

# ***13 Resonances of the Sodium D1 Line***

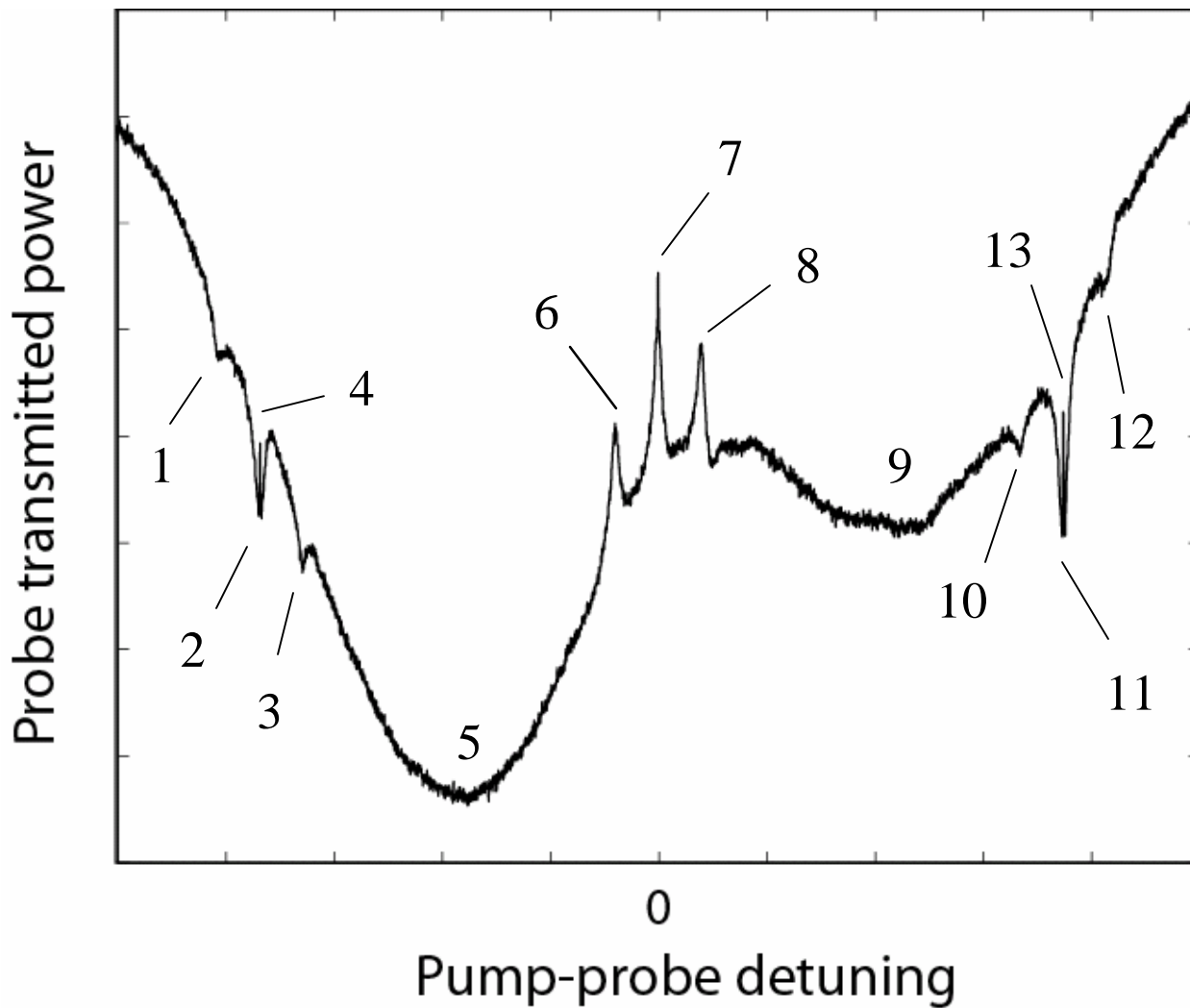
***Vincent Wong, Robert W. Boyd, C. R. Stroud, Jr.,  
Ryan S. Bennink and Alberto M. Marino***

