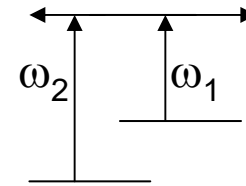


# Research Interests of Moshe Shapiro

## Coherent control – theory

**Bichromatic control of a superposition state:**

**The control of electronic branching in the**  
 **$\text{CH}_3 + \text{I}^* \leftarrow \text{CH}_3\text{I} \rightarrow \text{CH}_3 + \text{I}$ , reaction**

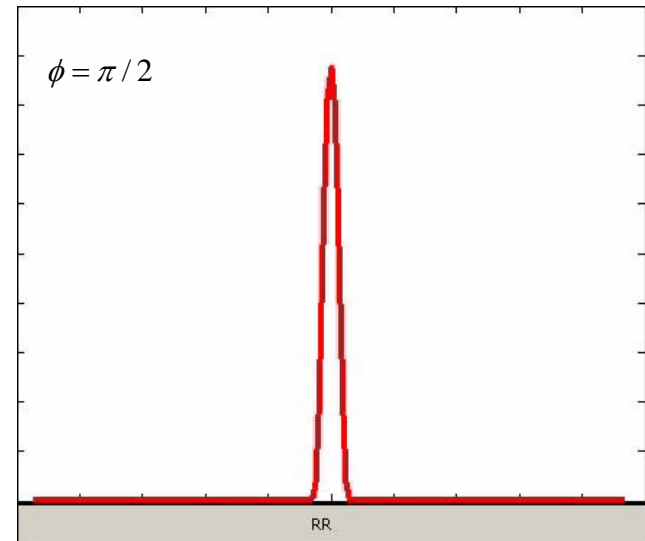
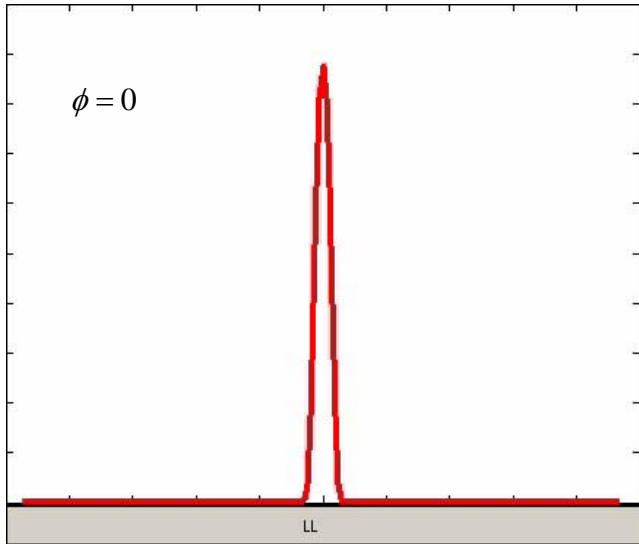


**Elliptic polarization control of differential cross-sections**

**1 photon vs. 3 photon interference**

**1 photon vs. 2 photon interference**

**Symmetry breaking and differential control:**  
**creation of DC photo-current in semi-conductors**  
**with *no bias voltage*.**



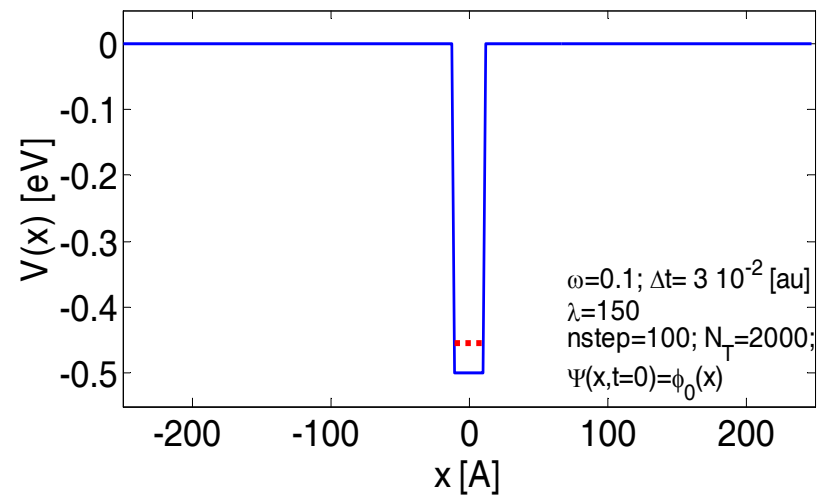
$$\dot{\psi} = -iH\psi$$

$$H = -\frac{\hbar^2}{2m} \frac{d^2}{dx^2} + V(x) + U(x,t)$$

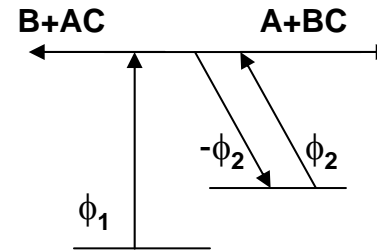
$$V(x) = \begin{cases} 0 & |x| > 0.1 \text{ nm} \\ -0.5 \text{ eV} & |x| < 0.1 \text{ nm} \end{cases}$$

$$U(x,t) = x [\sin(\omega t) + \sin(2\omega t + \phi)] f(t)$$

$$f(t) = e^{-(t/\lambda)^2}$$



## Interference Control with Incoherent light



## Coherent Control of refractive indices

Enantiomeric purification of chiral racemic mixtures by coherent control techniques

