

The AF2+WYFFOS pipeline: An algorithm for an improved sky estimation based on Principal Component Analysis

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Abstract

The accuracy of sky subtraction is one of the most important aspect of the multi-fibre data reduction. It is never as good as with a slit spectrograph, since it is limited either by inaccurate knowledge of fibre-to-fibre relative throughput, or by intrinsic variability of the night sky. As part of our ongoing effort to improve the reliability and precision of the sky subtraction in the dedicated IDL-based AF2+WYFFOS data reduction pipeline, we have applied the PCA approach to the sky estimation routines. Principal component analysis is a robust statistical technique, based on the statistical description of random variables that uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components. In this way, the number of principal components is less than or equal to the number of original variables. In the context of fiber spectroscopy, The PCA algorithm can be used to find the relations between different skylight spectra and reconstruct a dedicated skylight spectra at position of each target fiber, based on the principle components of all available sky spectra. Our primary results show a significant improvement in the quality of the sky estimation, especially in longer wavelengths, where sky background is dominated by the emission lines originated from the OH radical.