**The Institute of Optics, University of Rochester, NY14627, USA**

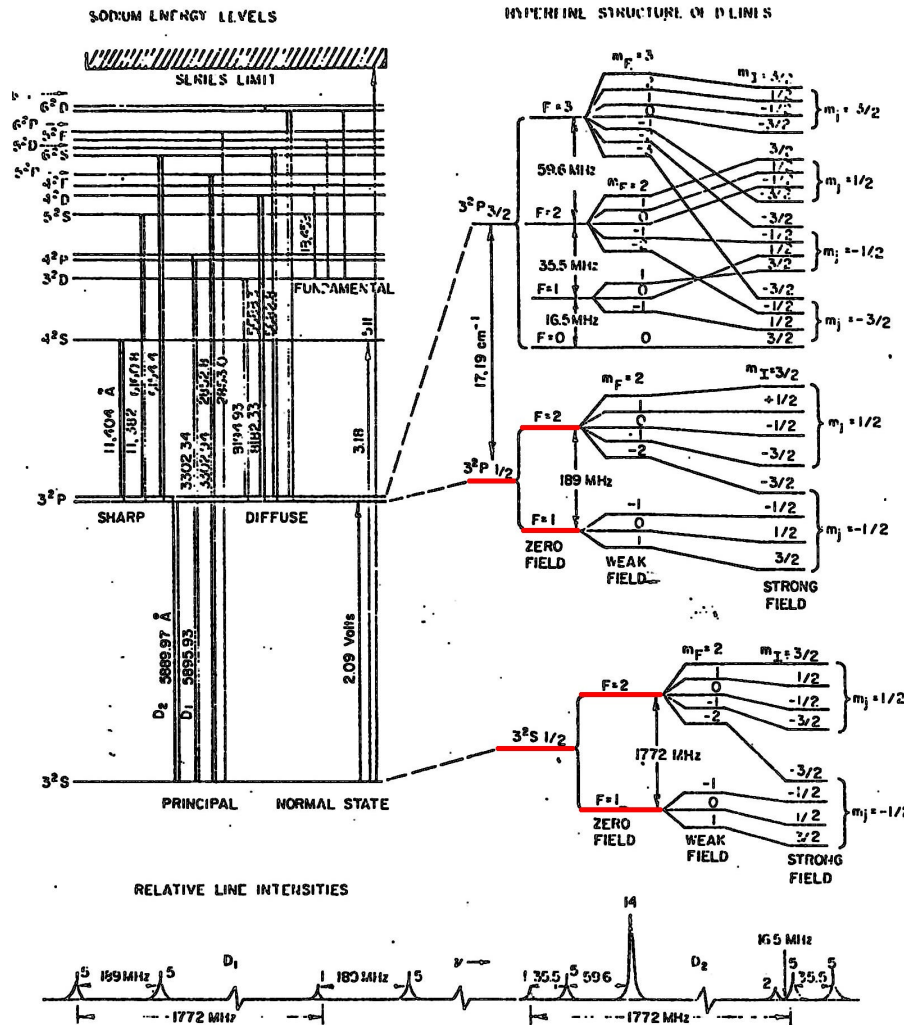


**Acknowledgements to  
the Office of Naval Research and the Department of Energy**

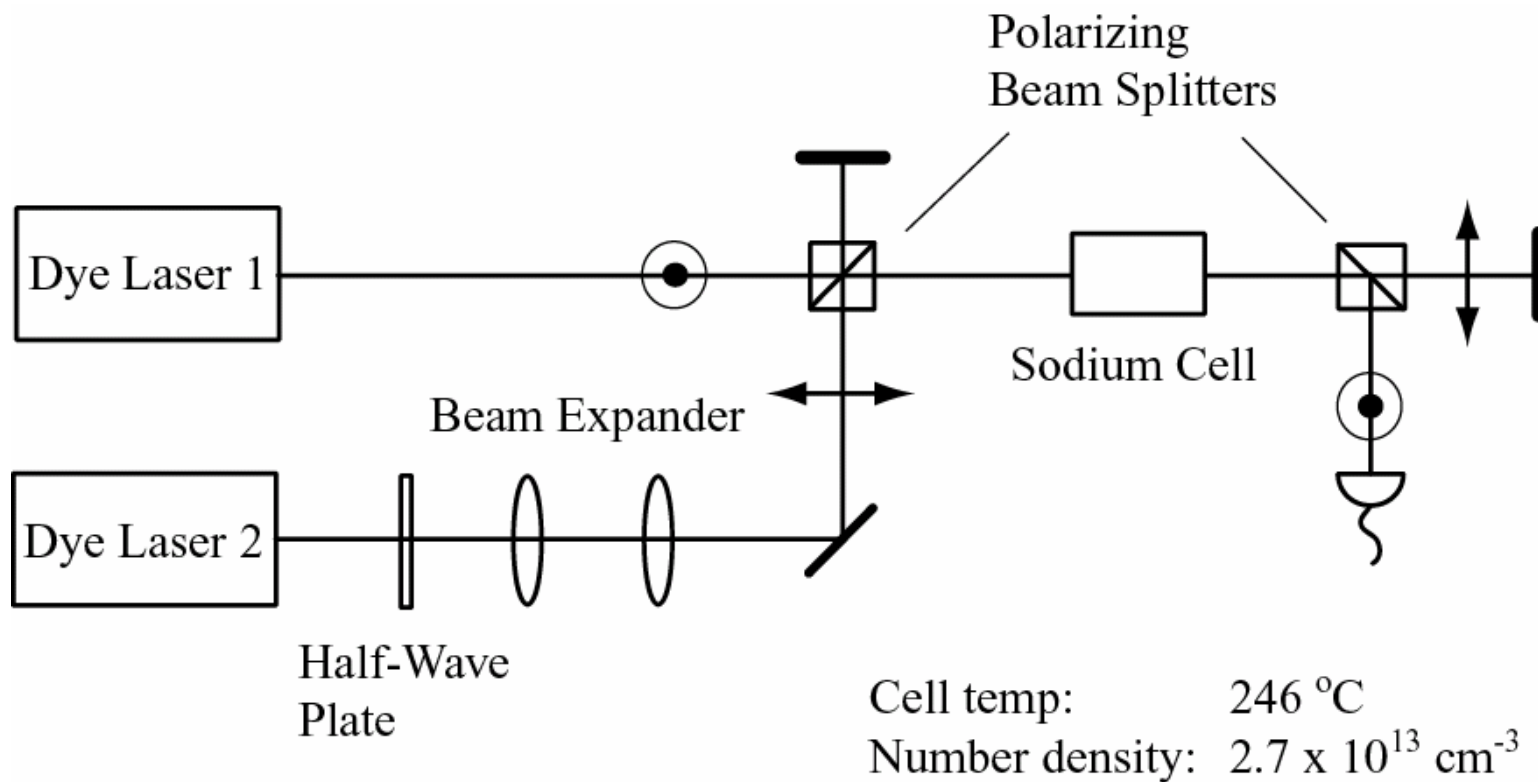
# 13 Resonances in a Pump-Probe Experiment



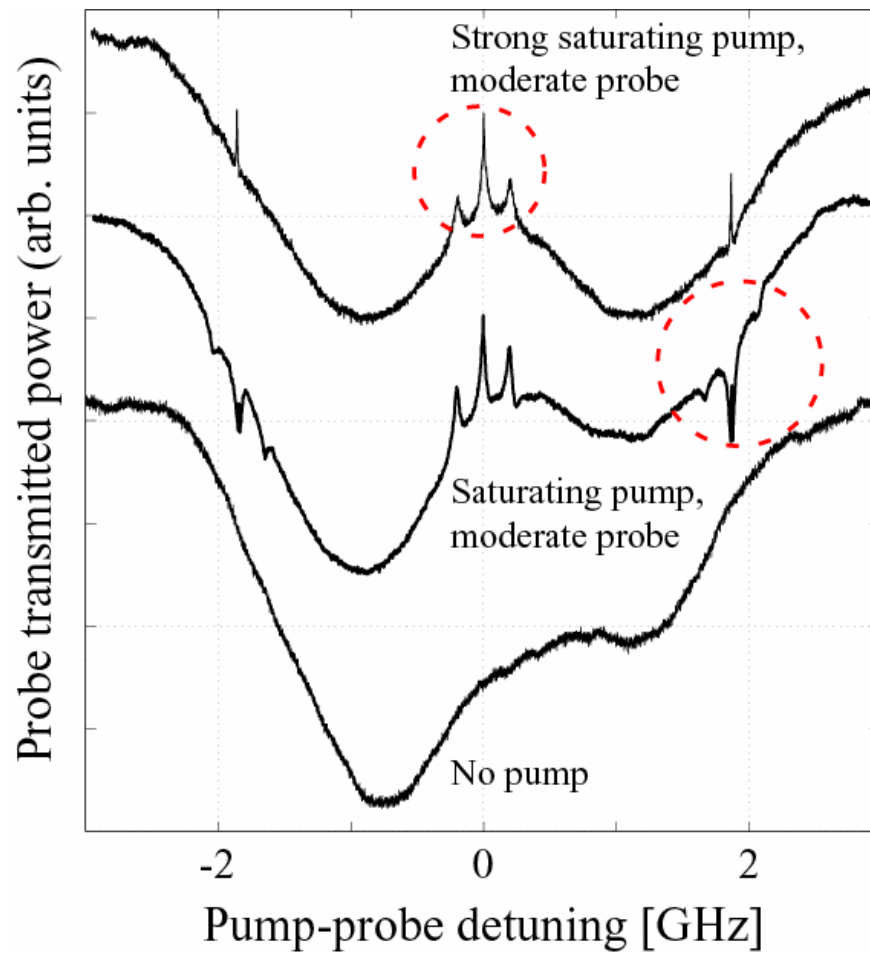
# Energy Level Structure of Atomic Sodium



