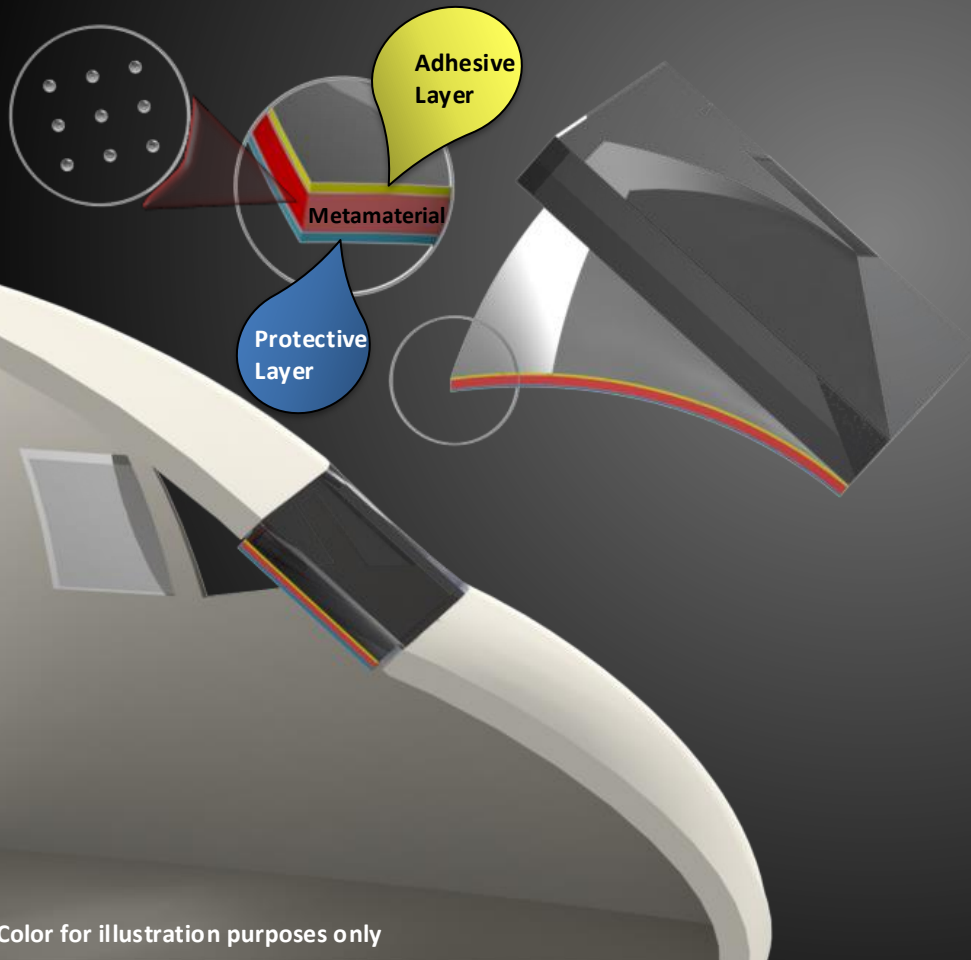
- ✓ Spin Coating
- ✓ ebeam Lithography
- ✓ Self assembly

(Sophisticated)
Bragg Mirrors



Fabrication methods:

- ✓ GLAD
- ✓ Sputtering
- ✓ Sol-gel



- ✓ Blocks multiple laser beams & colors
- ✓ Transparent
- ✓ Suitable for night use
- ✓ Thin film solution is adhesively fixed to the inside of the cockpit glass

Patents:
12780779.0 (EU)
BR112014008611-7 (Brazil)
2851347 (Canada)
201280049648.7 (China)
231830 (Israel)
14/349931 (USA)

The Next Steps



A banner for a seminar titled "Seminar on laser interference in aviation". The background is a green-tinted cockpit view with a bright green laser beam cutting through the air. At the top, there are logos for IATA, IFALPA (The Global Voice of Pilots), ECA (European Civil Aviation Conference), the European Union flag, the ICAO (International Civil Aviation Organization) logo, and EUROCONTROL. The text "Seminar on laser interference in aviation" is centered in white. At the bottom right, it says "10-11 October 2011, Brussels, Belgium".



