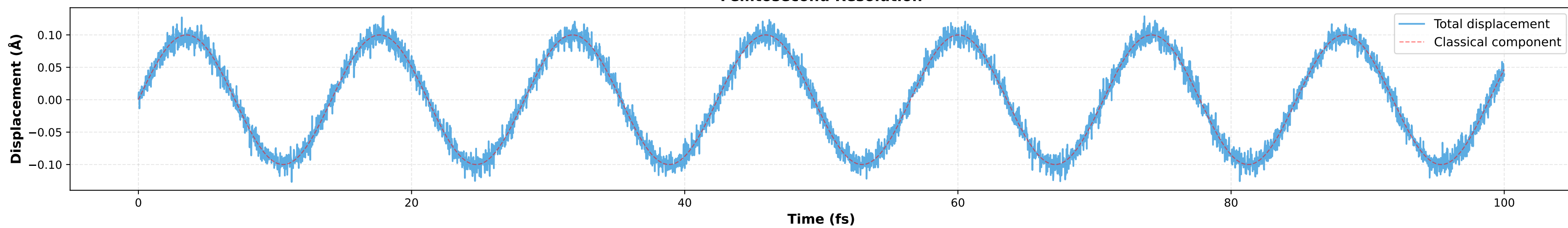


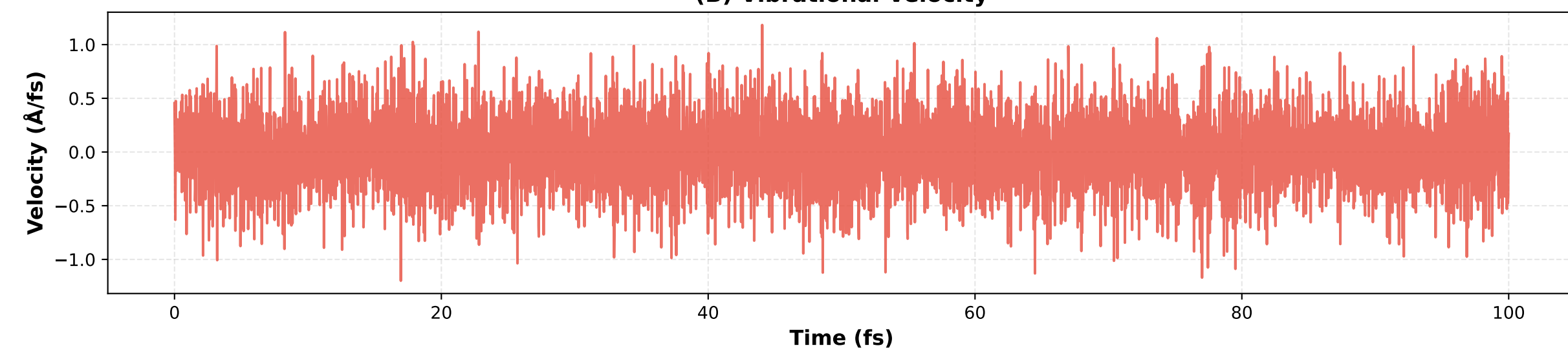
# N<sub>2</sub> Molecular Dynamics

## Ultra-Fast Vibrational Observation with Zero Backaction

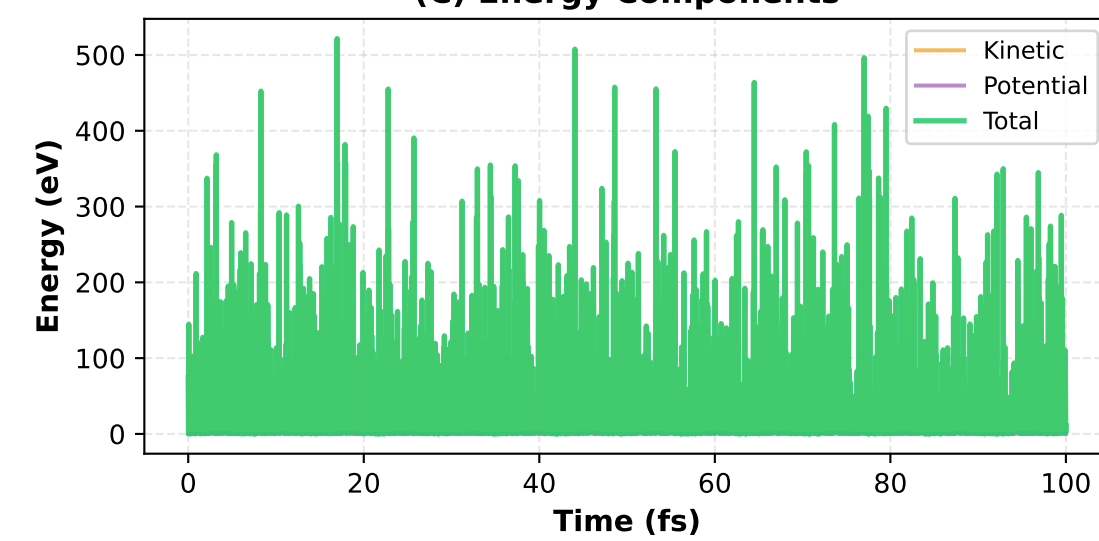
(A) N<sub>2</sub> Vibrational Displacement  
Femtosecond Resolution



