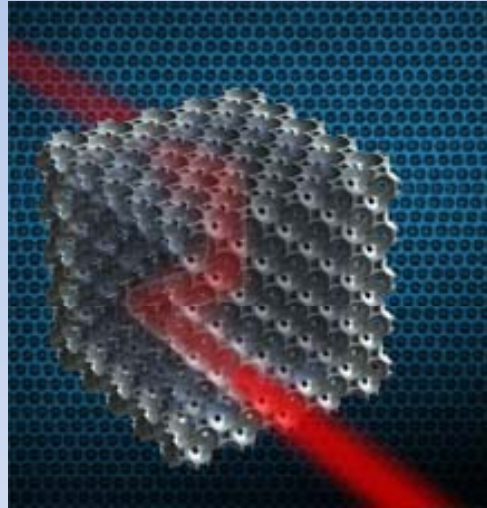


# Use of Photochromatic Polymers for Localized Tuning of Photonic Crystal Cavities



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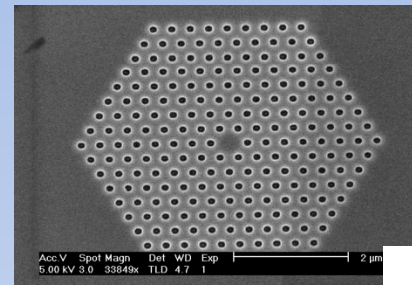
*UMD Advisor: Prof. Edo Waks*

# Outline

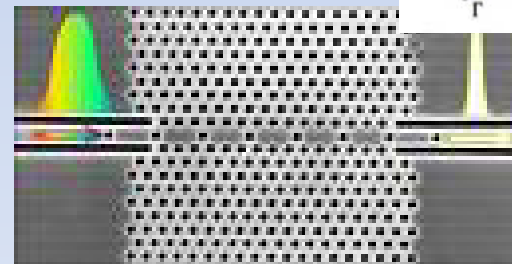
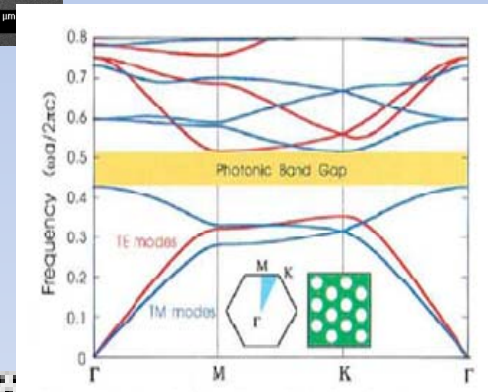
- Describe photonic crystals and their potential applications
- Elaborate on my project's goal
- Explain theory of the photochromic materials used in the project
- Display and analyze the results obtained
- Summarize conclusions drawn and continuations to be made

# Photonic Crystals

- Creates a band-gap for photons like semiconductors do for electrons
- Can tune the crystal to change the location of the bandgap and thus, the resonance
- Uses include: optical waveguides, coatings for mirrors and lenses, and photonic-crystal fibers



Change to pic of our groups fabricated crystals



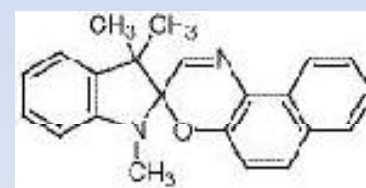
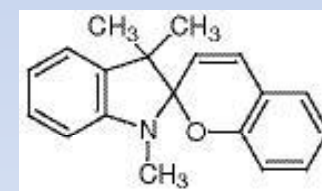
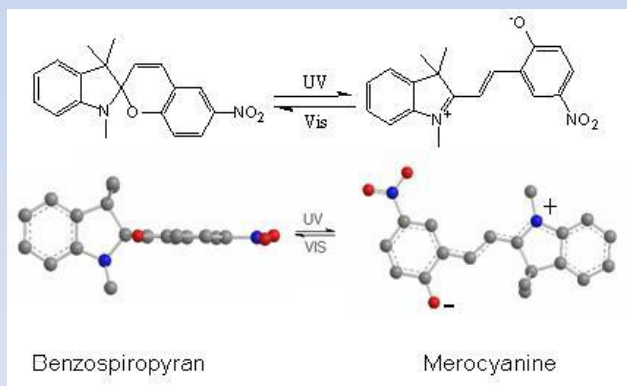
Images From:  
<http://www.phy.cam.ac.uk/research/sp/sppictures/eb13.png>  
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<http://nanophotonics.st-and.ac.uk/EPIX/images/PBGCompression.jpg>

# Project Motivation

- Fabrication of photonic crystal cavities is an extremely sensitive process
- Photochromic compounds have been explored as a means by which to tune photonic crystal structures
- This project demonstrates how a compound called spiropyran in thin film coats achieves reversible tuning of Gallium Arsenide photonic crystals

