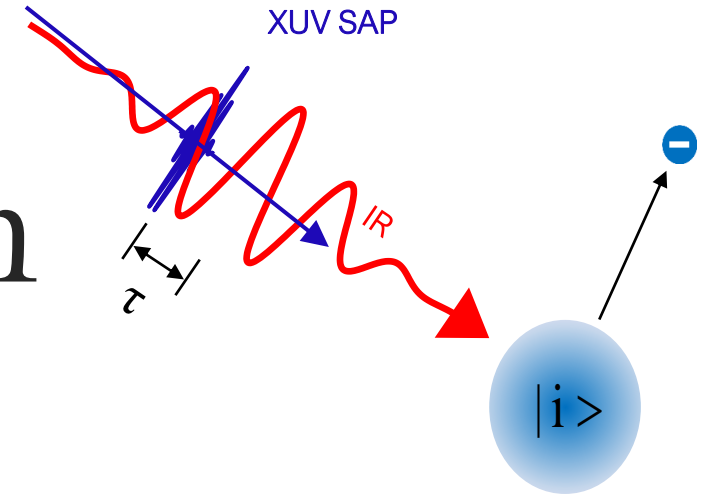


# Electron Correlation in Streaked Photo-Emission of Helium



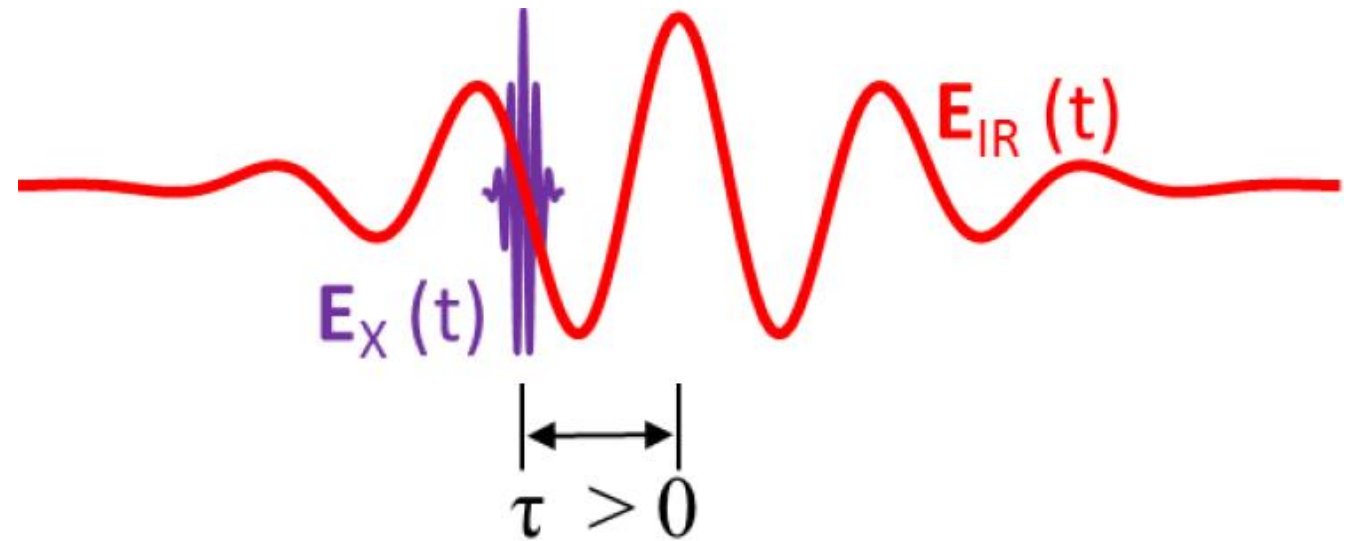
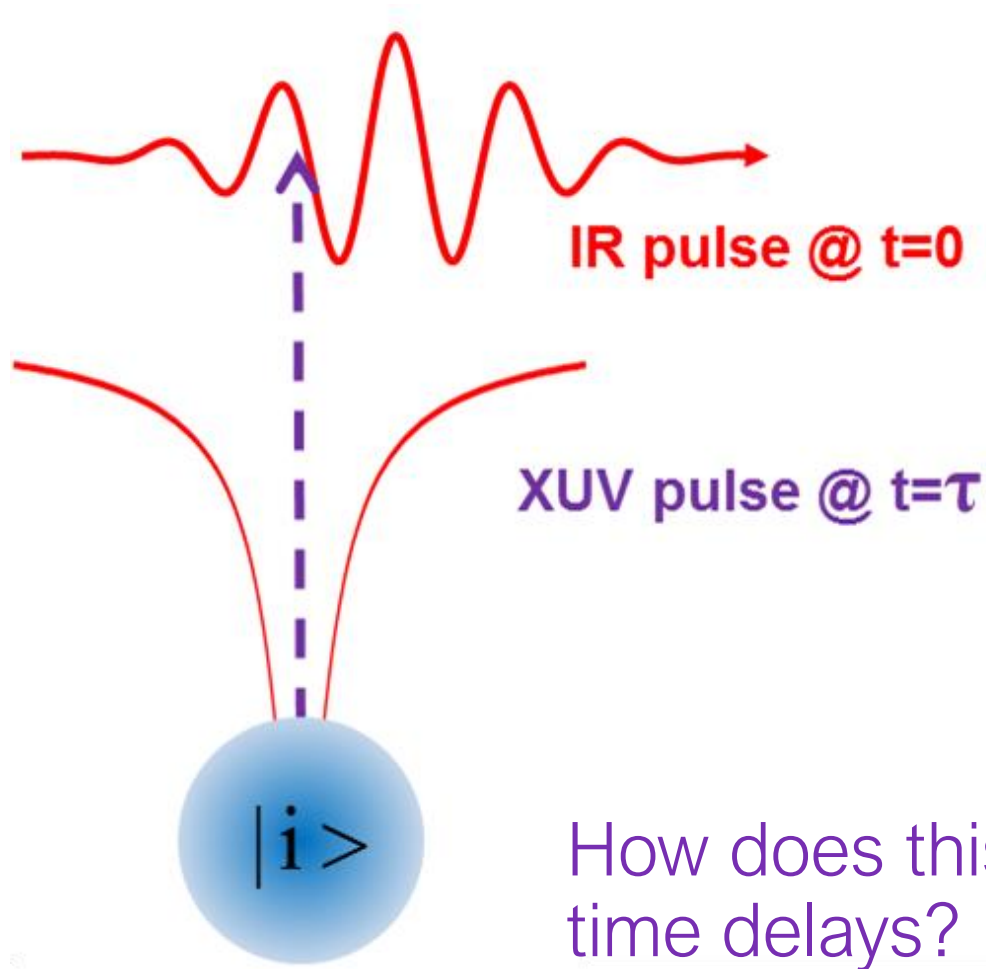
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# What is electronic streaking?