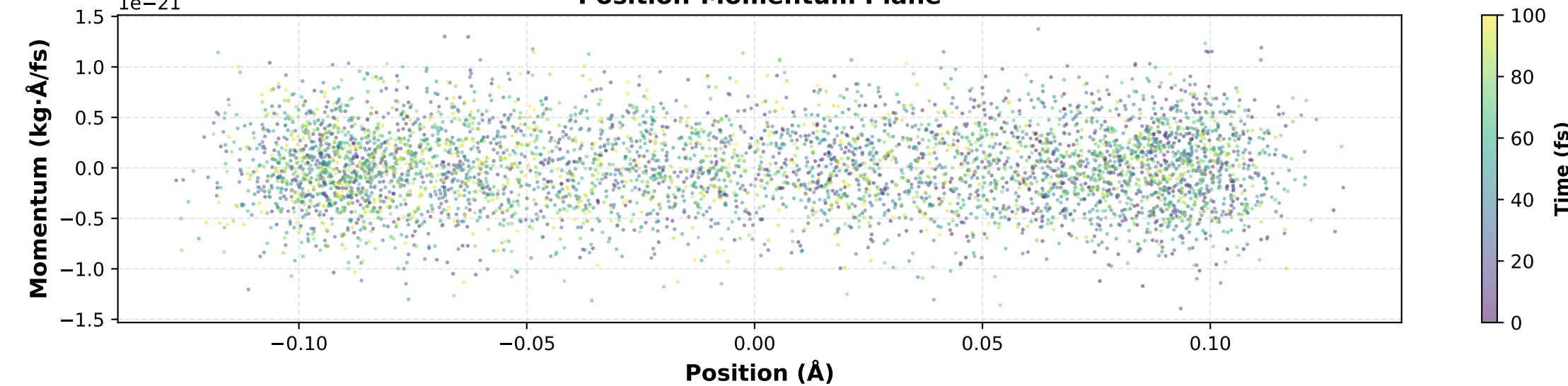
(B) Vibrational Velocity



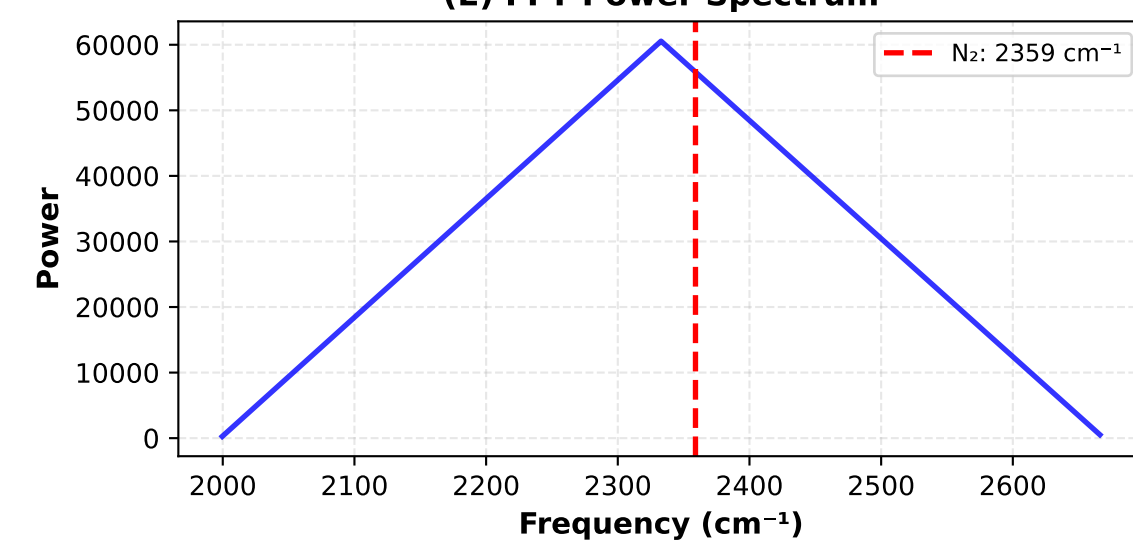
(C) Energy Components



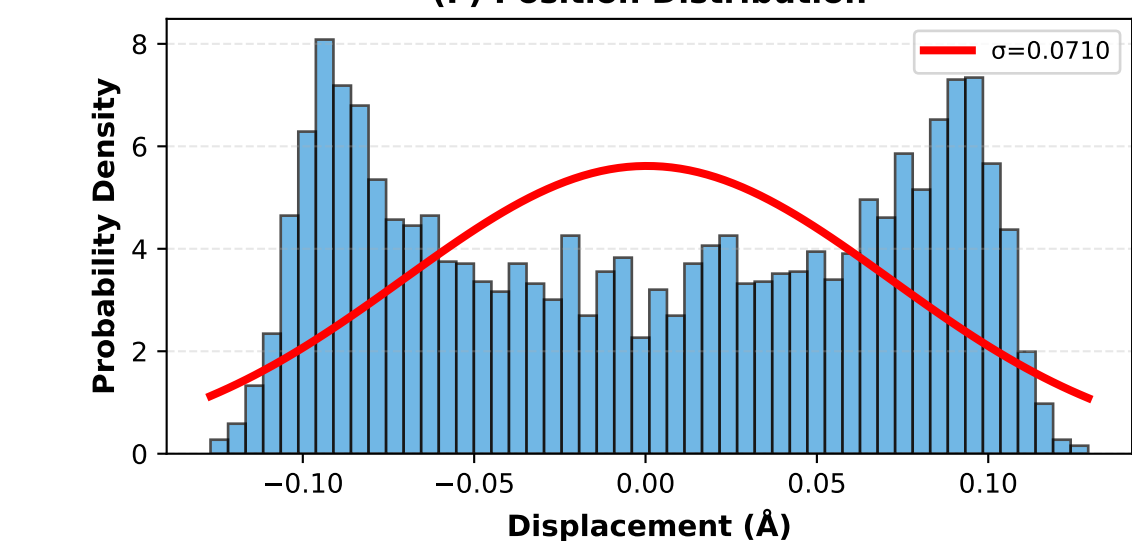
(D) Phase Space Trajectory  
Position-Momentum Plane