# Photochromic Materials

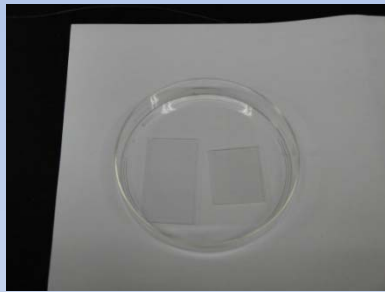
- Changes structure with illumination under different wavelengths of light
- Form shift is reversible and accompanied by shifts in absorption and refractive index
- Benzospiropyran vs. Naphthospirooxizane



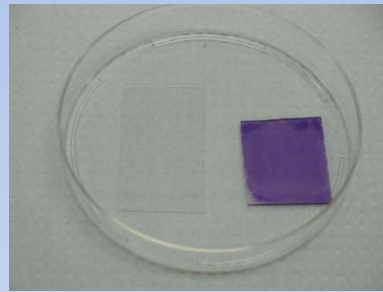
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# Visable Results

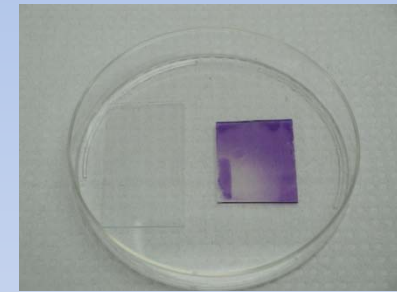
5% Spiropyran (by weight) in solution of .5% PMMA in Anisole



5 min UV



15 min Green

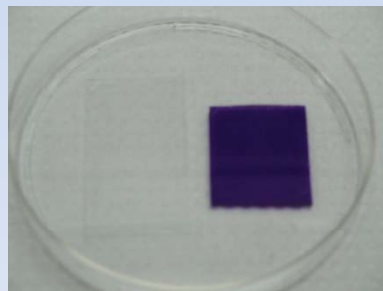


5 min Green (High)

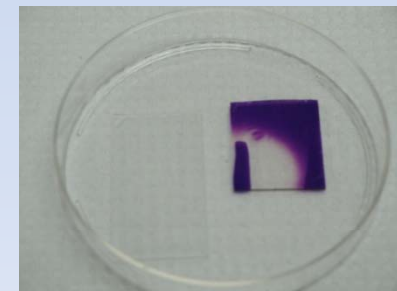
5% Spiropyran (by weight) in solution of 4% PMMA in Anisole



5 min UV

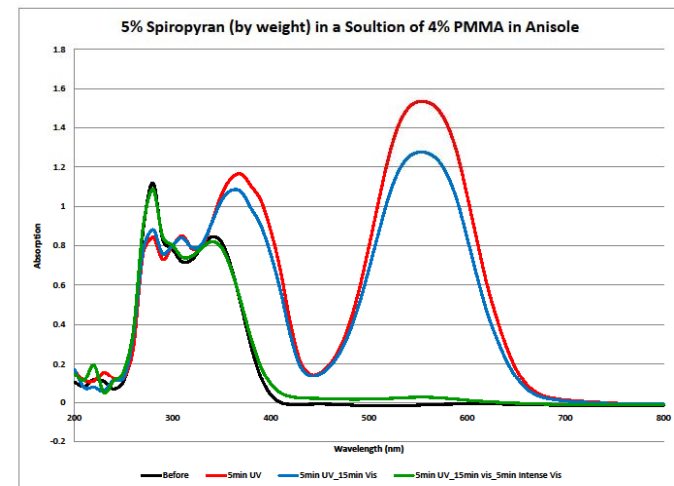
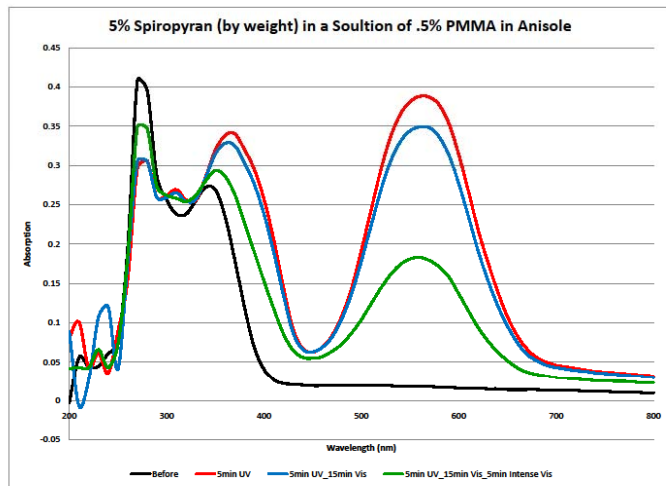


15 min Green



5 min Green (High)

# Spectrophotometer Results



# N & K analysis



# Conclusions

- Results are promising for the use of spiropyran as a local modulator photonic crystal resonance
- Reversible shifts in refractive index were observed at both low and room temperature
- Low temperature type has been proven to work as a method of tuning a photonic crystal of GaAs in a cryogenic experiment done by graduate student, Deepak Sridharan.
- This work should supplement a graduate publication on reversible photochromatic films

# Acknowledgements

- **Prof. Edo Waks**
- **Deepak Sridharan**
- **TREND Research Grant**
- **Institute for Research in Electronics and Applied Physics**
- **University of Maryland Electrical and Computer Engineering Dept.**