# Physical Layout of the Pump-Probe Spectroscopy Experiment

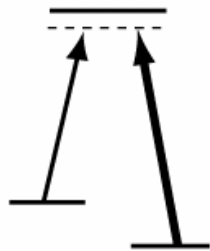


# Pump Intensity Dependence of the Resonances

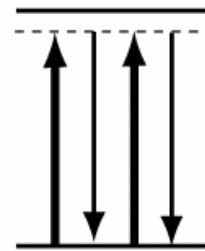


The Institute of Optics  
**L-Subsystem EIT and FDFWM in a TLA-Subsystem**

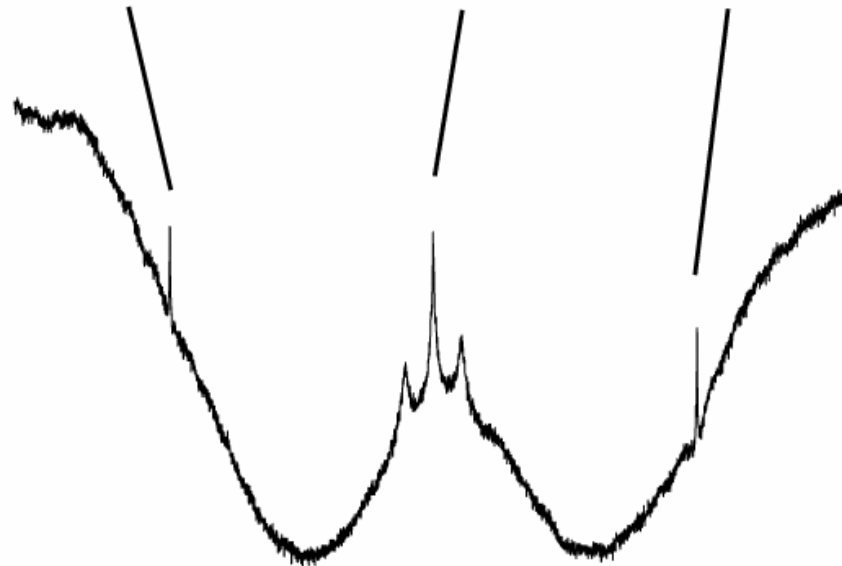
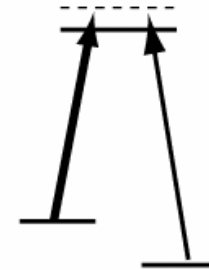
Three-level  
Lambda System



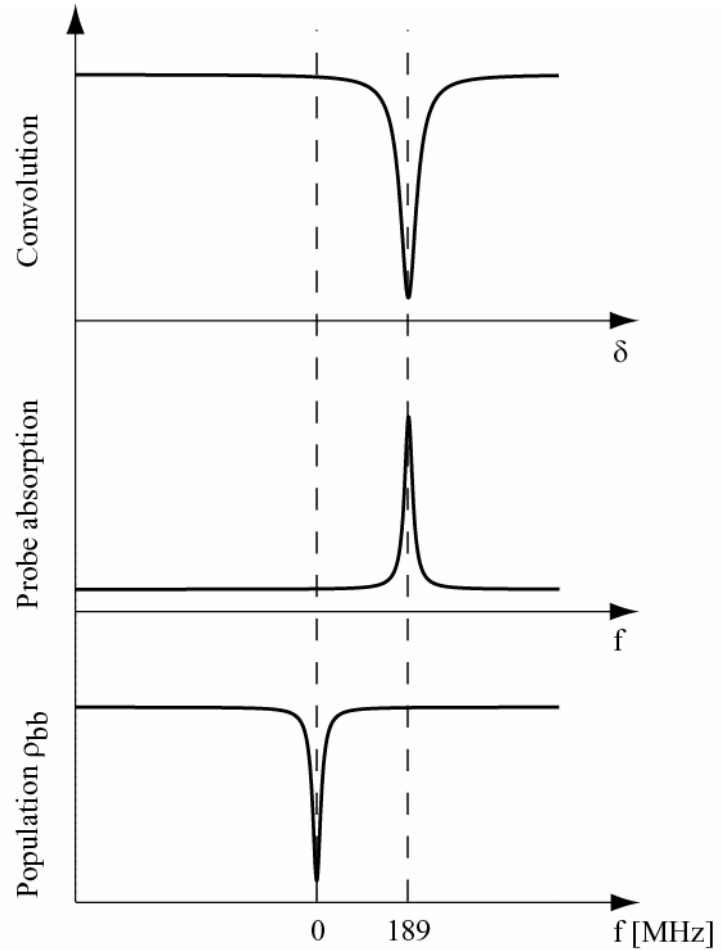
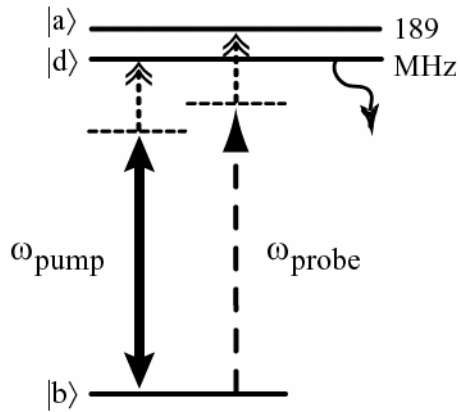
Two-Level Atom