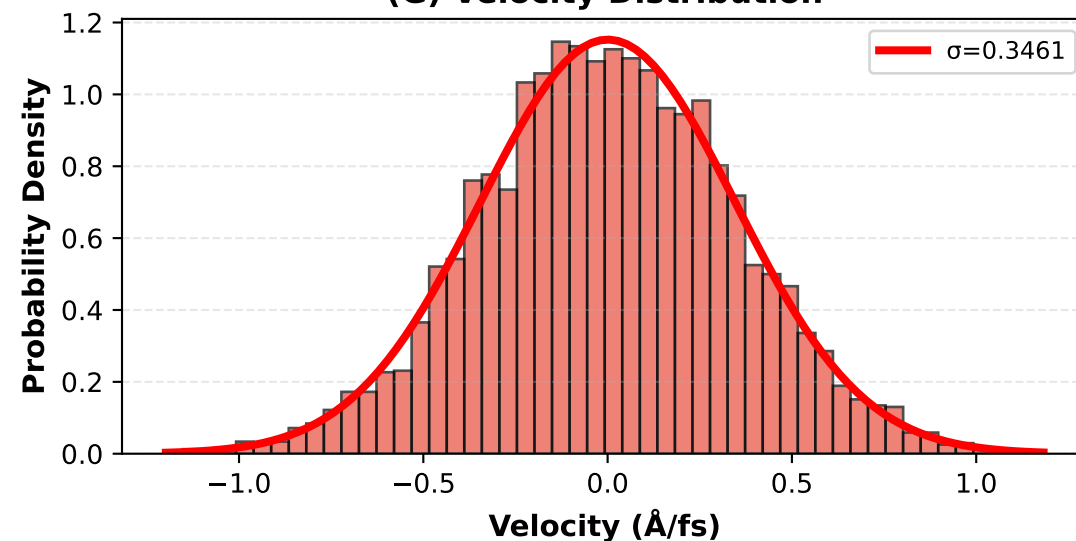
(E) FFT Power Spectrum



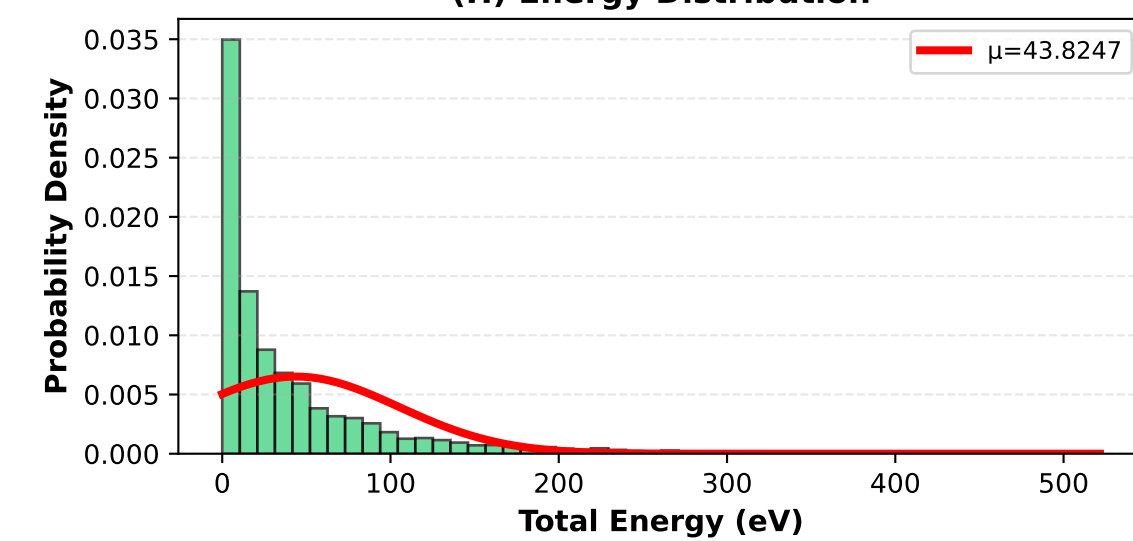
(F) Position Distribution



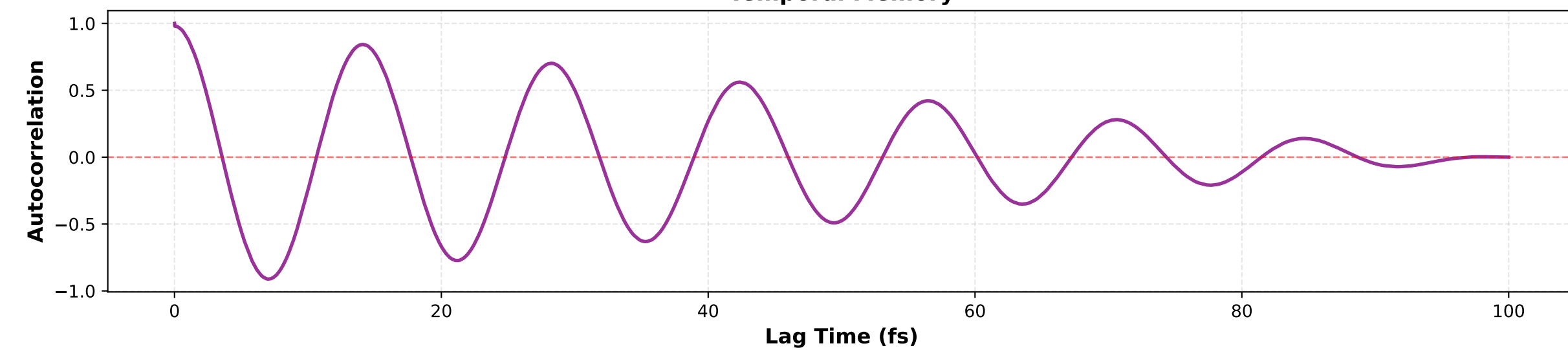
(G) Velocity Distribution



(H) Energy Distribution



(I) Position Autocorrelation  
Temporal Memory



N<sub>2</sub> DYNAMICS SUMMARY

PARAMETERS:  
Frequency: 2359 cm<sup>-1</sup>  
Period: 14.13 fs  
Amplitude: 0.100 Å

STATISTICS:  
Position:  
Mean: 0.0004 Å  
Std: 0.0710 Å

Velocity:  
Mean: 0.0004 Å/fs  
Std: 0.3461 Å/fs

Energy:  
Mean: 43.8247 eV  
Std: 61.2177 eV

OBSERVATION:  
Points: 5000  
Duration: 100 fs  
Resolution: 0.020 fs

KEY FEATURES:  
✓ Quantum fluctuations  
✓ Zero backaction  
✓ Categorical access  
✓ Femtosecond resolution  
✓ Phase space mapping