A banner for a conference titled "LASER ILLUMINATION OF AIRCRAFT: A GROWING THREAT CONFERENCE". The background is a dark image of an aircraft with a bright green laser beam illuminating it. The text "LASER ILLUMINATION OF AIRCRAFT: A GROWING THREAT CONFERENCE" is in yellow and black. At the bottom right, it says "October 27, 2011 | Washington, DC".

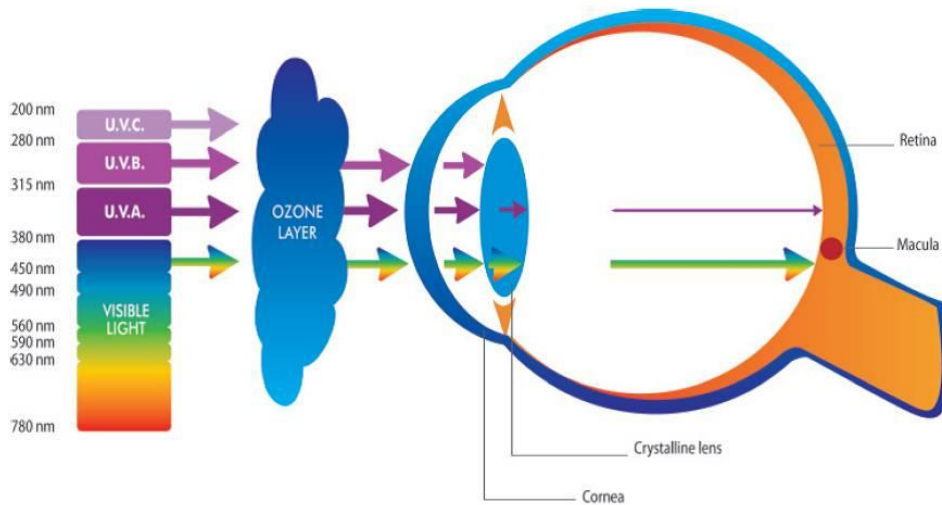
- Submitted White Paper
- Only ones proposing a solution

The Next Steps

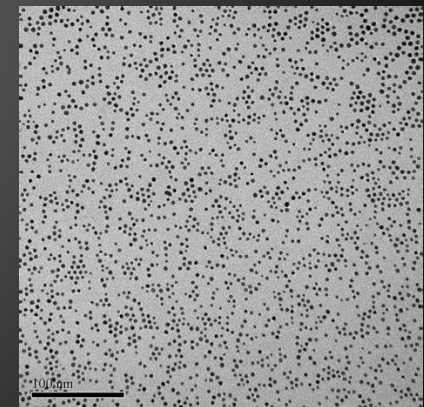


- Fabricated prototypes in Atlantic Canada
- \$1.4m +\$5m of funding (incl. government)
- Partnership with Airbus
- Targeted specifications

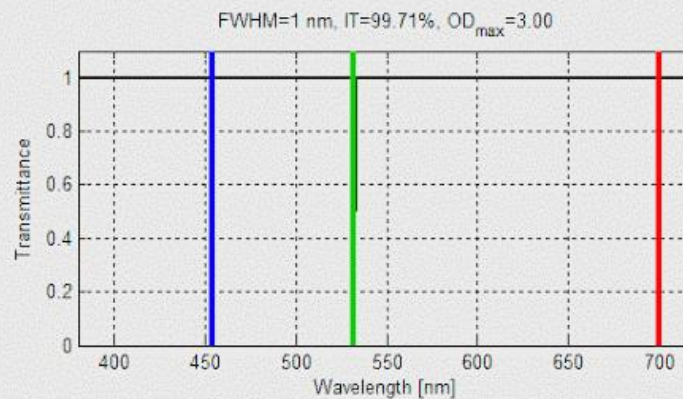
Eyewear Applications



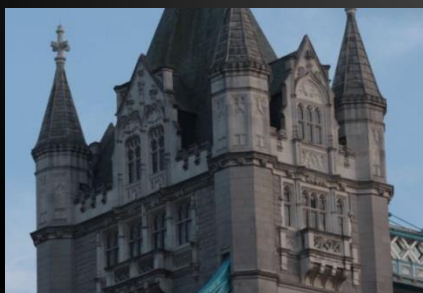
- Interest from commercial eyewear manufacturers
- Filter UV/Blue Light
- Broadband nanoparticle filtering



