

# Phase-Aware Non-Negative Spectrogram Factorization



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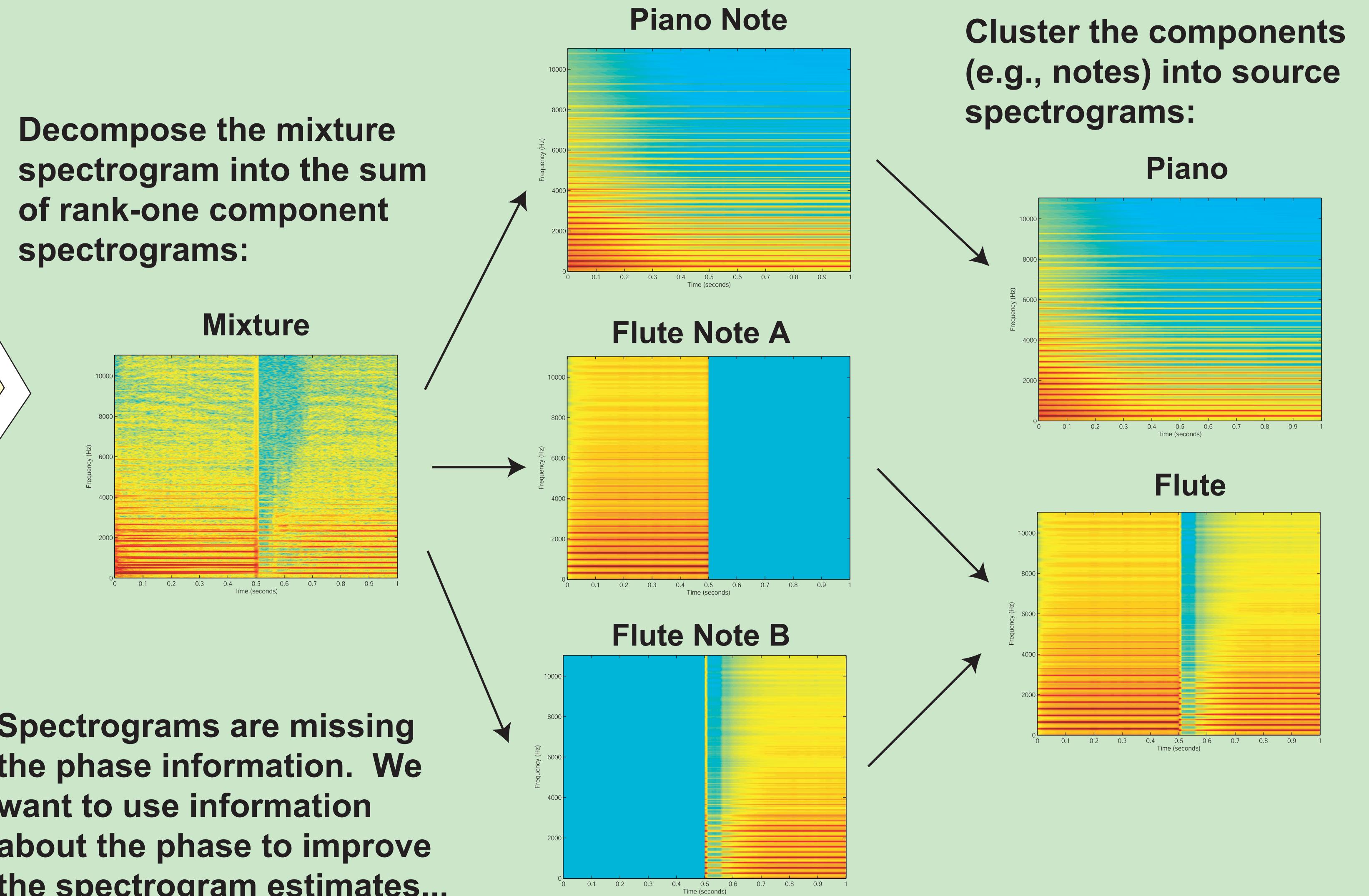


