
DARPA
DARPATech
2002 Symposium
Transforming
Fantasy


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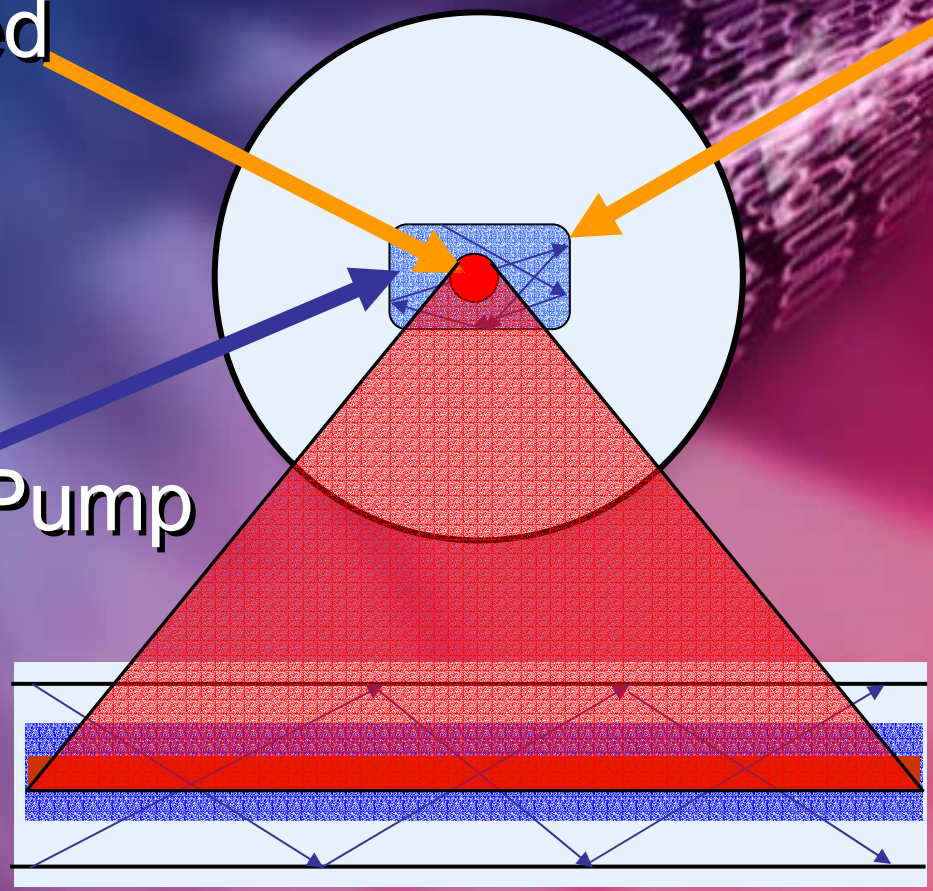
Program Manager
Transforming
Fantasy

High Power Fiber Lasers

High Power Fiber Lasers

- Wall-plug efficiency ~ 20 to 30%
- Large surface to volume ratio
  - Efficient thermal management
- Robust Architecture/Compact Packaging