Simulating Visual Response



Original



Simulated



Actual

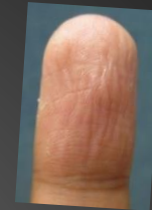




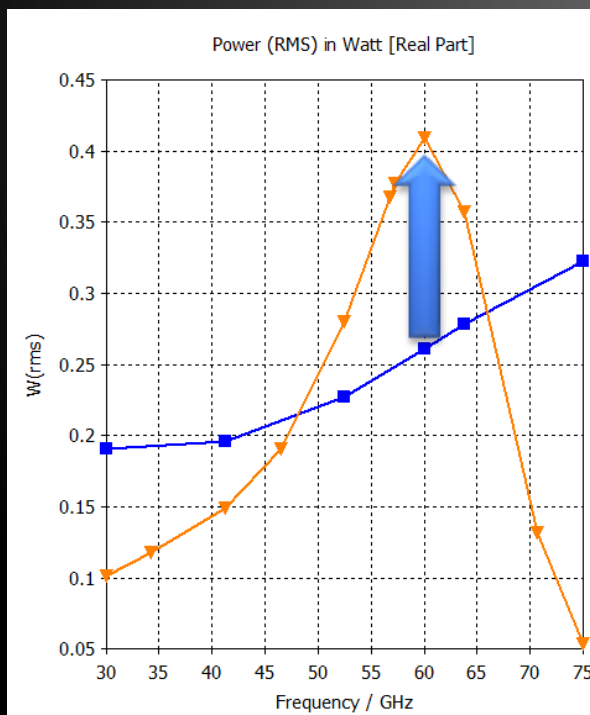
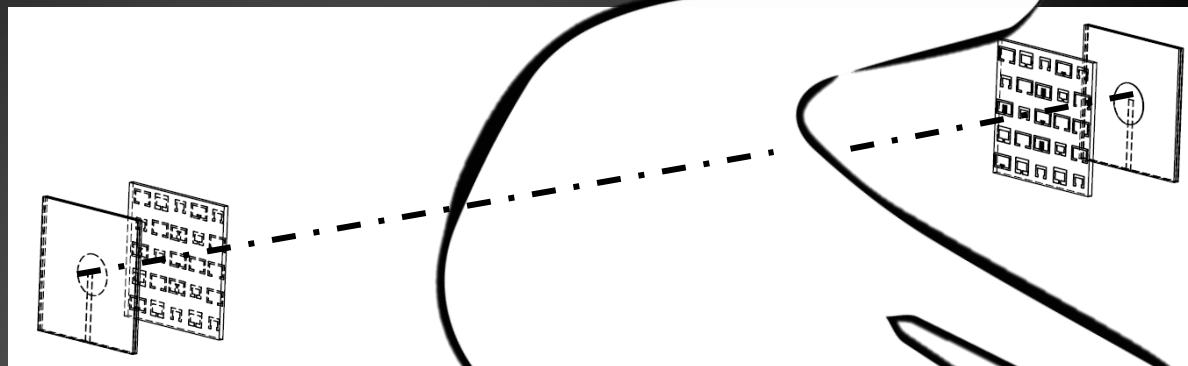
mediwise
MEDICAL WIRELESS SENSING

The Skin Mismatch Problem

- Microwaves reflect off skin
- Reduces accuracy of non-invasive diagnostics
- Wearables & smart watches



Impedance-matching Metamaterial



- Ultra-thin layer ($< 100 \mu\text{m}$)
- Double the energy penetrating

Non-invasive Glucose Sensing (60 GHz)



Microwave Breast Cancer Imaging (2 GHz)