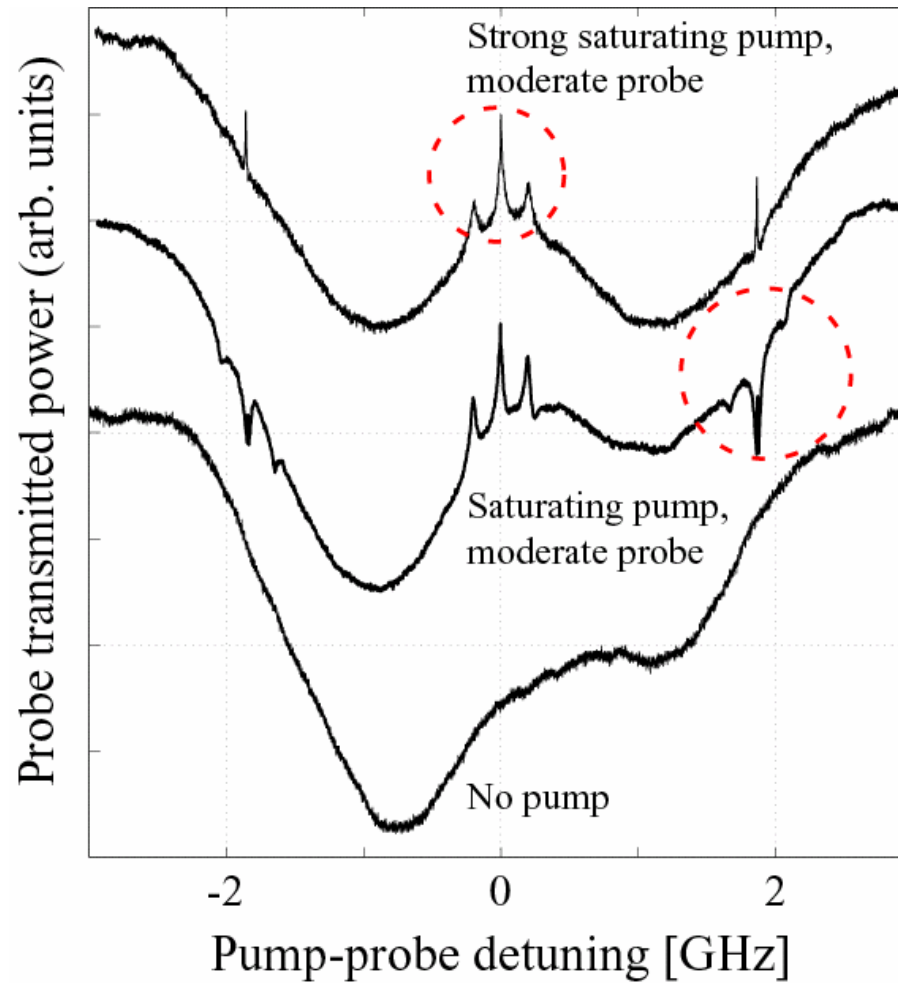
Three-level  
Lambda System



# V-Subsystem Hyperfine Ground State Optical Pumping

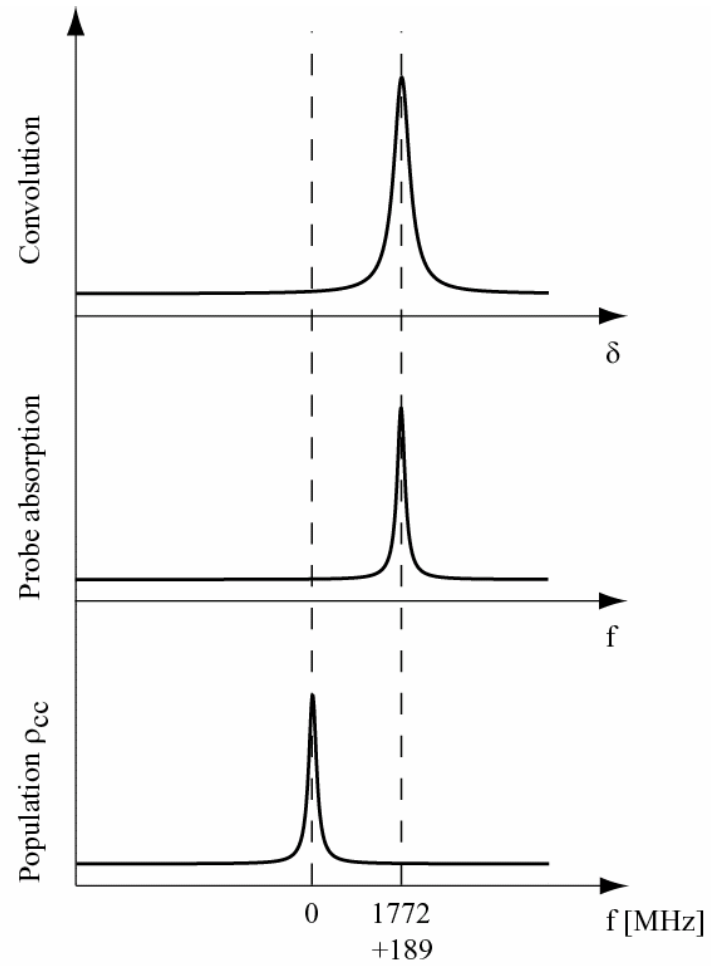
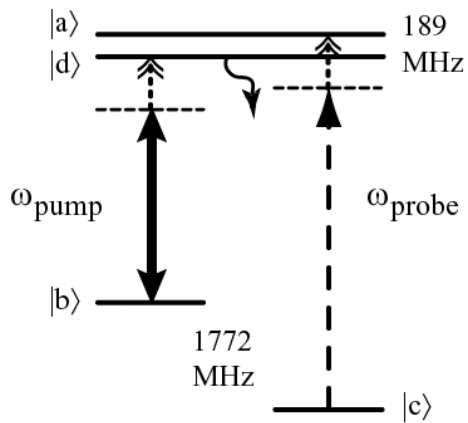


