We are currently using Principal Component Analysis (PCA) to analyze the morphology of a vast range of profiles with varying inclination angles $i$, degrees of absolute and differential rotation $\varphi$ and $\dot{\varphi}$, and varying degrees of microturbulence $\xi$. PCA is a pattern recognition technique whose eigenprofiles we are using to look at the “principal components” of our stellar spectra. PCA involves performing singular value decomposition on a covariance matrix $C$ from $N$ profiles $M_i$ (observation matrix $X$).

$$X = M C^{1/2} U V^T$$

Where $X$ is the singular value decomposition (SVD) of the covariance matrix $C$.

For this SVD of the covariance matrix $C$, $C^{1/2}$ contains eigenvalues $\lambda_i$, $\xi_i$, which correspond to eigenvectors $U_i$. In other words, $C$ can be reconstructed $X=U \Sigma V^T$, where $\Sigma$ contains $\lambda_i$, $\xi_i$, and corresponding eigenprofiles are reconstructed in eigenvectors $U_i$. These eigenprofiles are the “principal components.”

To the right is an example of our first two eigenprofiles while varying only inclination, differential rotation $\varphi$, and microturbulence $\xi$.

**References and Acknowledgements**

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