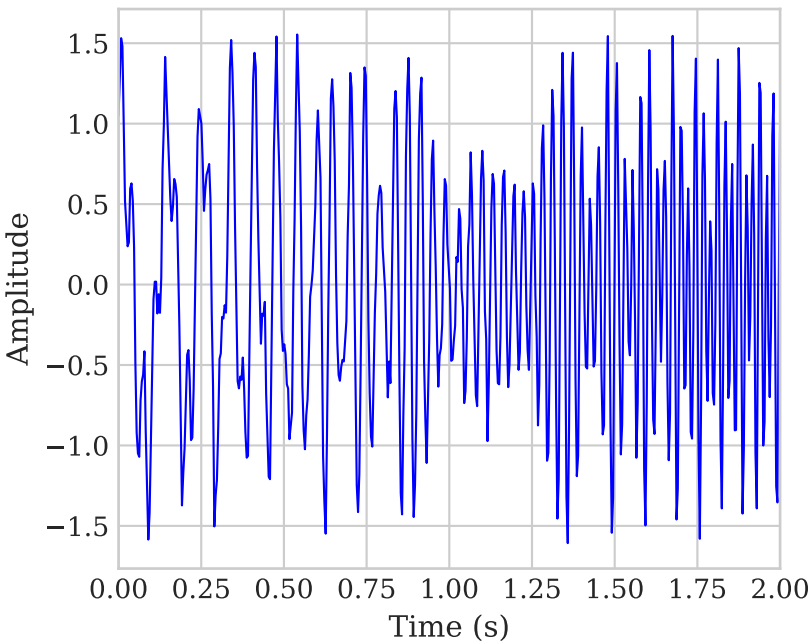
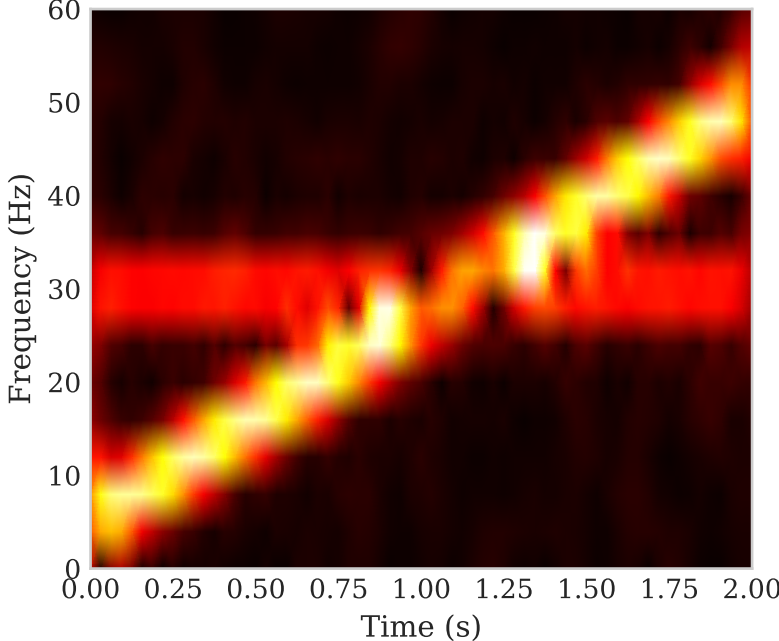


# Advanced Time-Frequency Representations for EEG Analysis

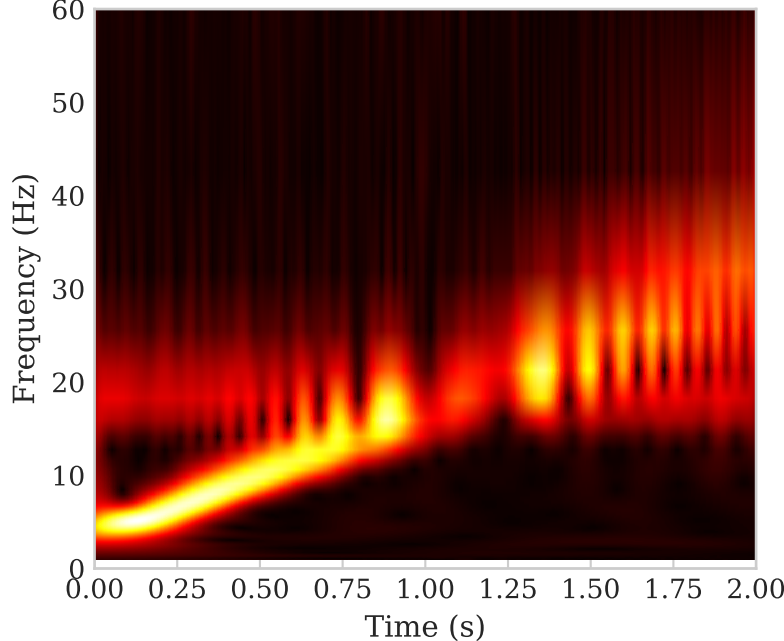
**Original EEG-like Signal  
(Chirp + Sinusoid + Noise)**