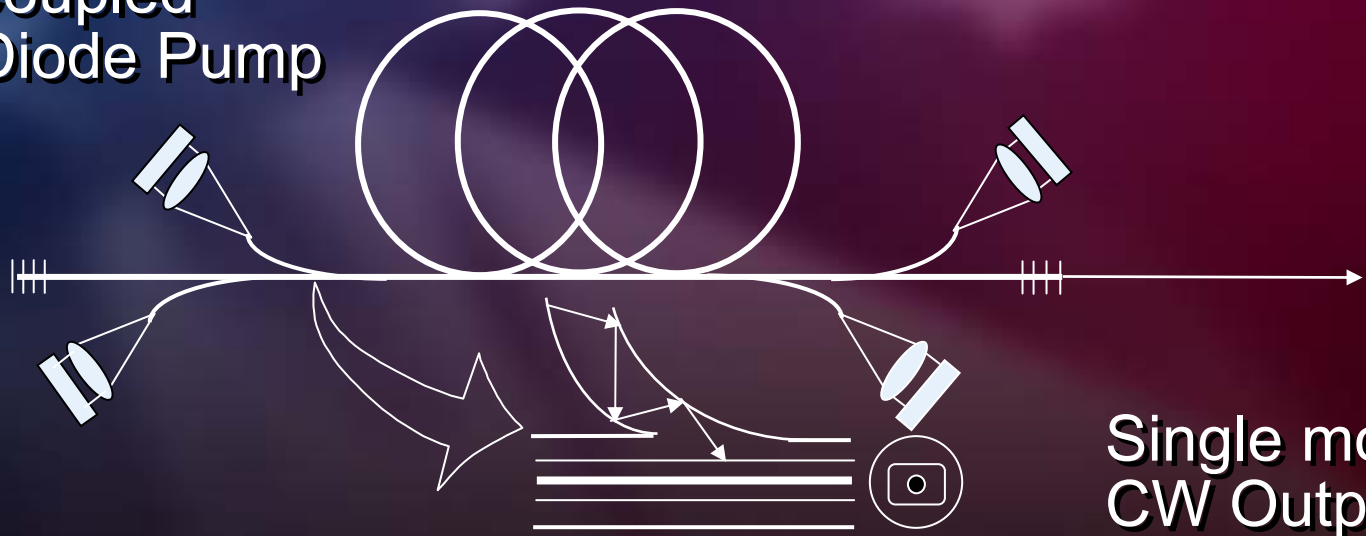
Fiber Laser Cross-section



High Power Fiber Lasers

Fiber Laser
Gain Medium

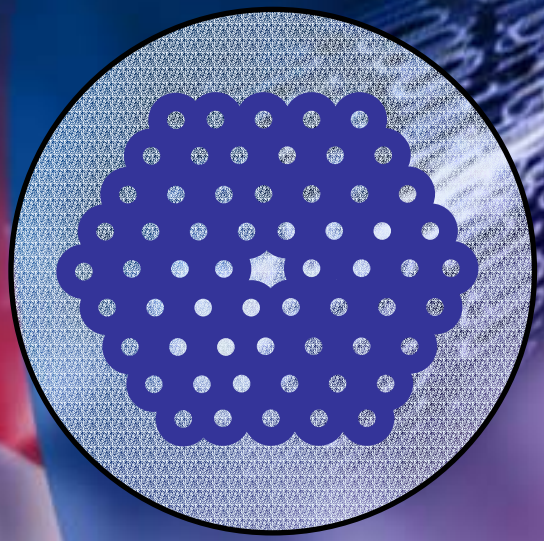
Fiber Coupled
Laser Diode Pump



Single mode
CW Output
at 1 micrometer

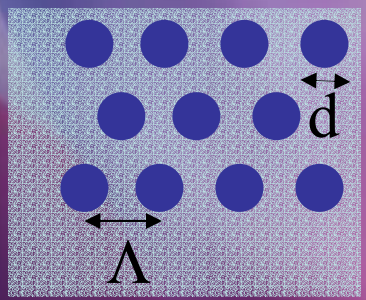
Pump Coupling
Scheme

Photonic Crystal Fibers

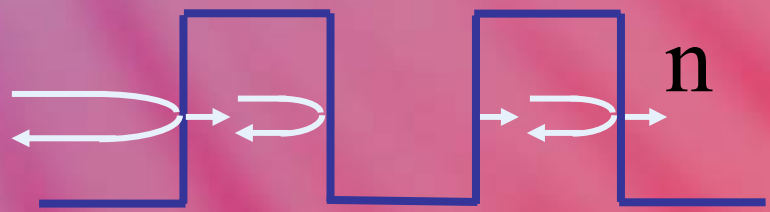


- Single mode operation
- Doped hollow or solid core

The holes act as fiber cladding

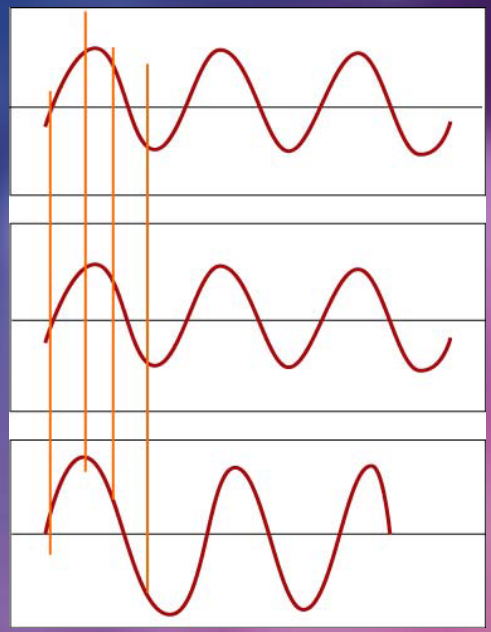


Periodically arranged air holes act as Bragg gratings and confine light

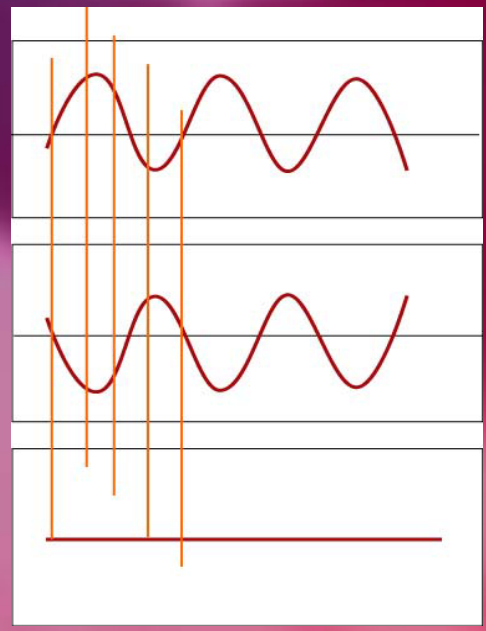


Constructive and Destructive Interference

In Phase

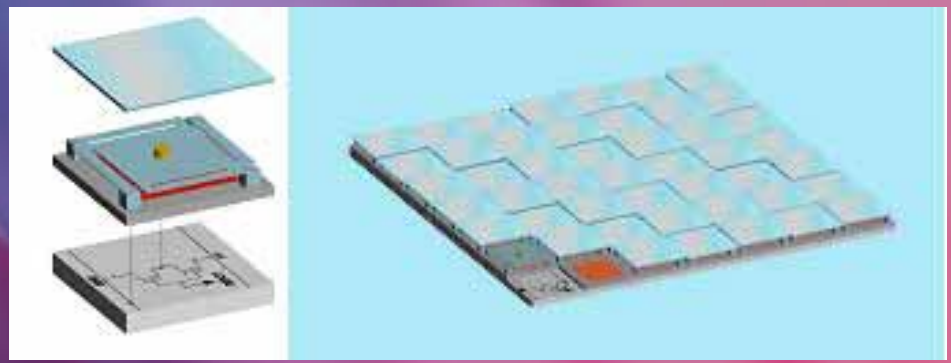


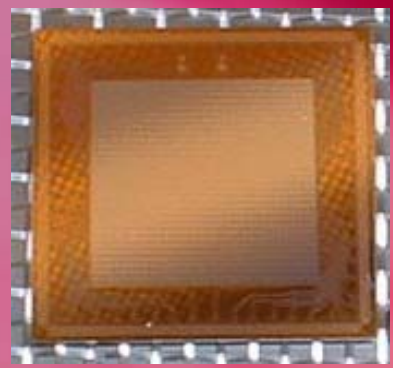
Out of Phase



Spatial Light Modulators (SLMs)

- 1024x1024 pixels
- Pixel flatness ~ λ/50, 98% fill factor
- 8 bits phase resolution (256 levels)
- 10 μs response time





32x32 SLM

Technical Challenges

- Eliminate nonlinear effects in large mode area fibers
- Polarization maintenance
- Launching of high power diode pump power
- Precise control of the phase of multiple fiber lasers for coherent combining

Program Development Plan

Phase I

Task 1

Develop large mode area (LMA), polarization preserving fiber designs

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Demonstrate single mode 100 watt fiber lasers

Task 2

Develop designs for coherent combining of 100's of fiber lasers

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Demonstrate greater than 1 kilowatt output power