A method of determining time delays of photo-emission

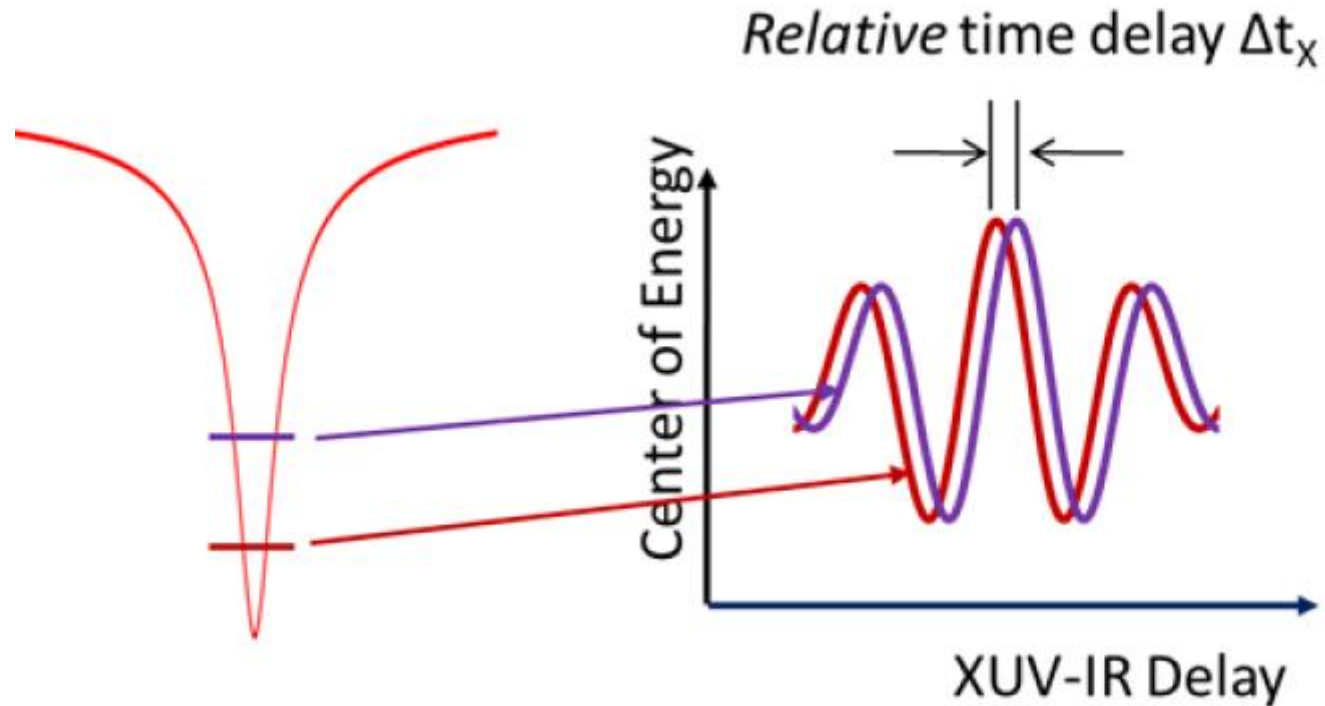


IR streaking pulse and XUV ionizing pulse

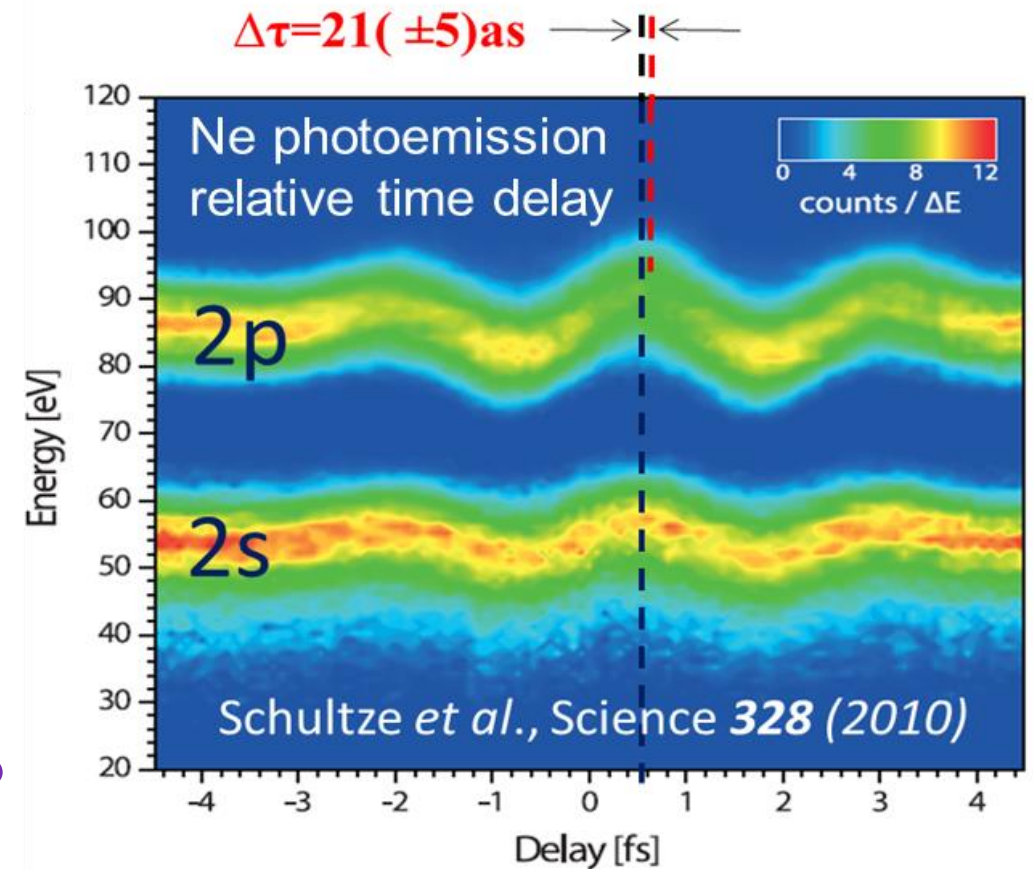
How does this enable the measurement of photo-emission time delays?