## Case 2: Saturating Pump and Moderate Probe

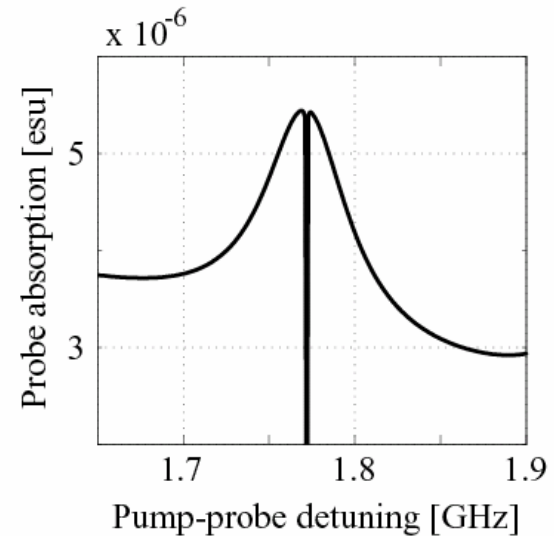
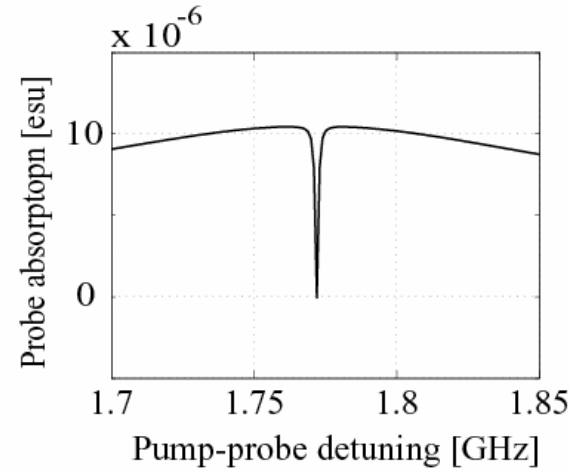
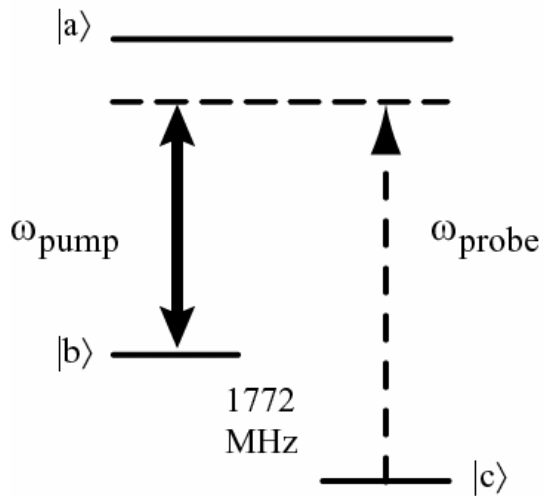




# L-Subsystem Hyperfine Ground State Optical Pumping



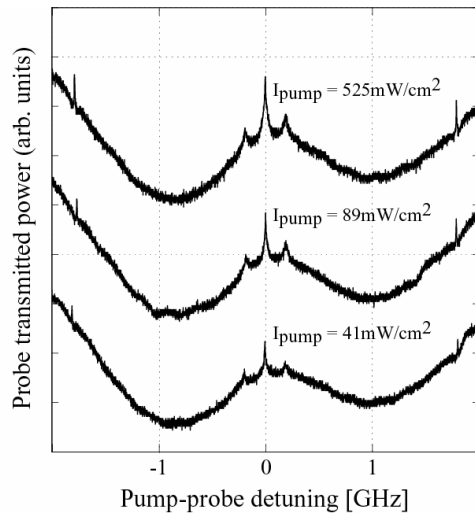
# Three-level L Electromagnetically Induced Transparency



# The Institute of Optics

## Intensity and Detuning Dependence with Strong Saturating Pump

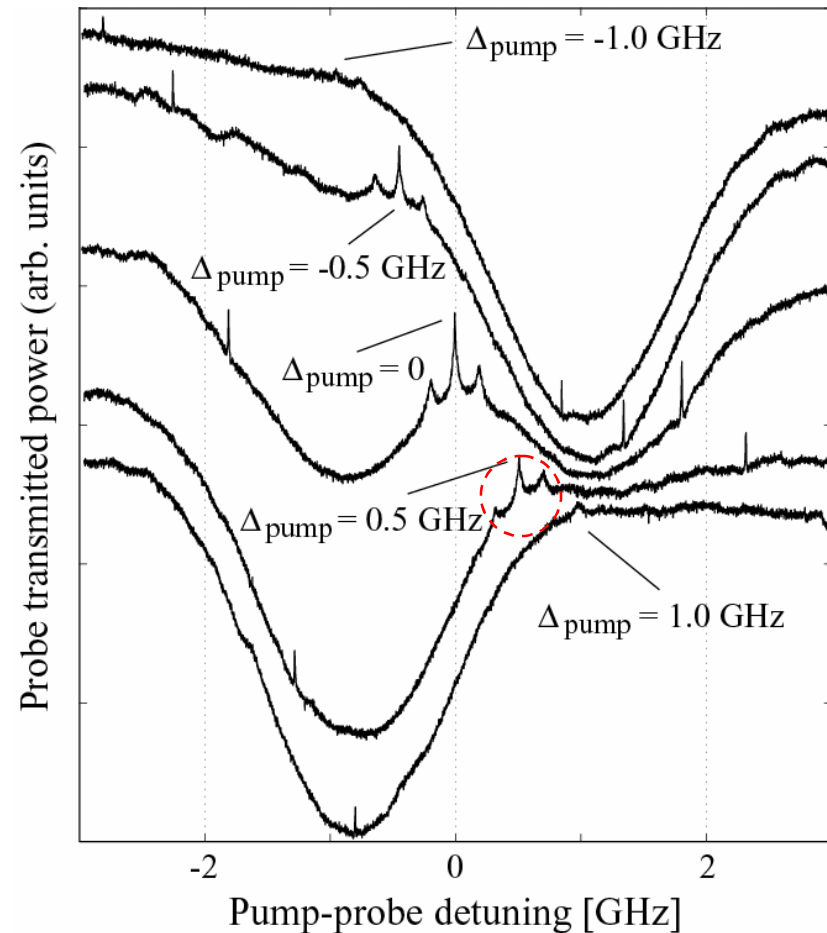
Vary Pump Intensity.