Phase II

Demonstrate single mode 1 kilowatt fiber lasers

Demonstrate 10's of kilowatts output power

Demonstrate greater than 100 kilowatt output power

Transformative Fantasy

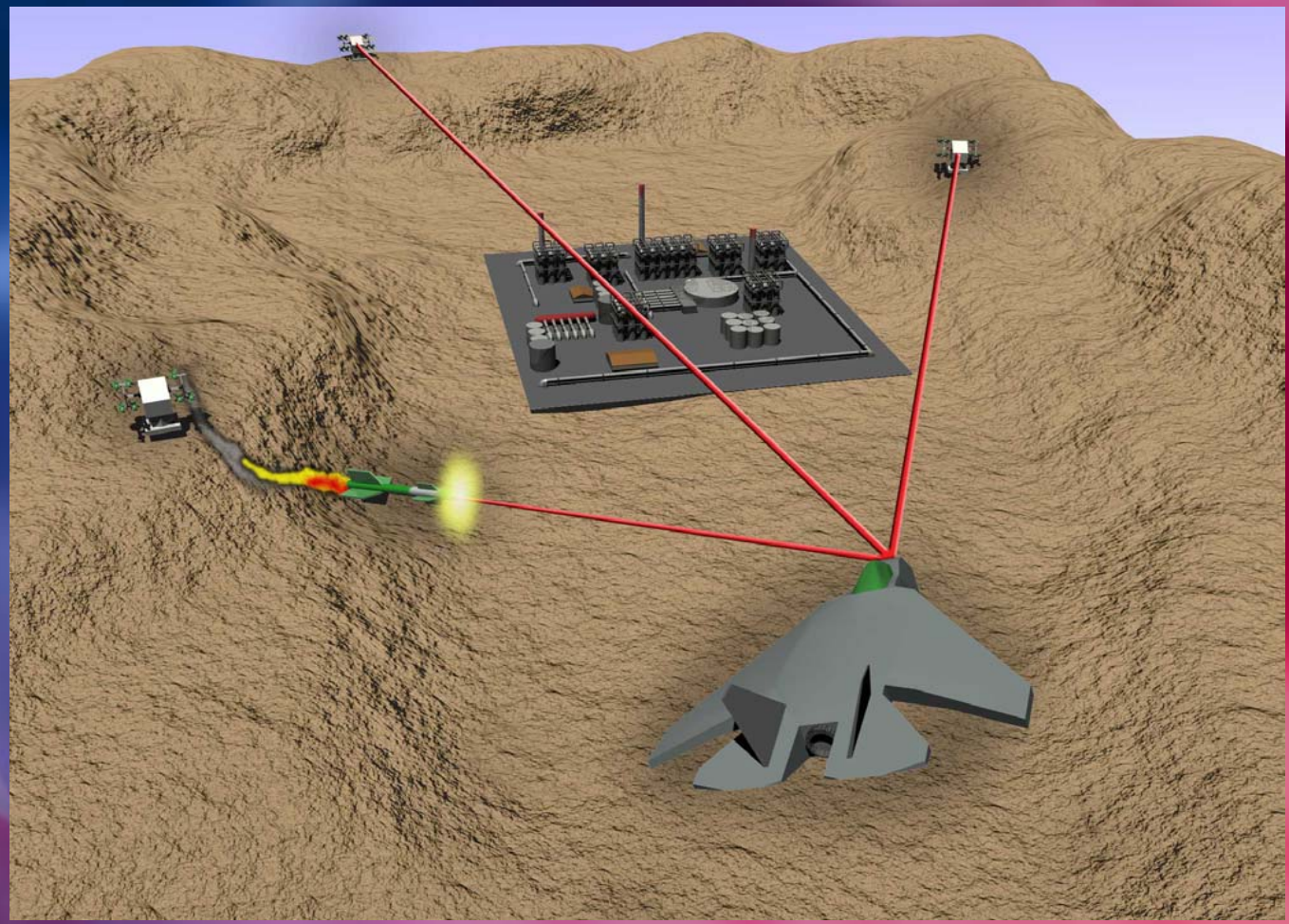
DARPA

High Power Fiber Lasers