# Measuring Time Delays

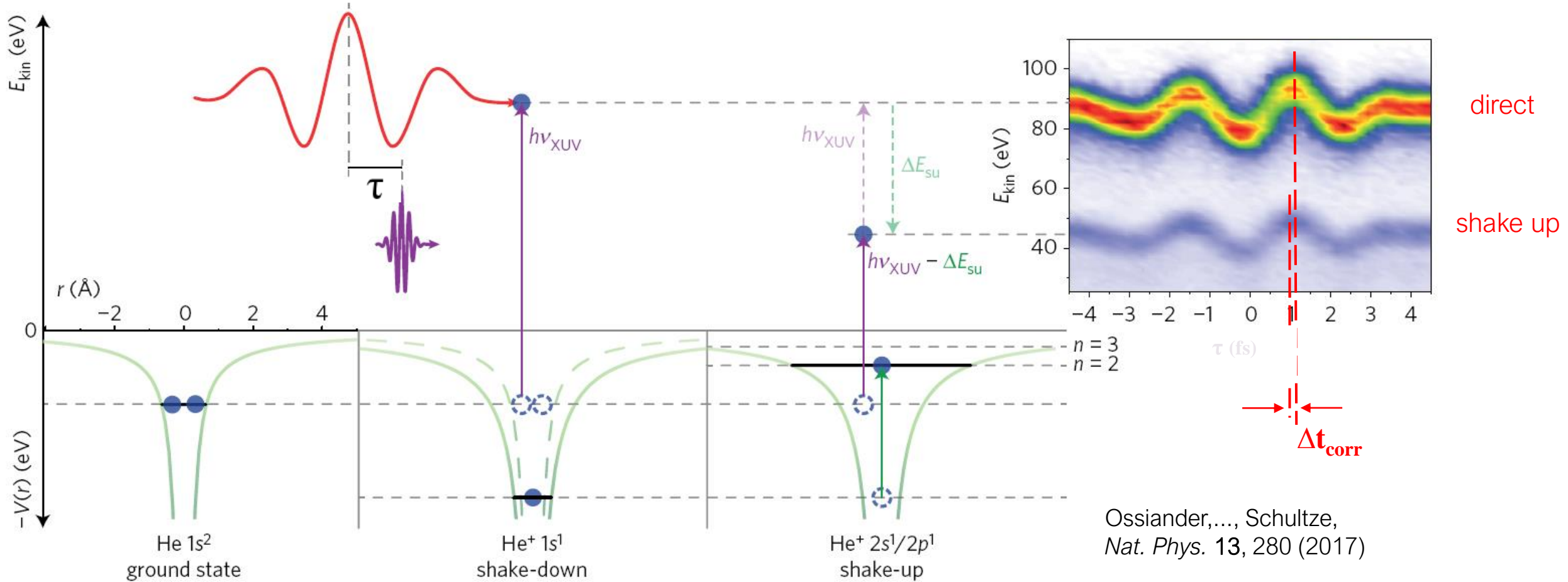
IR streaking pulse acts as a “clock” for the system



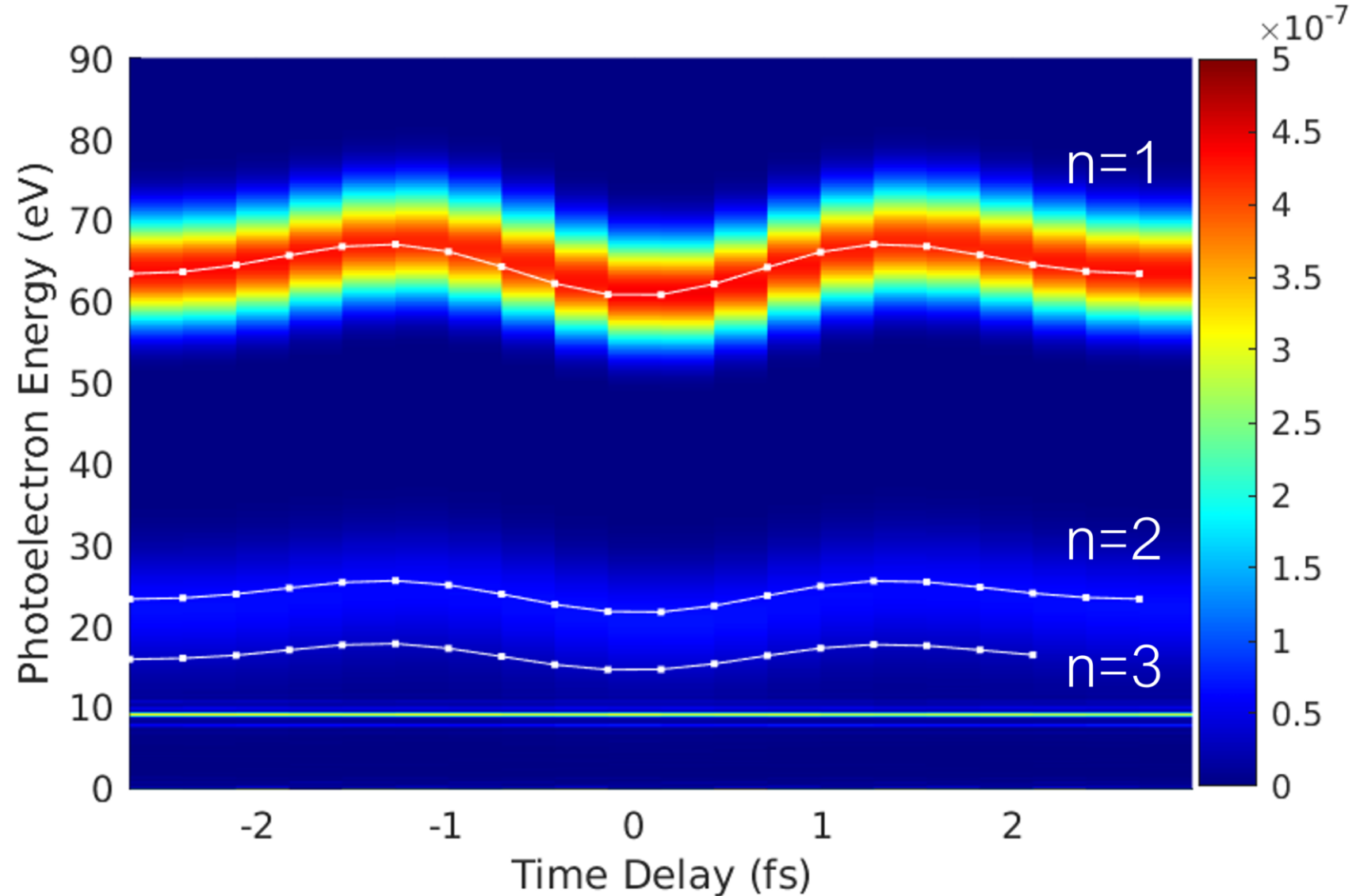
How does this method work for electron-electron interactions (electron correlation)?



