the region of the unit cell occupied by protein atoms should be featureless in solvent maps. It can also be assumed that, as an approximation, solvent regions further than 4 Å from the protein surface have bulk solvent characteristics and can be treated as a constant density region. Combining these two regions gives about 50–60% of the total volume of the unit cell.

Knowledge of the density content of such a large percentage of the unit cell places a strong constraint on the overall character of the Fourier transform, a fact that can be used to improve the quality of the experimentally determined phases

19.1.8. Applications of $D_2O - H_2O$ solvent difference maps

19.1.8.1. *Orientation of water molecules*

In the case of a highly ordered water in a $D_2O - H_2O$ difference map, the oxygen scattering components will cancel (having identical locations and scattering potential), but because H and D have very different scattering properties (H = −3.8 f, D = +6.7 f), large peaks will be found in the map at the D − H positions. Consequently, these ordered waters can usually be oriented with reasonable accuracy in maps better than 2.0 Å resolution (see Fig. 19.1.3.1*b*).

19.1.8.2. *H/D exchange*

Fig. 19.1.8.1 shows examples of density around exchanged and unexchanged amide peptide sites. The density in Fig. 19.1.8.1(*a*) is characteristic of $2F_o - F_c$ Fourier maps; the D is in positive density, extending off the peptide nitrogen, and the H is represented by negative density, separated and translated off the nitrogen. Fig. 19.1.8.1(*b*) shows a $D_2O - H_2O$ density map at the same resolution (2.0 Å). Assignment of H/D character is unambiguous, and it is possible to evaluate partial exchange properties more reliably.

references