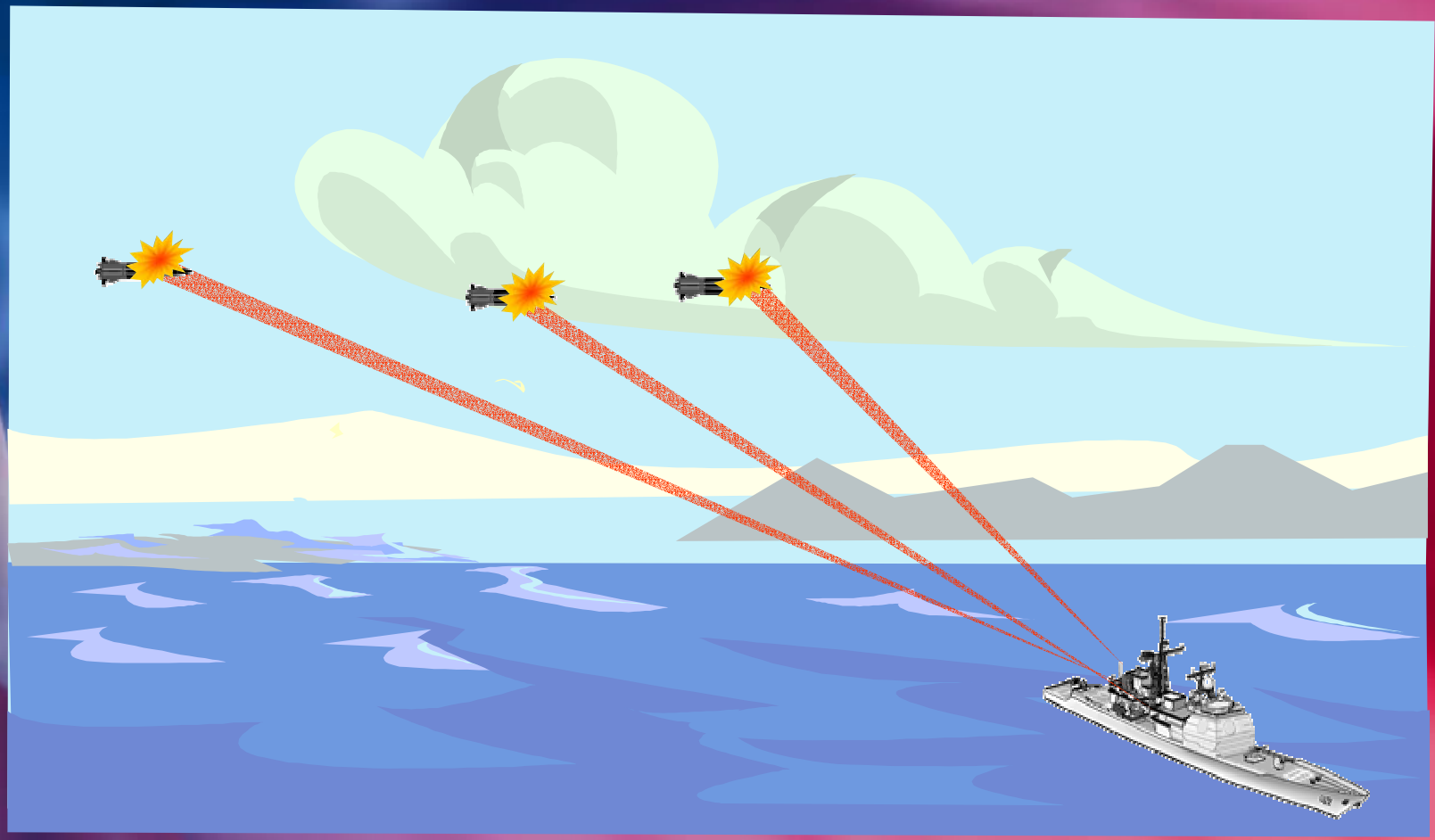
- Simplified logistic tail
- Deep magazine
- Compact foot print

Theater/Area Defense

Self-protection of Combat Platforms



Defense Against Anti-Ship Missiles

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