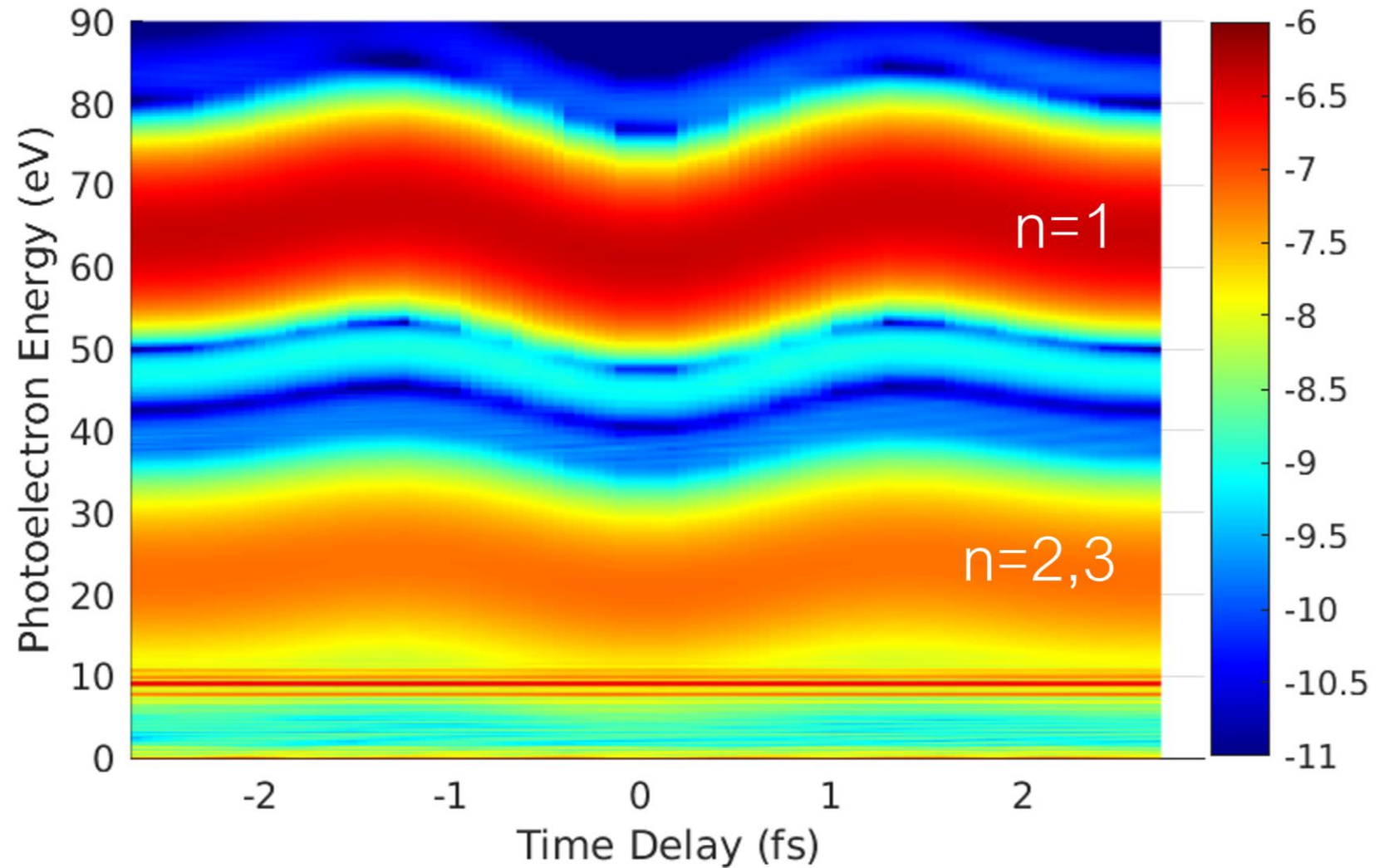
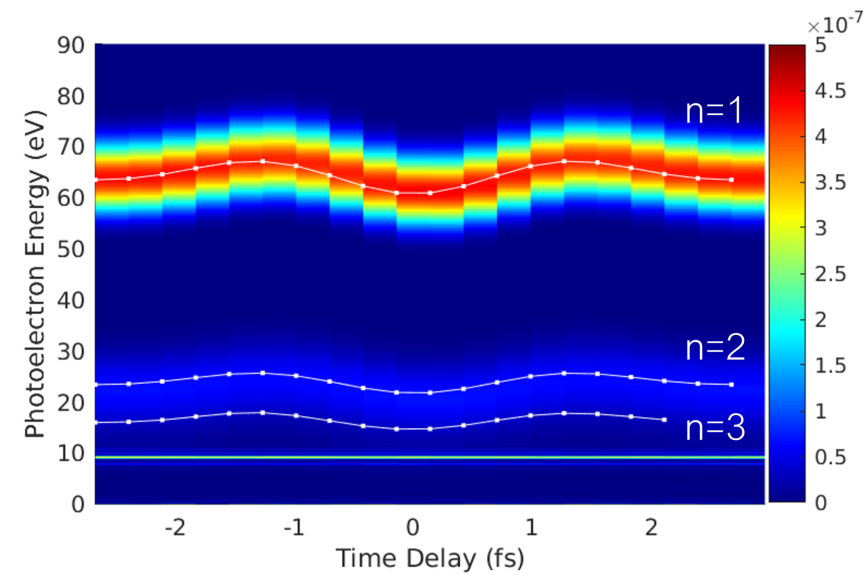
# Streaked Electron Correlation