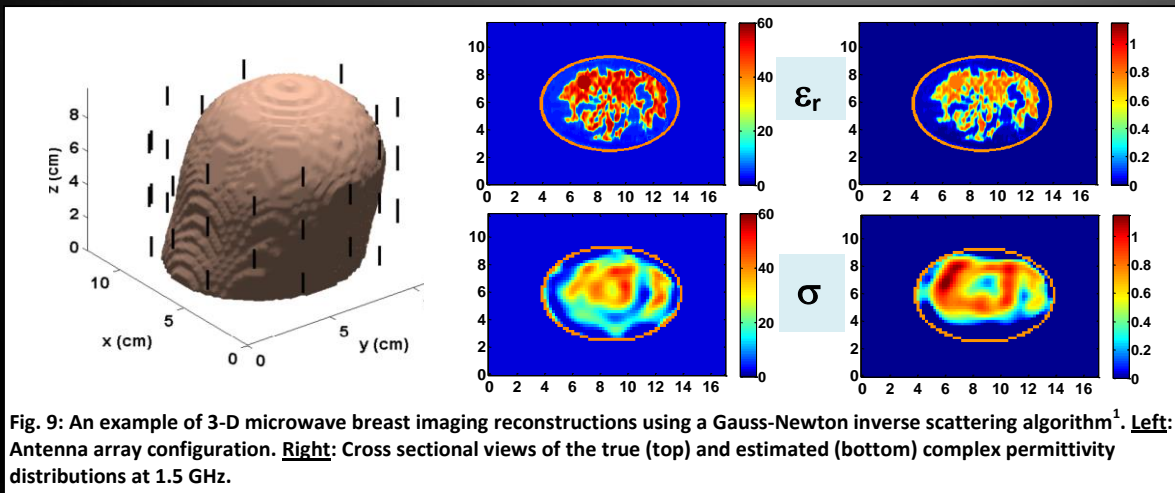
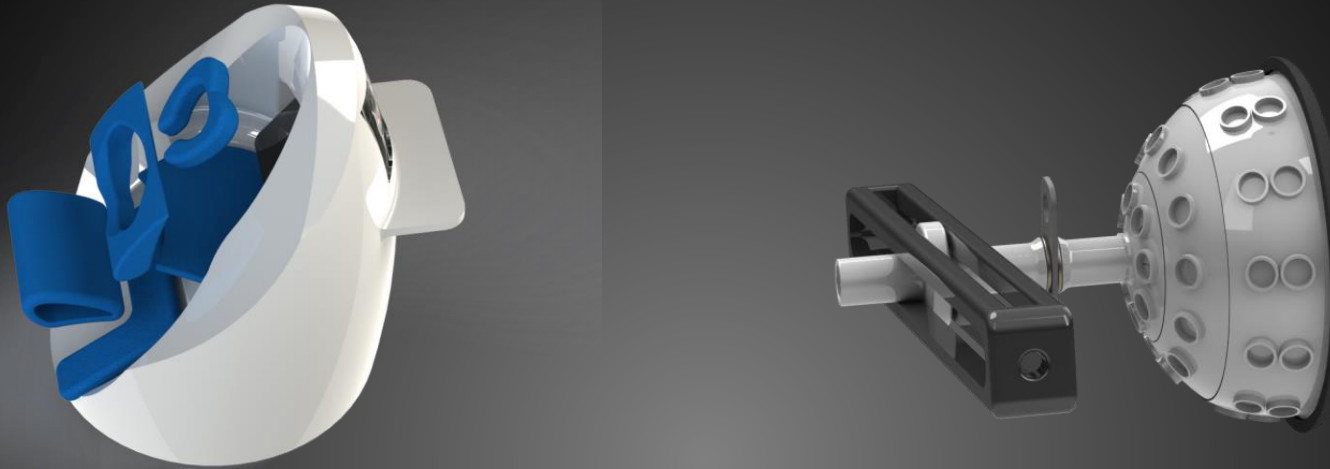