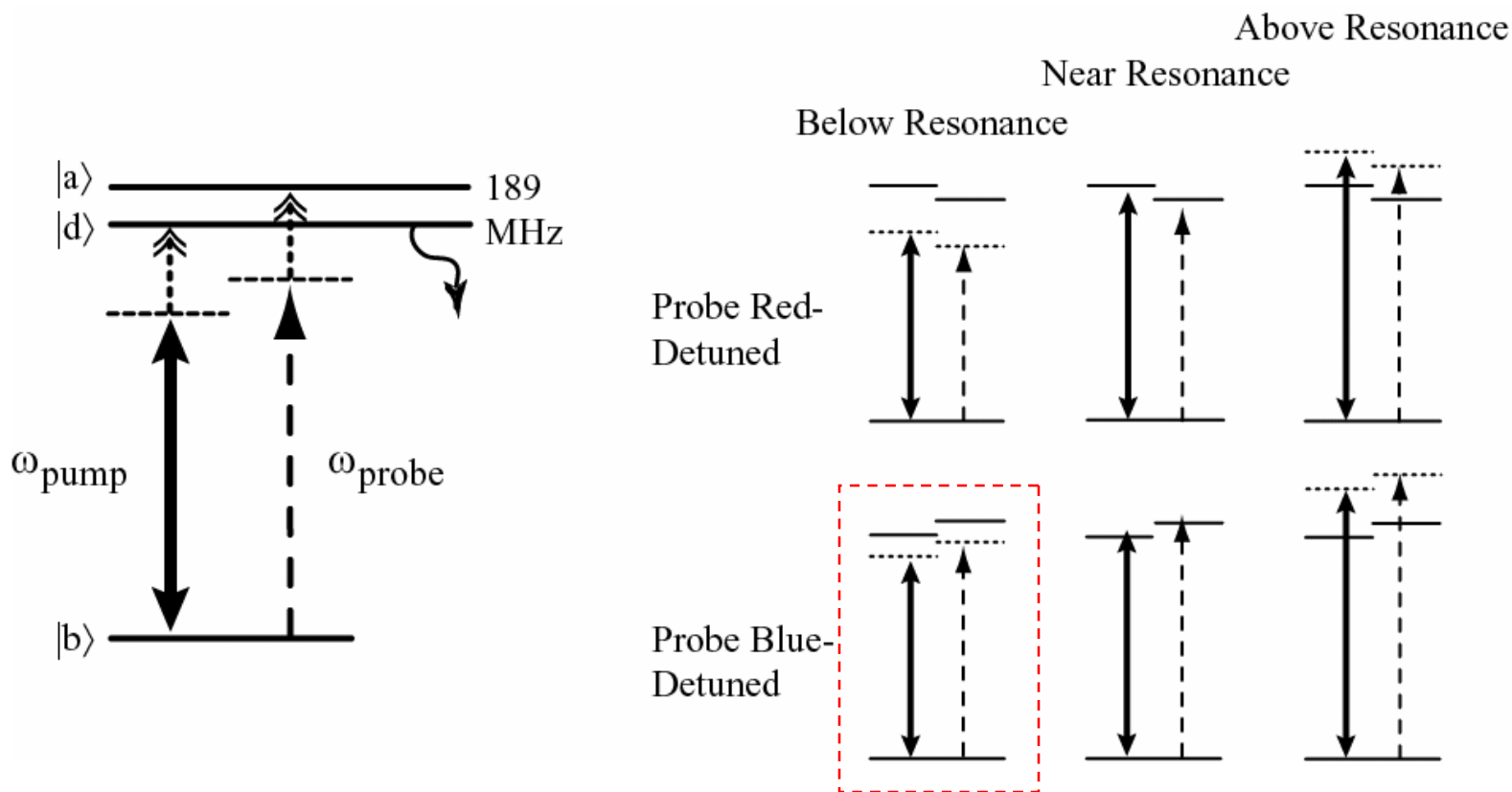
Probe intensity  $1.3 \text{ mW/cm}^2$ .

Pump intensity  $325 \text{ mW/cm}^2$ ,  
probe intensity  $1.3 \text{ mW/cm}^2$ .