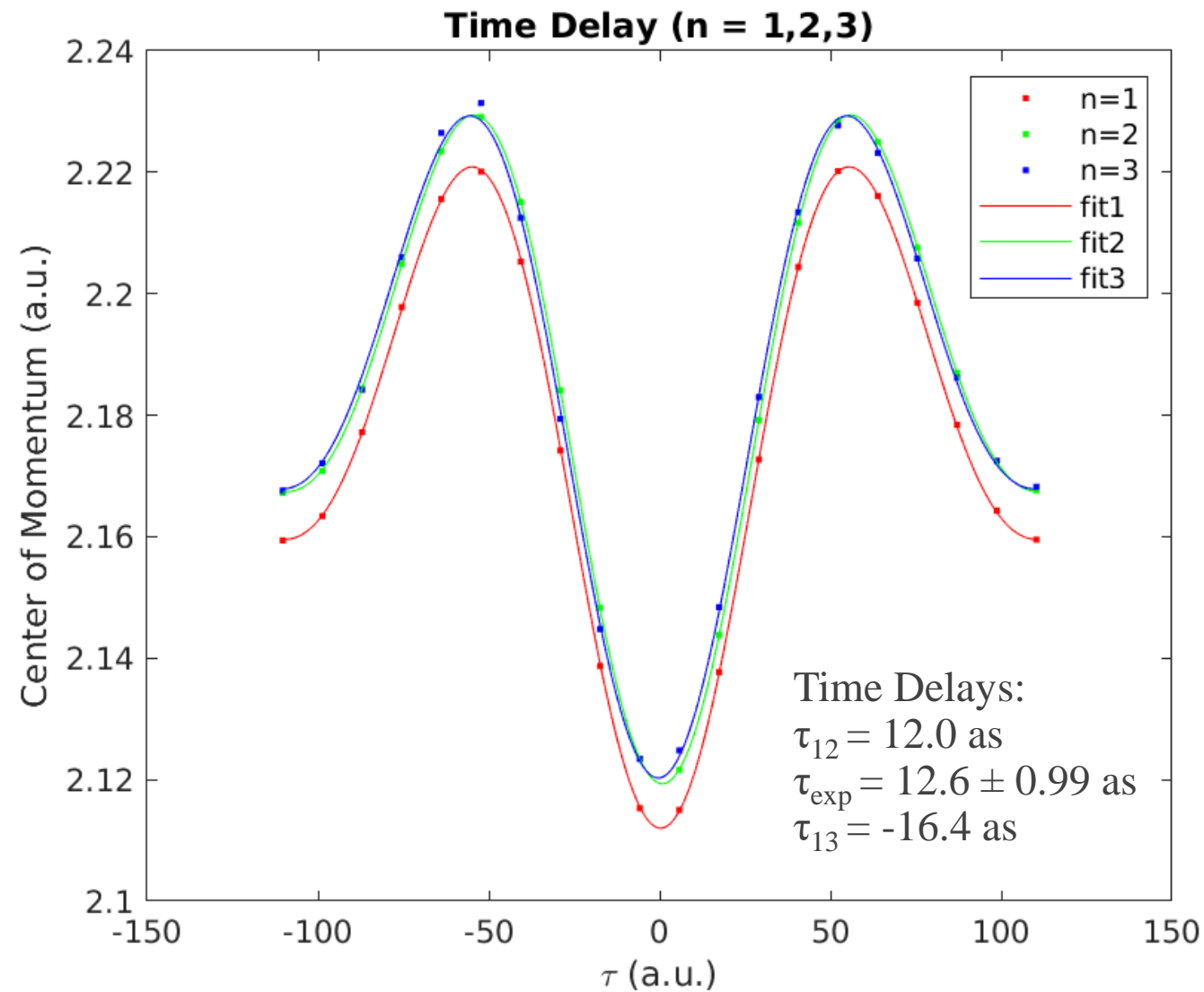
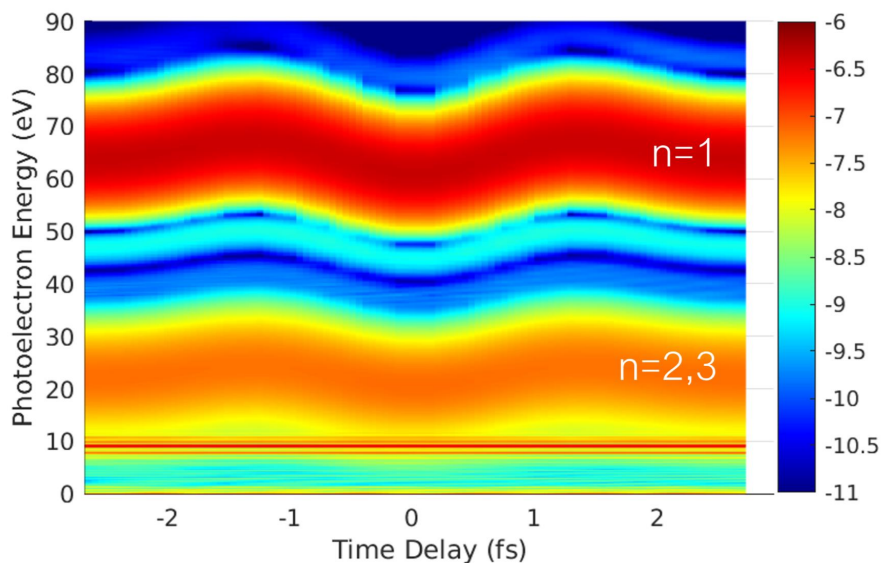
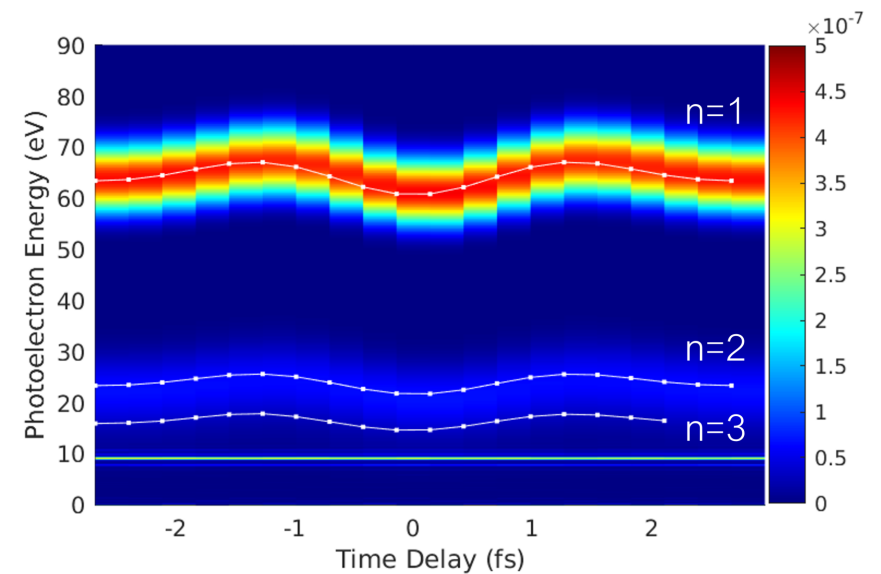
# Electronic Correlation in Streaked Photo-Emission