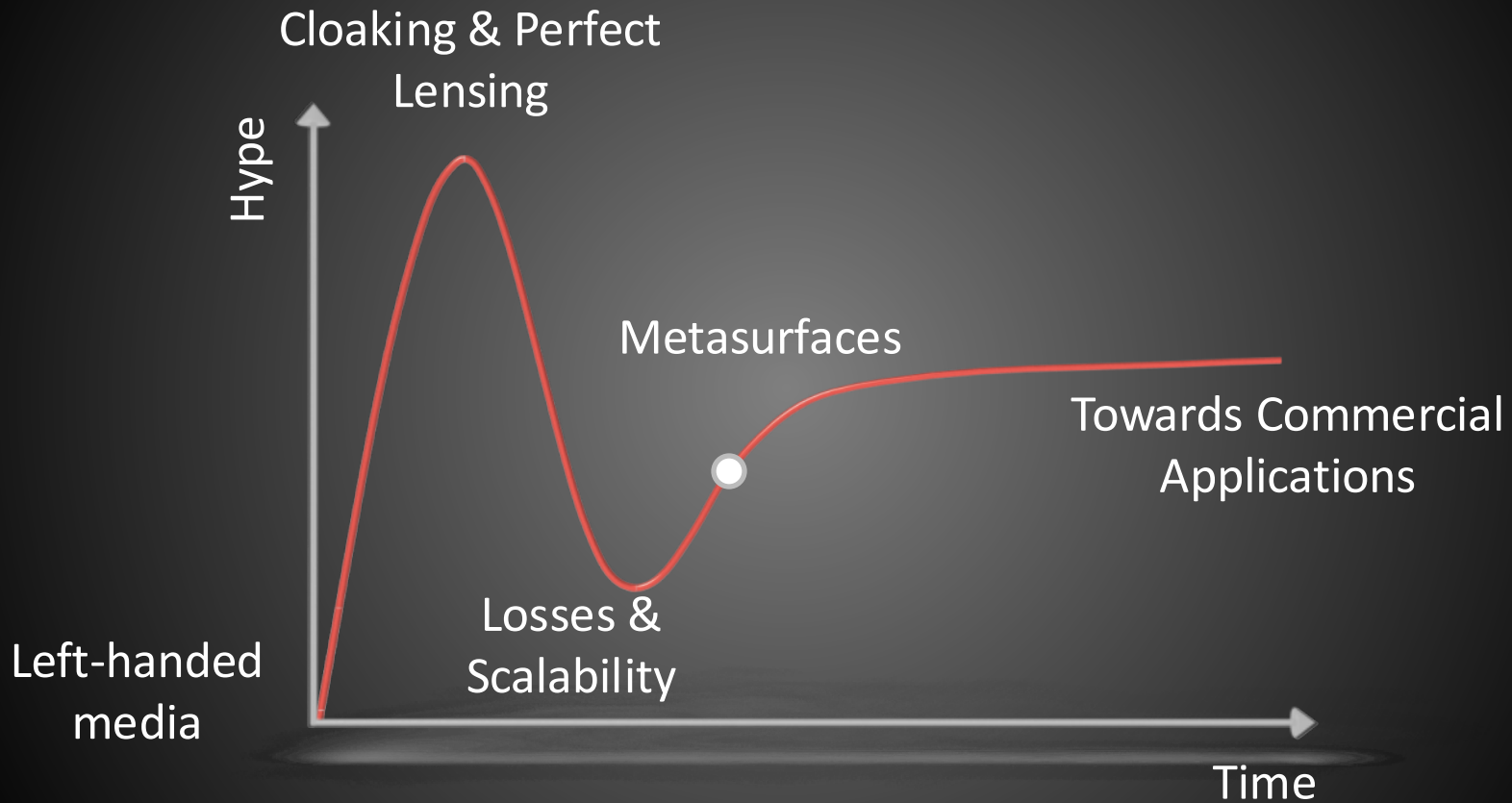