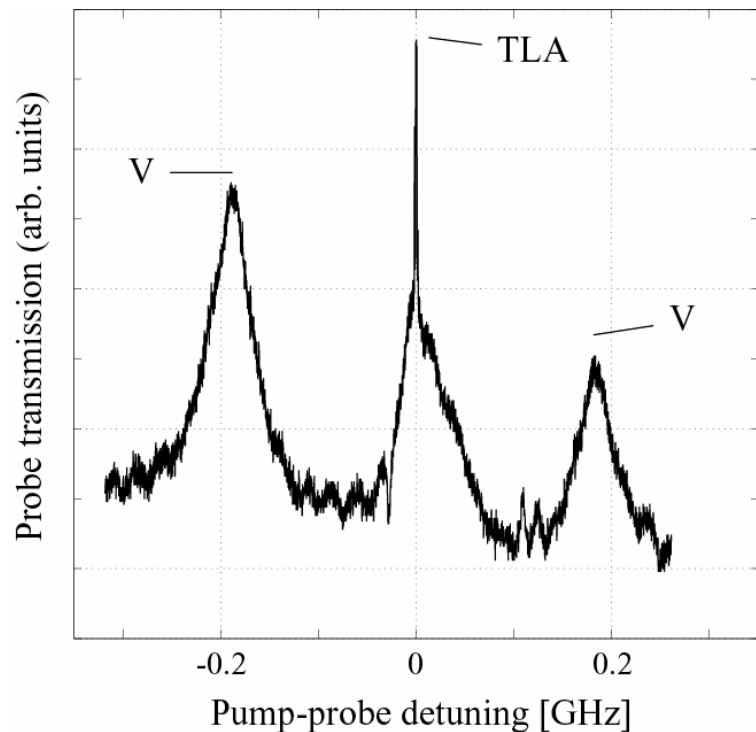
Vary Pump Detuning



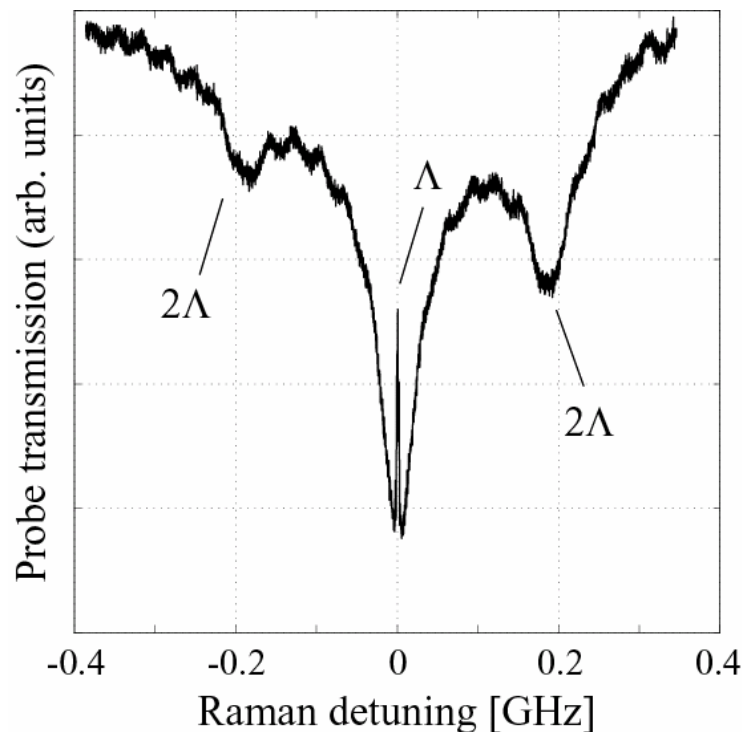
# Pump Detuning Dependence of V-Subsystem Optical Pumping



# Experimental Spectra of the Pump-Probe Resonances

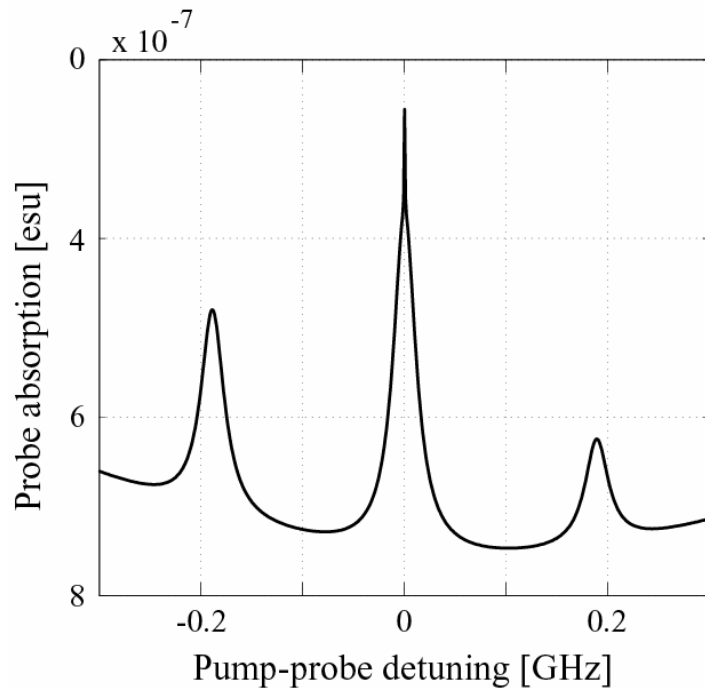


TLA and V subsystems features.

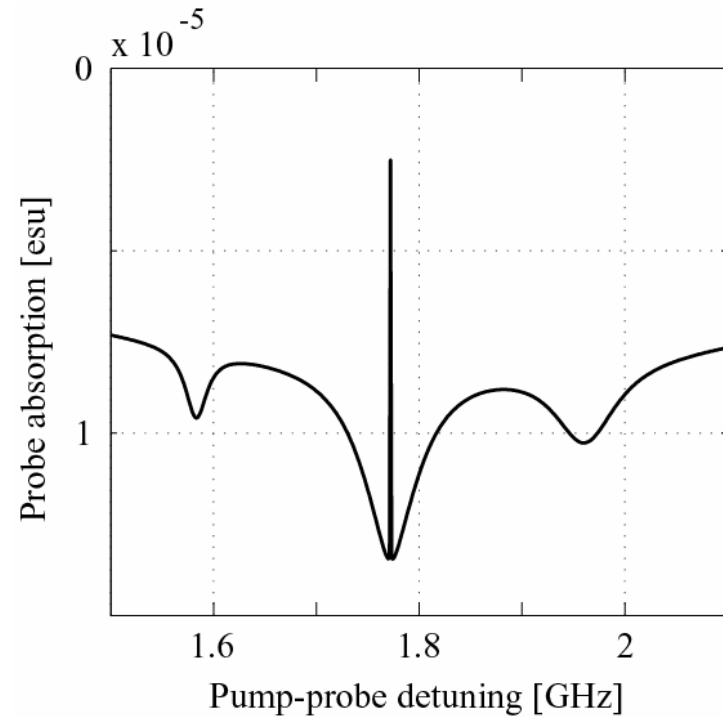


$\Lambda$  and double- $\Lambda$  subsystems features.

# Theoretical Spectra of the Pump-Probe Resonances



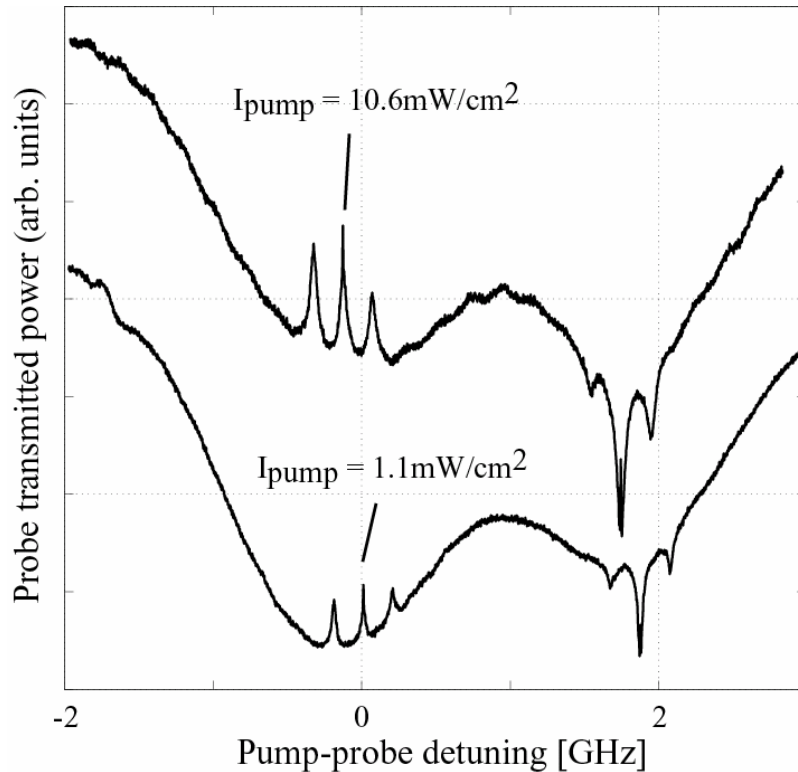
TLA and V subsystems features.