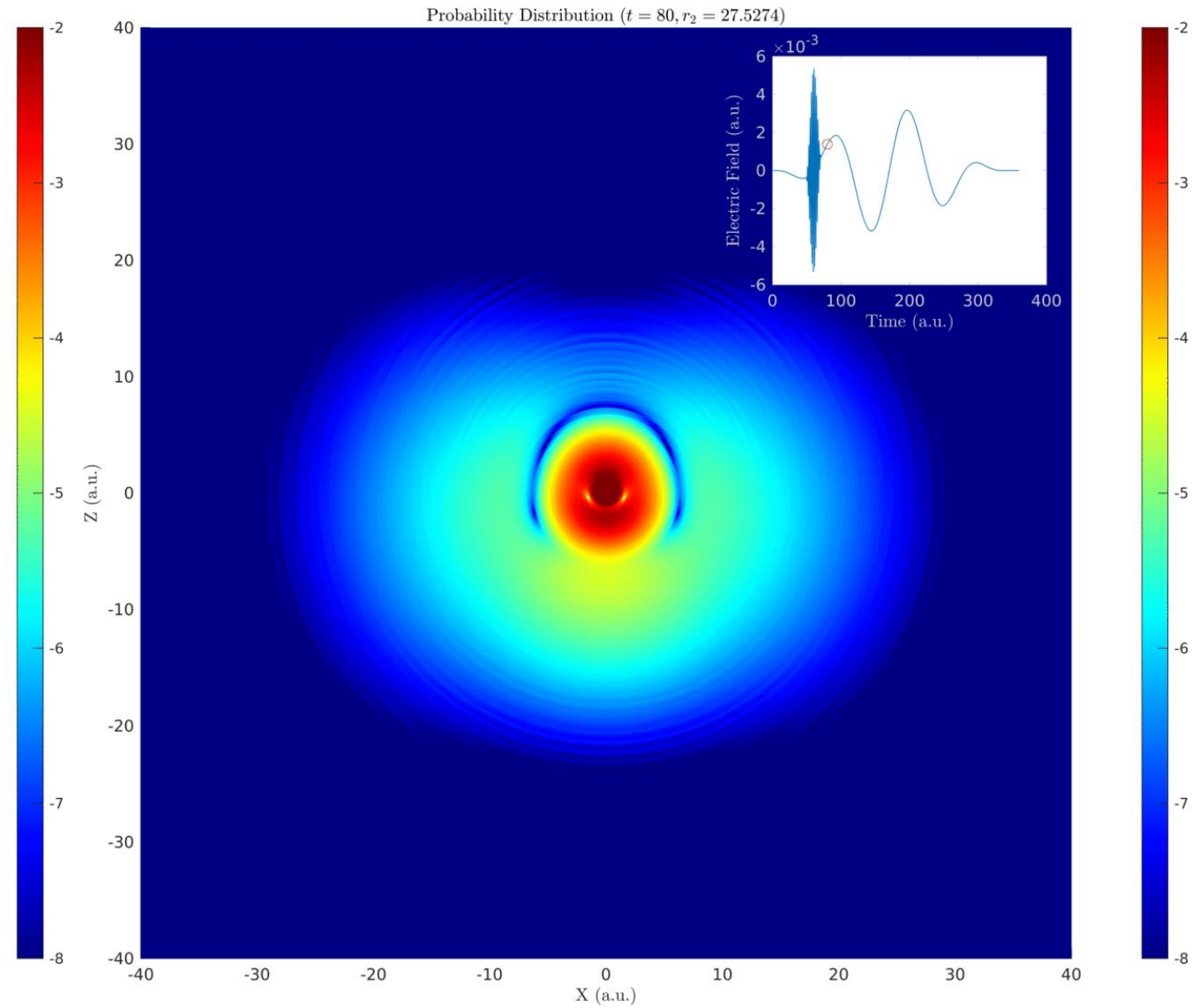
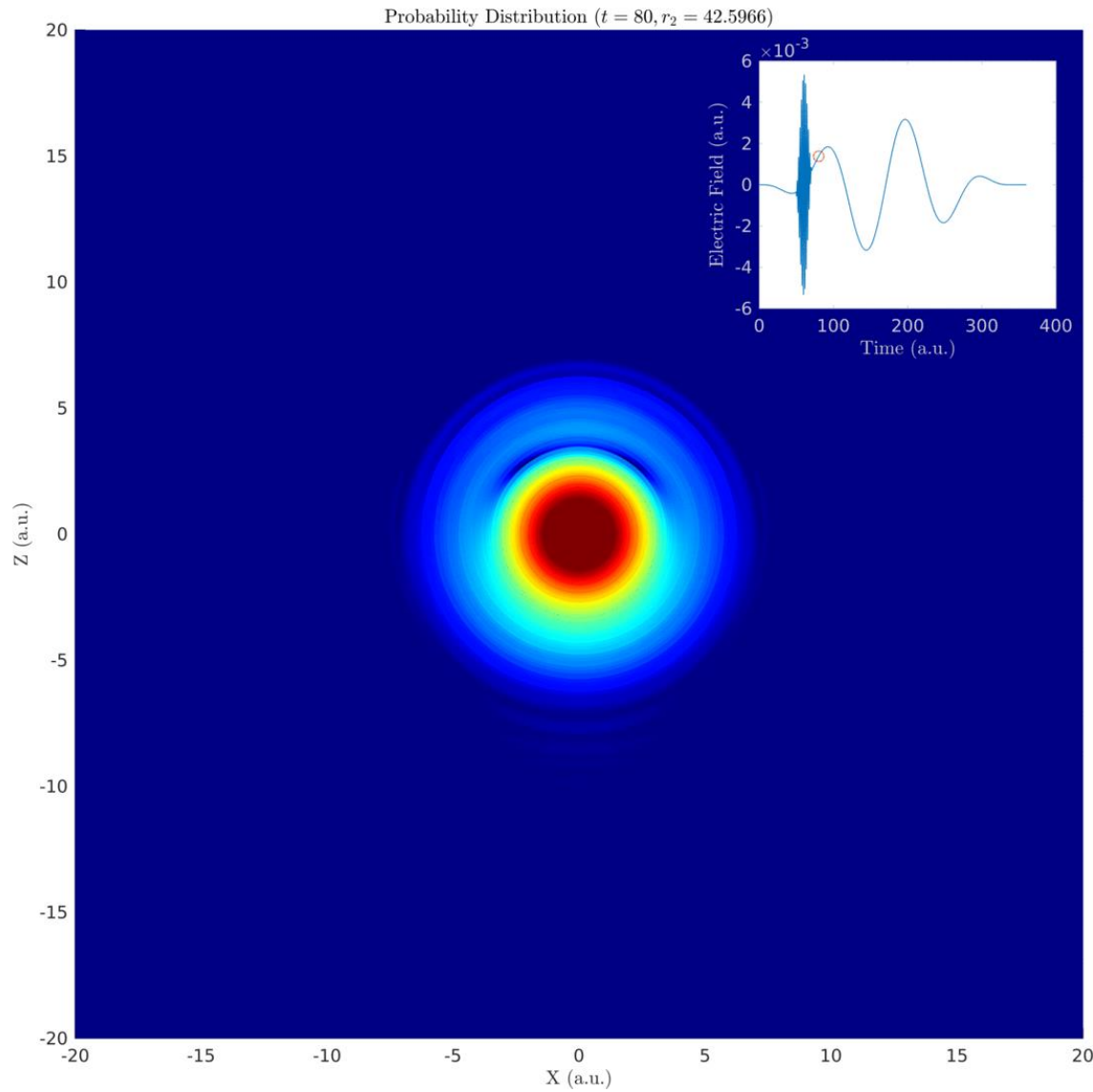
# Electronic Correlation in Streaked Photo-Emission