Fig. 9: An example of 3-D microwave breast imaging reconstructions using a Gauss-Newton inverse scattering algorithm¹. Left: Antenna array configuration. Right: Cross sectional views of the true (top) and estimated (bottom) complex permittivity distributions at 1.5 GHz.

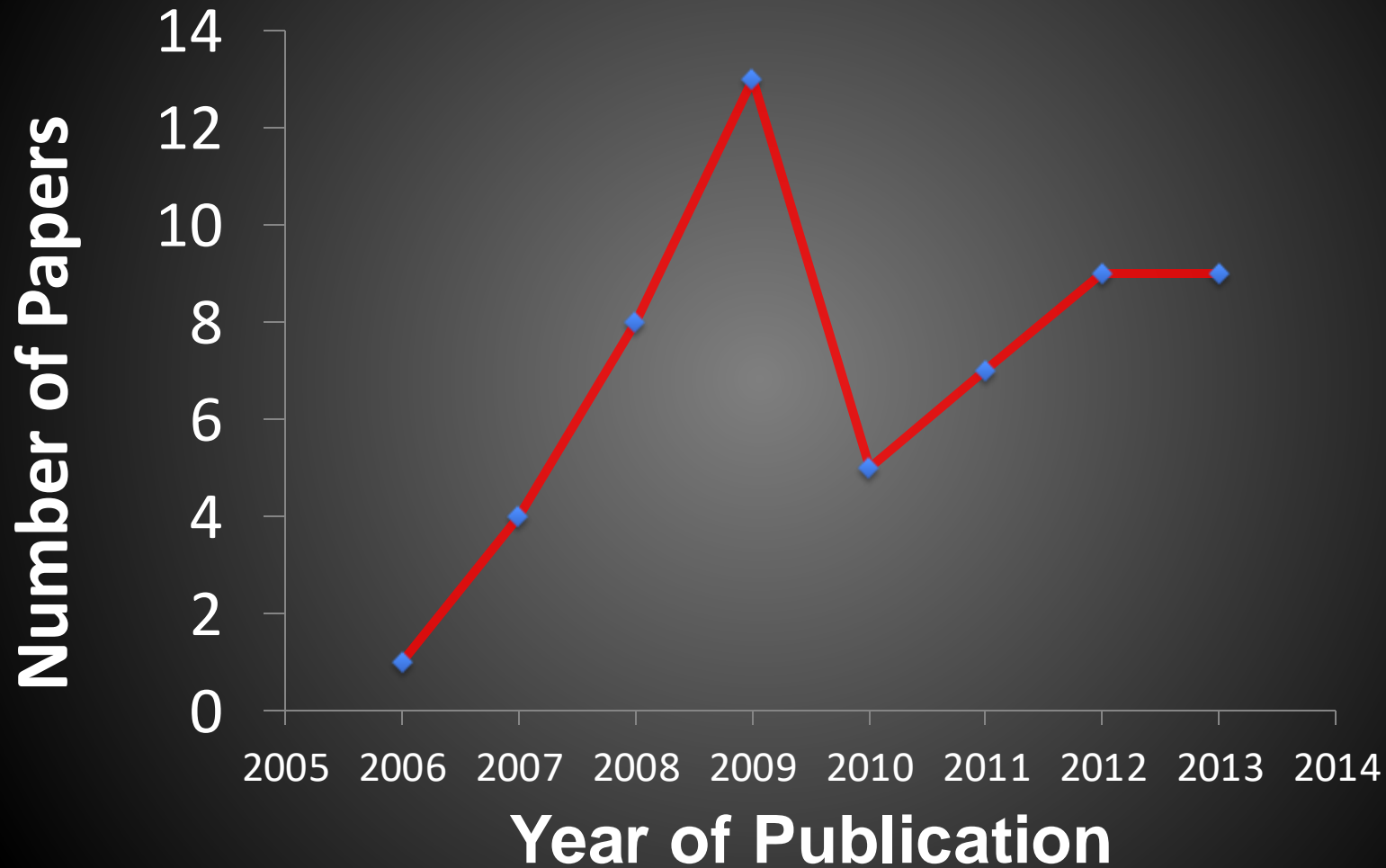


Conclusions

The Hype Cycle for Commercial Metamaterials



Cloaking Publications in High Impact Journals



- Transparency for visible applications
- Large scale nanofabrication
nm accuracy over meter surfaces
- Cost-effective fabrication
\$1-10 per cm² on volume production

Some Lessons

- Wouldn't be here without cloaking & perfect lensing
- Entrepreneurship takes time
- No need to be a genius
- Investors have little clue about metamaterials
- Recipe for success:
 - Funding (investors/grants)
 - Academia
 - Commercial Partners
- Look for Game changers:
Big enough pain for someone to pay for a solution
- Either improve by an order of magnitude or make it cheaper



Tak

We're hiring metamaterial scientists

Contact us at metamaterial.com