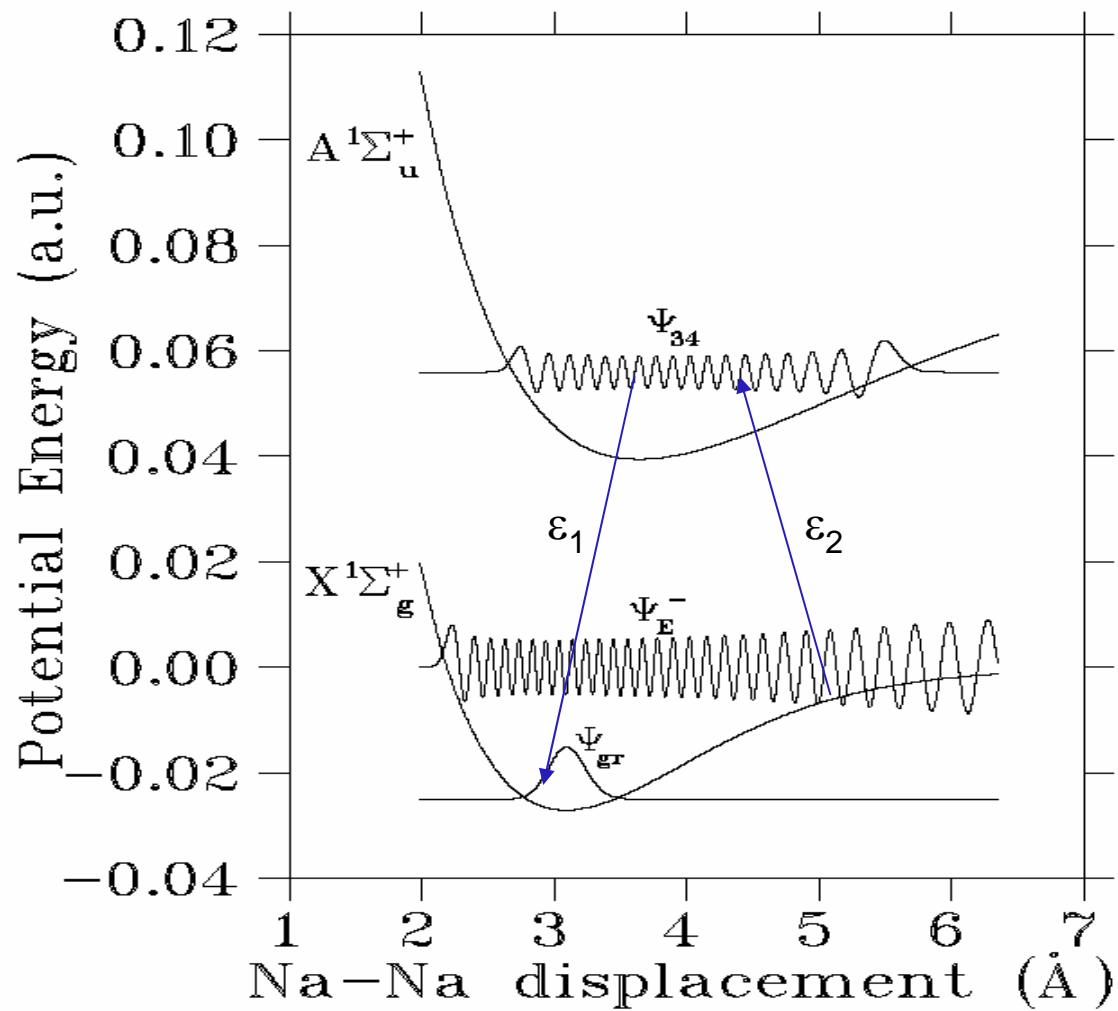
Optically controlled nanoscale deposition on surfaces

Coherent Suppression of spontaneous emission using overlapping resonances

Coherent control with non-classical light

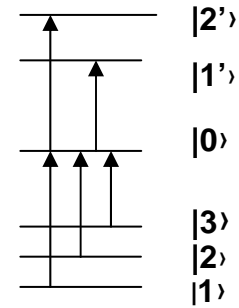
Tubular Image States

## Photoassociation of ultracold atoms to form ultracold molecules via coherent Raman processes (The molecular BEC)



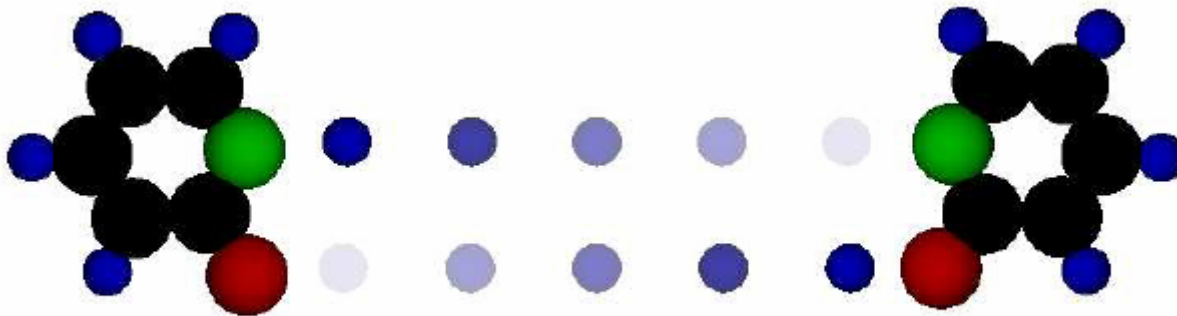
An exact analytical solution of the non-degenerate and degenerate quantum control problem

Experimental demonstration of phase locking between two 2-photon processes in 2-photon vs. 2-photon coherent control



Control of radiationless transitions by interference between overlapping resonances

Automatic optical repair of mutations caused by dihydrogenic tunneling between two nucleotides



Quantum computation using electrons trapped in an array of quadrupoles of carbon nanotubes