# Electronic Correlation in Streaked Photo-Emission



# Influence of Residual $\text{He}^+$ Ion



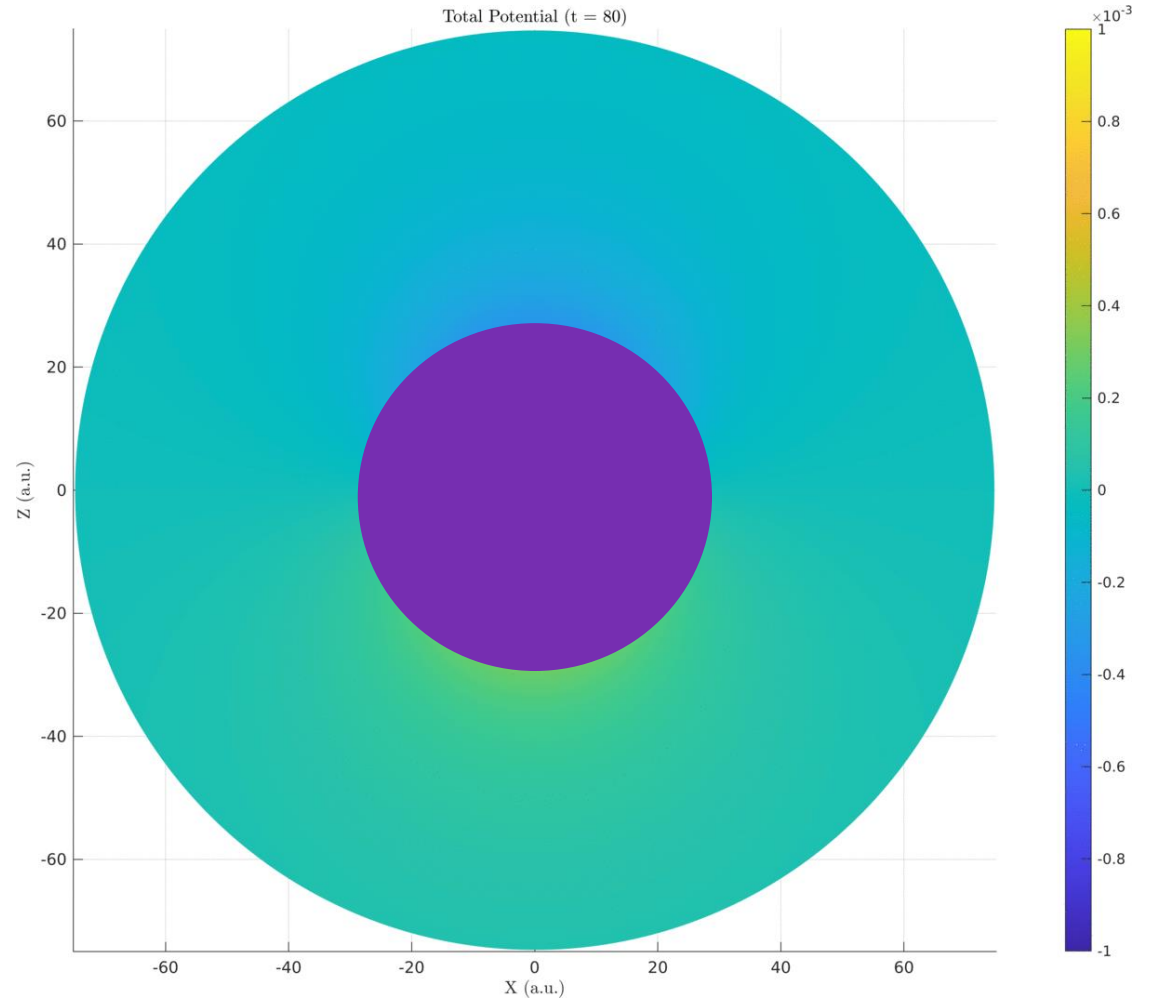


# Influence of Residual $\text{He}^+$ Ion

We know the asymptotic effects, but the intermediary effect is unknown

$$V(\mathbf{r}) = \sum_{l=0}^{\infty} \sum_{m=-l}^l \frac{C_{l,m}}{r^{l+1}} Y_{l,m}(\hat{\mathbf{r}})$$

$$C_{l,m} = \frac{1}{(2l+1)\epsilon_0} \int \rho(\mathbf{r}) r^l Y_{l,m}^*(\hat{\mathbf{r}}) d^3r$$