Computational Perception Lab

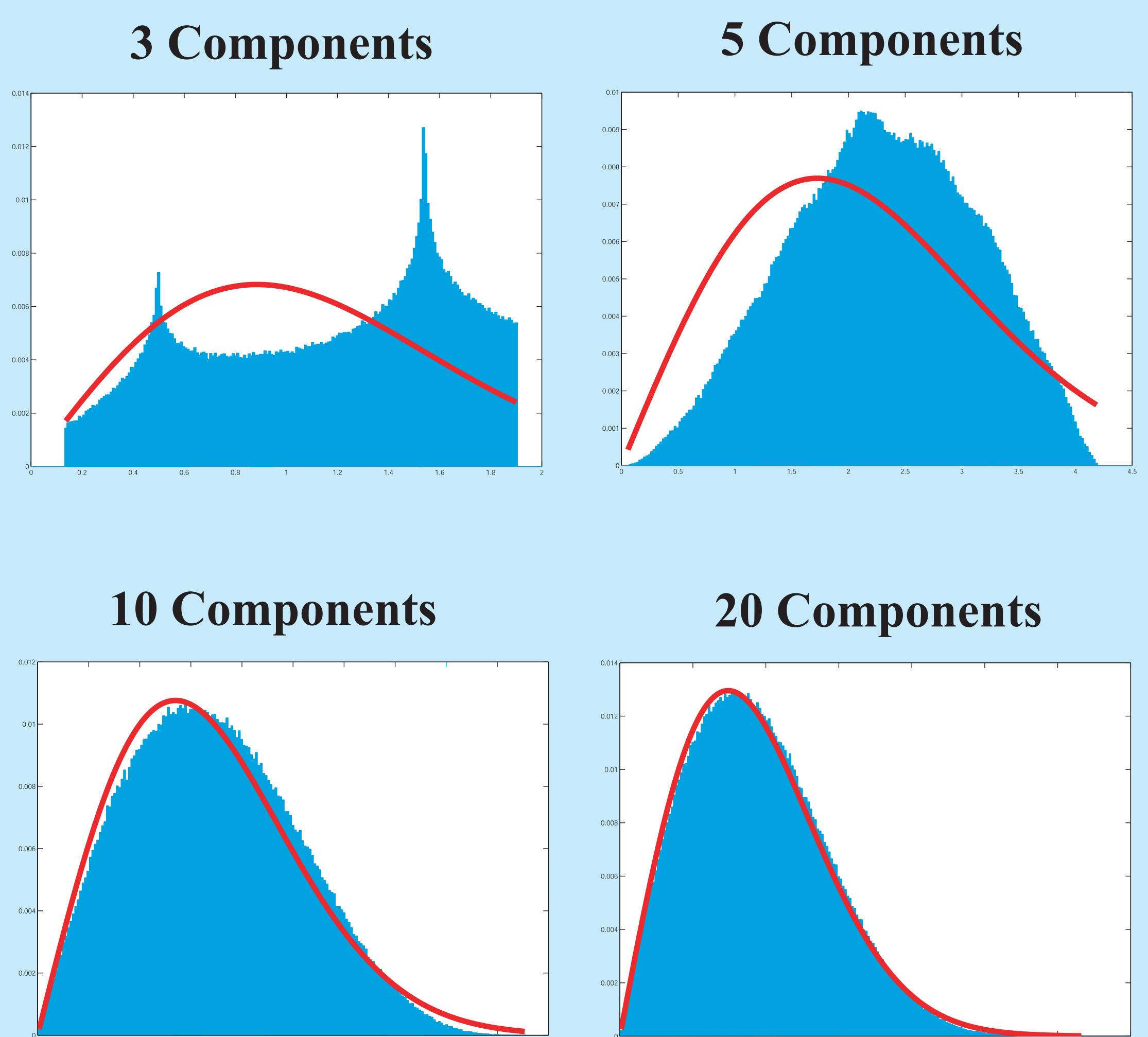
## Summary

Non-negative spectrogram factorization has been proposed for single-channel source separation tasks. The usual assumption is that the mixture spectrogram is well approximated by the sum of source components. However, this relationship additionally depends on the unknown phase of the sources. Using a probabilistic representation of phase, we derive a cost function that incorporates this uncertainty. We compare this cost function against four standard approaches for a variety of spectrogram sizes, numbers of components, and component distributions. This phase-aware cost function reduces the estimation error but is more affected by detection errors.

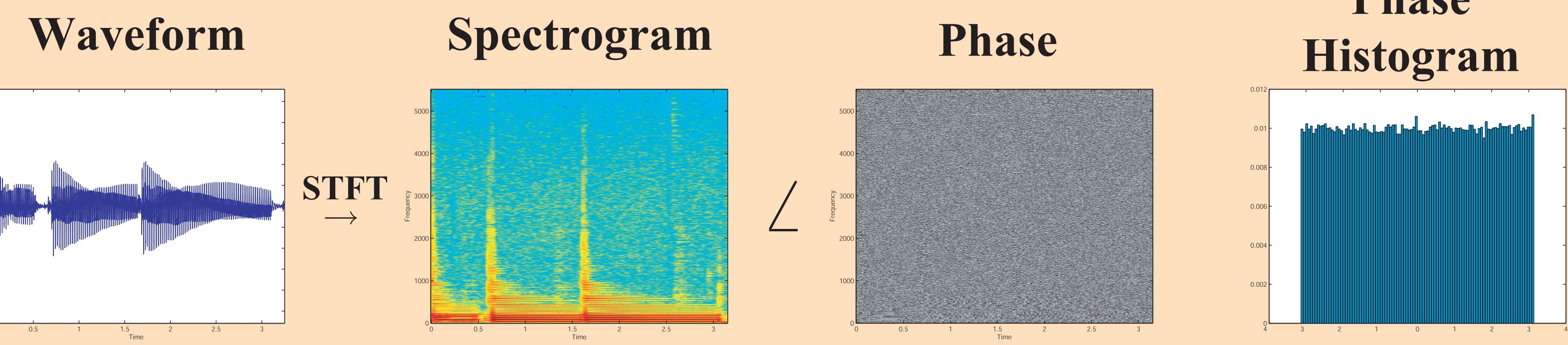
## Spectrogram Factorization



## Rayleigh Distribution



## Short-time Fourier Transform



## Random Phase

The mixture signal is the sum of the component signals:

$$x = \sum_r s_r$$

The mixture STFT is the sum of the component STFTs:

$$\mathcal{F}_x = X e^{i\theta} = \sum_r S_r e^{i\theta_r} = \sum_r \mathcal{F}_{s_r}$$

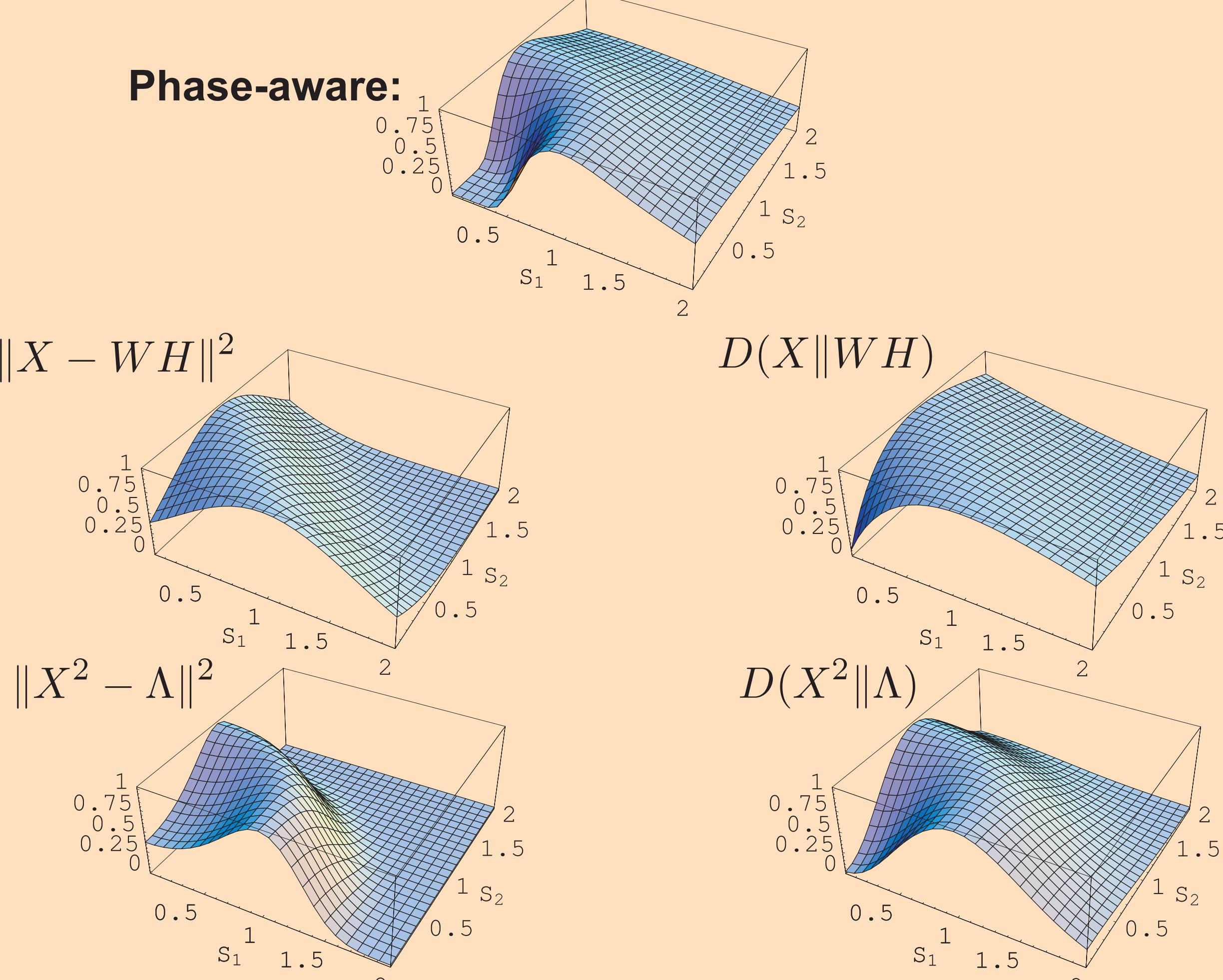
The mixture spectrogram is a function of the component spectrograms and phases:

$$X = \sqrt{\sum_{qr} S_q S_r \cos(\theta_q - \theta_r)}$$

Treat phase as a uniform random variable:

$$\theta_r = U(-\pi, \pi)$$

## Optimization Functions



## Results

