

1 Wavelength scale for HIRES_REDUX files

A 2D Legendre polynomial fit to the ThAr exposure provides a 2D wavelength solution as a function of pixel coordinate in the dispersion direction, x , and echelle diffraction order, o , of the form

$$\lambda(x, o) = \frac{1}{o} \sum_{m=0}^{N_x-1} \sum_{n=0}^{N_o-1} C_{mn} P_m(x') P_n(o'), \quad (1)$$

where $P_m(x')$ and $P_n(o')$ are the m th and n th coefficients for the Legendre polynomials of order N_x and N_o respectively. The normalized values of x and o are used here:

$$x' \equiv 2(x - a_0)/a_1 \quad \& \quad o' \equiv 2(o - b_0)/b_1, \quad (2)$$

where the normalizing factors, a and b , are fairly arbitrary.

It is convenient in the coding of UVES_popler to only carry around coefficients for the wavelength solution particular to each echelle order, o ,

$$A_m(o) \equiv \frac{1}{o} \sum_{n=0}^{N_o-1} C_{mn} P_n(o') \quad (3)$$

so that the wavelength anywhere along that order can be calculated quickly and without reference to the coefficients relevant to other orders,

$$\lambda(x; o) = \sum_{m=0}^{N_x-1} A_m(o) P_m(x'). \quad (4)$$