$\Lambda$  and double- $\Lambda$  subsystem features.

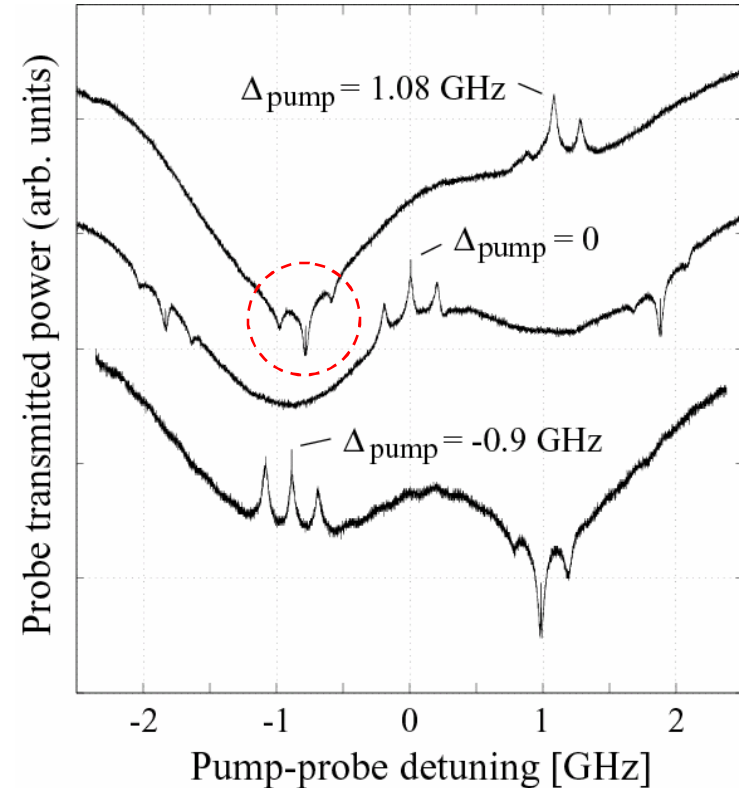
# Intensity and Detuning Dependence with Saturating Pump

Vary Pump Intensity.



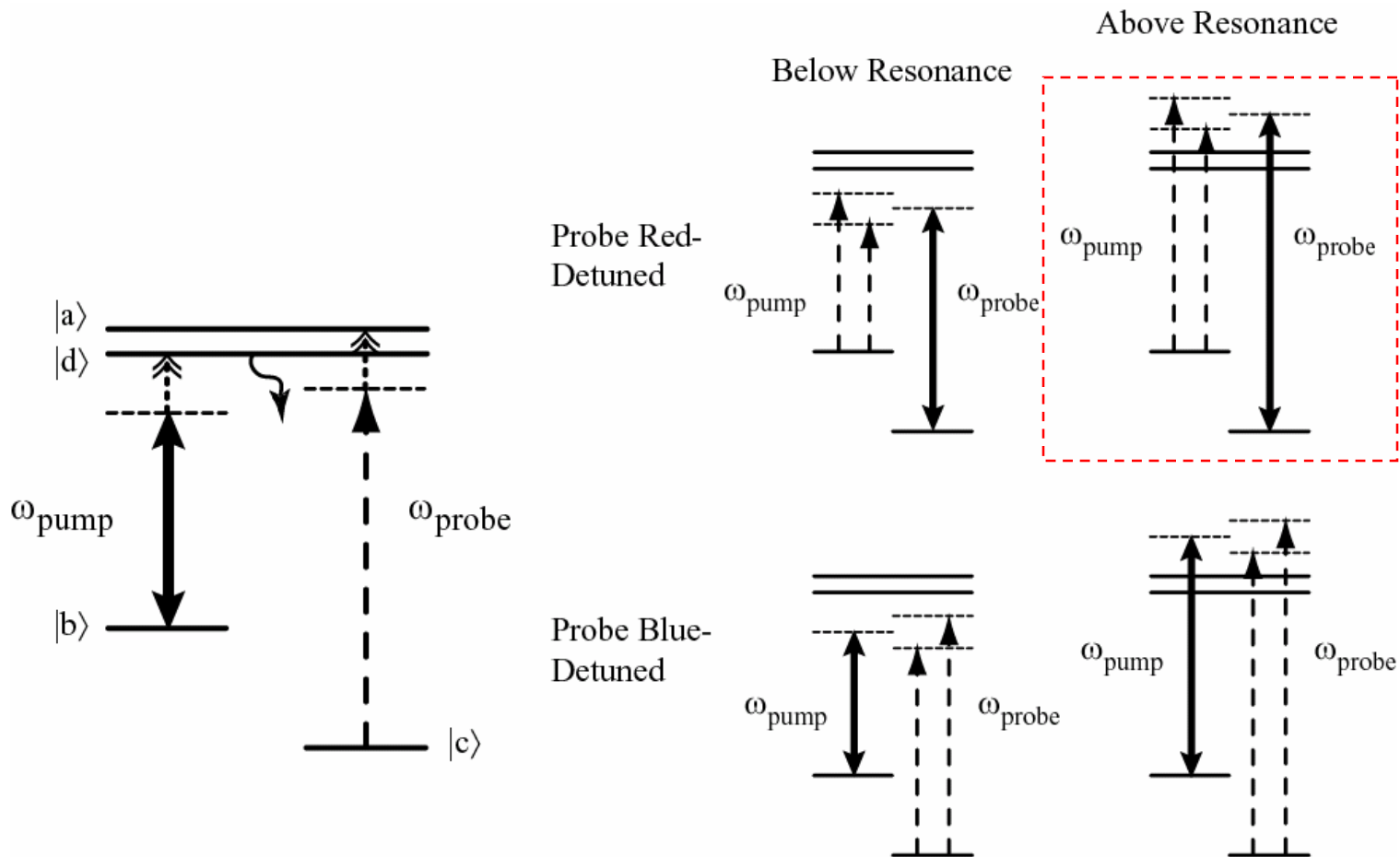
Probe intensity  $1.2 \text{ mW/cm}^2$ .

Vary Pump Detuning



Pump intensity  $9.7 \text{ mW/cm}^2$ ,  
probe intensity  $1.2 \text{ mW/cm}^2$ .

# Pump Detuning Dependence of L-Subsystem Optical Pumping





# Subsystems in the Sodium D1 Line