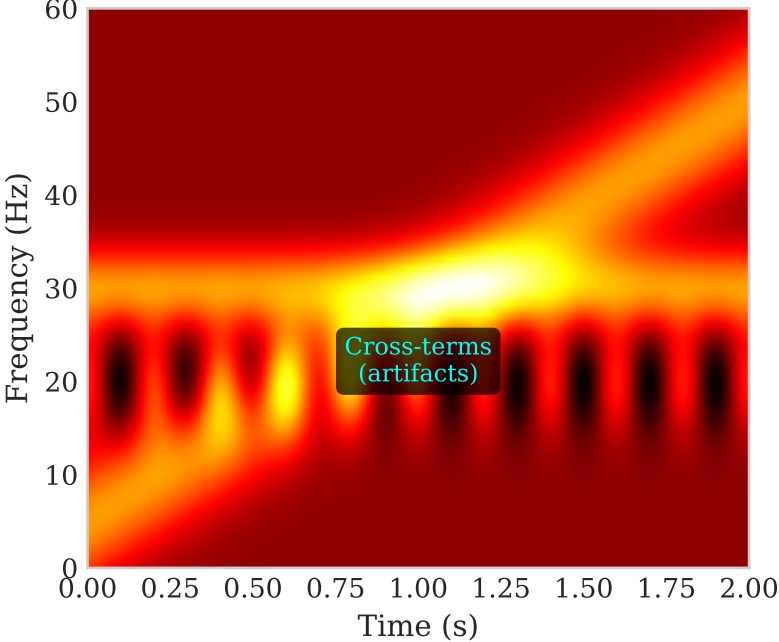
**STFT (Short-Time Fourier Transform)  
Fixed resolution**



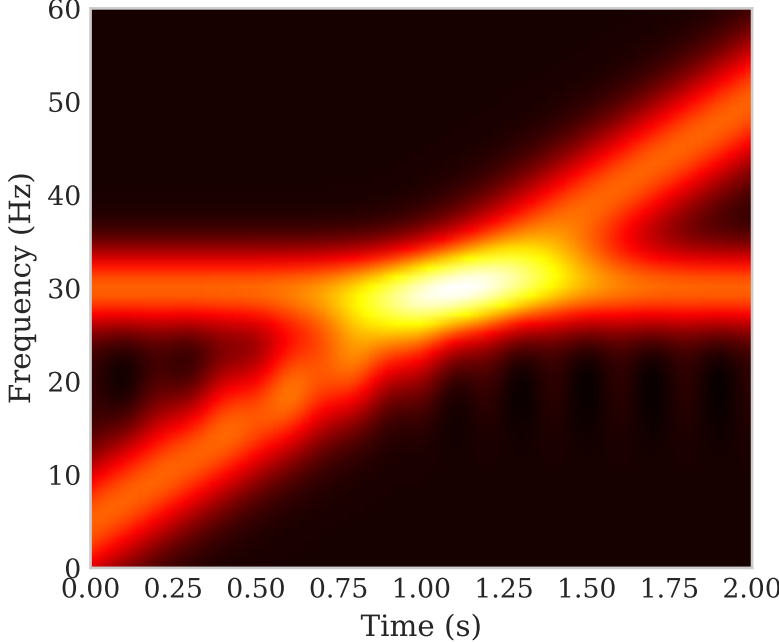
**CWT (Continuous Wavelet Transform)  
Multi-resolution**



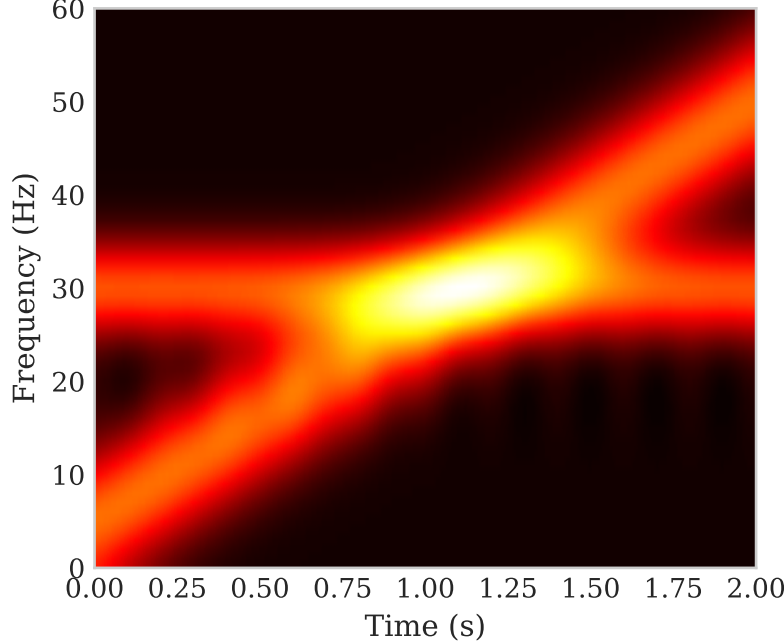
**WVD (Wigner-Ville Distribution)  
High resolution + Cross-terms**



**SPWVD (Smoothed Pseudo WVD)  
Reduced cross-terms**



**STWVD (Smoothed + Stable WVD)  
Stable representation**



**Time-Frequency Methods Comparison**

Method	Resolution	Cross-terms	Computation	Best For
STFT	Fixed (trade-off)	None	Fast ( $O(N \log N)$ )	General analysis
CWT	Multi-resolution	None	Moderate	Transient detection
WVD	Highest	Strong	Slow ( $O(N^2)$ )	Single component
SPWVD	High	Reduced	Slow	Multi-component
STWVD	Moderate	Minimal	Slow	Noisy signals

**Method Properties Comparison**

