



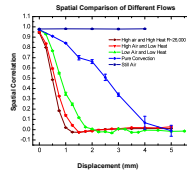
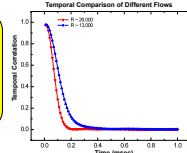
RESEARCH IN THE MARYLAND OPTICS GROUP

Christopher C. Davis, Stuart D. Milner, Kyuman Cho, Igor Smolyaninov, Quirino Balzano, Bob Gammon, Vildana Hodzic, Shawn Ho, Sugianto Trisno, Heba Yuksel, Jaime Llorca, Navik Agrawal, John Rzasa, Mohammed Eslami, Ehren Hwang, Juan-Carlos Franco, Peter Pham, Joe Harris

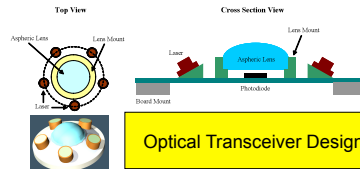


Free Space Optical Communications

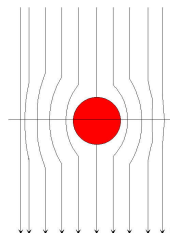
- Delayed diversity for fade resistance
- Pointing, Acquisition and Tracking
- Beacon-based Pointing with homographies
- Atmospheric turbulence measurements
 - correlation functions measured in the single scattering regime
- Direct observation of the Taylor microscale and size of the smallest turbulence vortices



Free Space Optical Sensor Networking



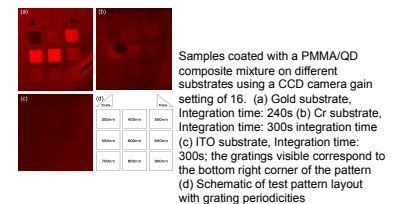
Surface Plasmon Polaritons And Invisibility



- Transformative optics:
 - Make electromagnetic waves flow around an object as if it were not there
- Re-projection
- Mirrors

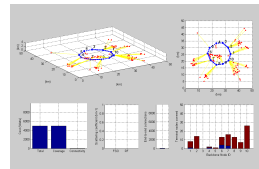
Enhanced Fluorescence from Quantum Dots

We have experimentally demonstrated the enhancement of fluorescence from quantum dots excited by interaction with surface plasmon polaritons on nanostructured metal surfaces

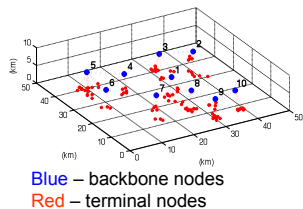


Samples coated with a PMMA/QD composite mixture on different substrates using a CCD camera gain setting of 16. (a) Gold substrate, Integration time: 240s (b) Cr substrate, Integration time: 300s (c) ITO substrate, Integration time: 300s; the gratings visible correspond to the bottom right corner of the pattern (d) Schematic of test pattern layout with grating periodicities

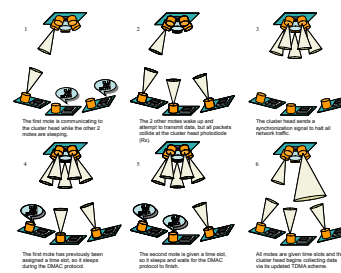
Directional Wireless Networks and Mobility Control



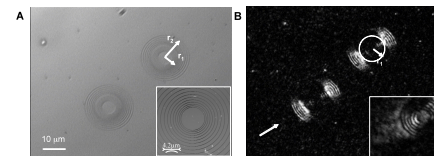
- Potential energy functions for network optimization
- Normal mode analysis to predict network breakdowns
- Topology control



Network D-MAC Protocol



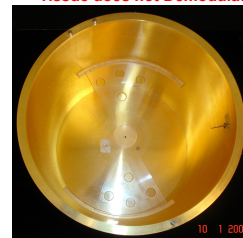
Cloaking with ring structures



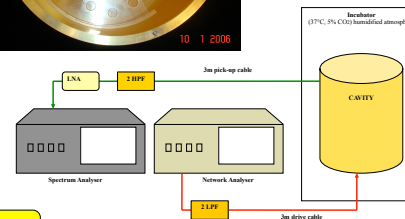
Bioelectromagnetics

Absence of Nonlinear Responses in Cells and Tissues Exposed to RF Energy at Mobile Phone Frequencies using a Doubly Resonant Cavity.

The Brain is not a Radio Receiver for Wireless Phone Signals: Human Tissue does not Demodulate a Modulated Radiofrequency Carrier



One of two made at the University of Maryland.
Radius = 12.35 cm
Length = 27.22 cm
Unloaded Q = 41000
Dominant modes
TE₁₁₁ = 900MHz,
TE₁₁₃ = 1800 MHz



Autonomous, Wireless-Networked HD Surveillance

OVERALL AIM: Improved traffic management, incident detection, security, improved highway utilization

Automatic multiple vehicle tracking
Automatic vehicle identification: model, color, license plate
Per-lane speed measurements
Origin-Destination tracking based on multiple cameras
"Event" detection: crashes, traffic backups, erratic driving, pedestrians
Algorithms for identifying driver behavior

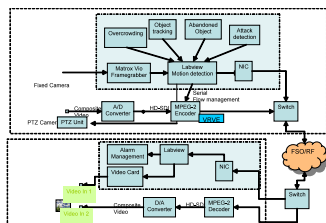
METHODS

High definition digital single-frame images analyzed for "events"

High data rate wireless data transfer from cameras to command center

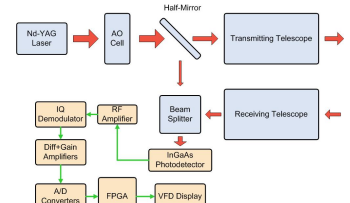
PROGRESS

Automatic tracking of multiple vehicles in a frame
Lukas-Kanade optical flow algorithm for speed detection
Automatic general vehicle type classification: sedan, van, SUV, truck
Variable rate encoder to handle multiple cameras



Remote Optical Vibrometry

Laser heterodyne detection of Doppler shift from remote target with I-Q demodulation in the RF domain. Sensitivity pm/sqrt(Hz)



Applications: Remote Sensing, Health Monitoring