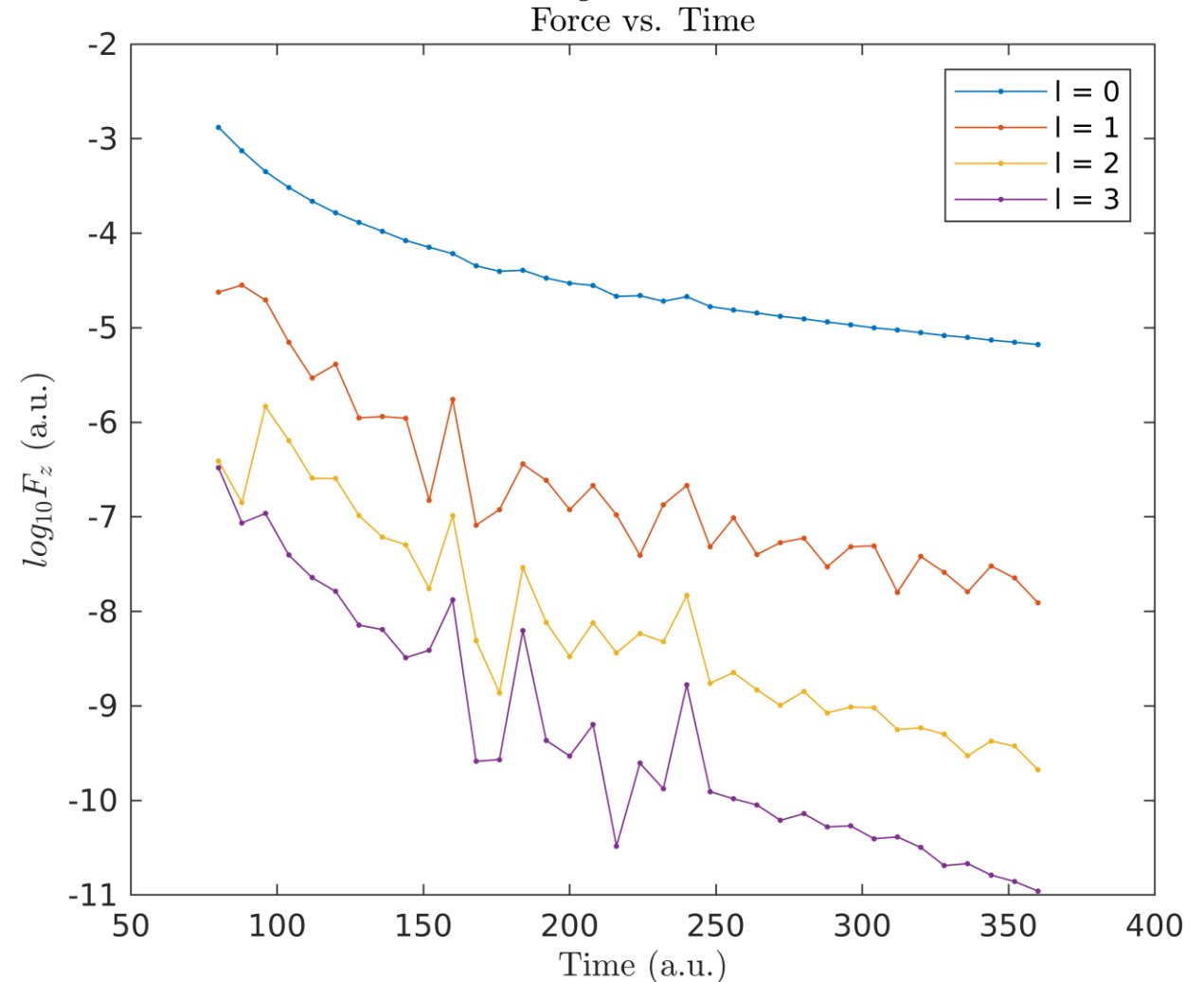
# Influence of Residual $\text{He}^+$ Ion

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$$F(\mathbf{r})|_{r=r_2} = [-\nabla V(\mathbf{r})]_{r=r_2}$$



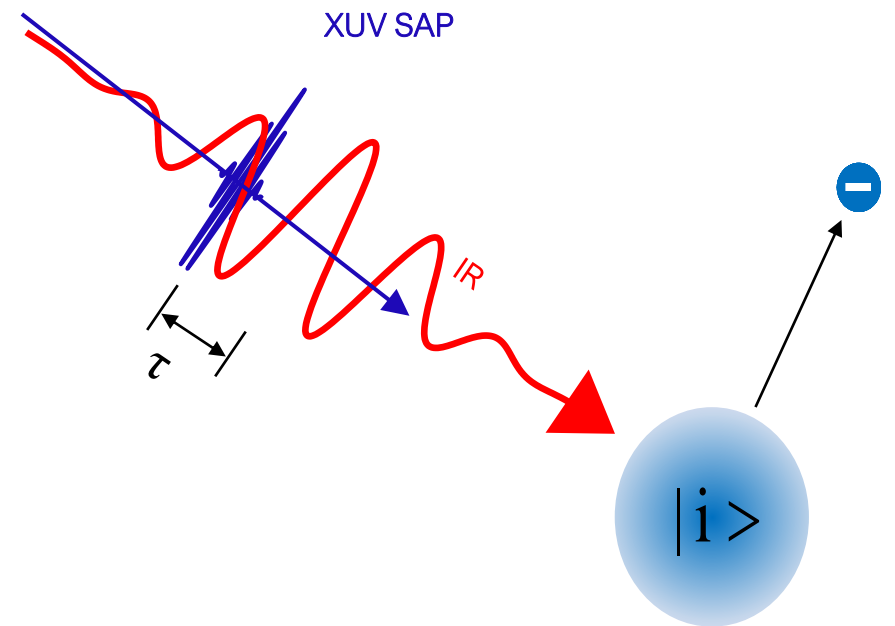
# Conclusions

We see evidence of  $n=2$  and  $n=3$  shake-up ionization in streaking spectra

Streaking spectra agree with experimental results and display expected characteristics

Calculated time delays agree with experimental results from Ossiander, *et al.*, *Nat. Phys.* **13**, 280 (2017)

Future work includes determining the effects of each multipole term on the time delay via SAE calculations



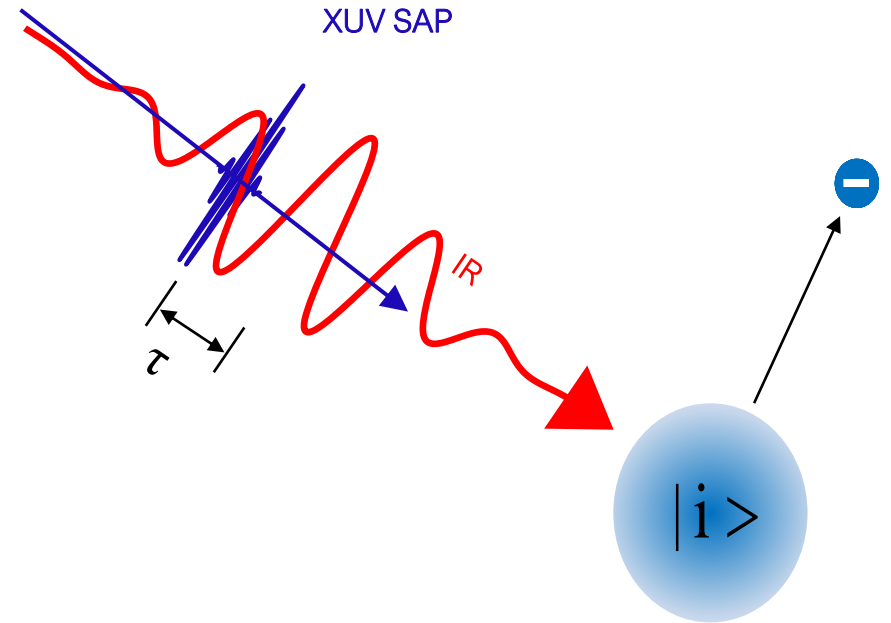
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## Questions?

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