International Tables for Crystallography (2006). Vol. B, Figure 4.6.3.33, p. 513.

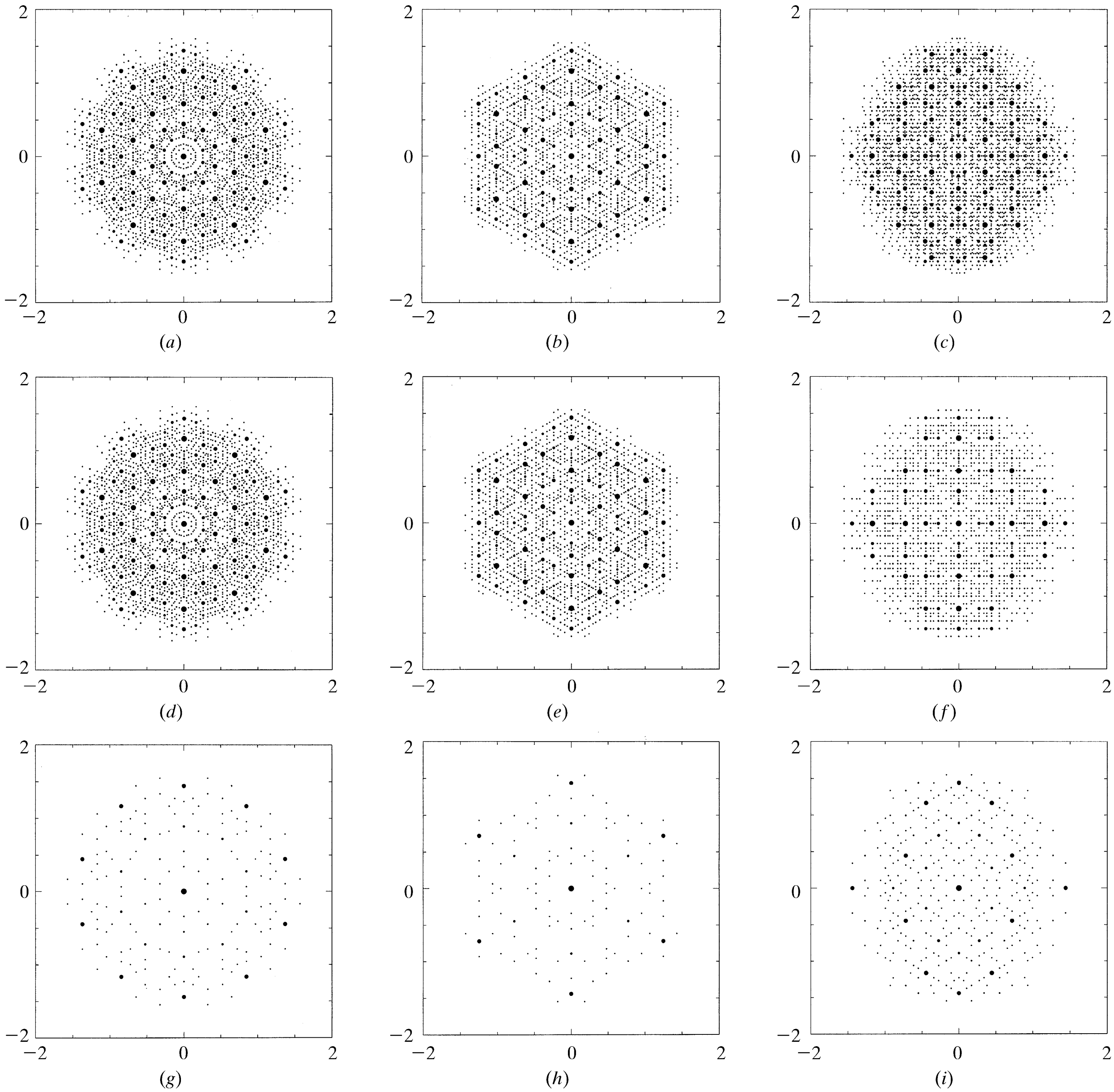

Fig. 4.6.3.33. Physical-space diffraction patterns of the 3D Penrose tiling decorated with point atoms (edge lengths of the Penrose unit rhombohedra $a_r = 5.0$ Å). Sections with five-, three- and twofold symmetry are shown for the primitive 6D analogue of Bravais type *P* in (*a*, *b*, *c*), the body-centred 6D analogue to Bravais type *I* in (*d*, *e*, *f*) and the face-centred 6D analogue to Bravais type *F* in (*g*, *h*, *i*). All reflections are shown within $10^{-4}|F(\mathbf{0})|^2 < |F(\mathbf{H})|^2 < |F(\mathbf{0})|^2$ and $-6 \leq h_i \leq 6, i = 1, \ldots, 6$.

$$g_k(\mathbf{H}^\perp) = (1/A^\perp_{\rm UC}) \int\limits_{A_k} \exp(2\pi i \mathbf{H}^\perp \cdot \mathbf{r})\, {\rm d}\mathbf{r},$$

where $A^\perp_{\rm UC}$ is the volume of the 6D unit cell projected upon $\mathbf{V}^\perp$ and A_k is the volume of the triacontahedron. $A^\perp_{\rm UC}$ and A_k are equal in the present case and amount to the volumes of ten prolate and ten oblate rhombohedra: $A^\perp_{\rm UC} = 8a_r^3[\sin(2\pi/5) + \sin(\pi/5)]$. Evaluating the integral by decomposing the triacontahedron into trigonal pyramids, each one directed from the centre of the triacontahedron to three of its corners given by the vectors $\mathbf{e}_i, i = 1, \ldots, 3$, one obtains

$$g(\mathbf{H}^\perp) = (1/A^\perp_{\rm UC}) \sum_R g_k(R^T \mathbf{H}^\perp),$$

with $k = 1, \ldots, 60$ running over all site-symmetry operations *R* of the icosahedral group,

$$g_k(\mathbf{H}^\perp) = -iV_r[A_2A_3A_4 \exp(iA_1) + A_1A_3A_5 \exp(iA_2) + A_1A_2A_6 \exp(iA_3) + A_4A_5A_6] \times (A_1A_2A_3A_4A_5A_6)^{-1},$$

$A_j = 2\pi \mathbf{H}^\perp \cdot \mathbf{e}_j$, $j = 1, \ldots, 3$, $A_4 = A_2 - A_3$, $A_5 = A_3 - A_1$, $A_6 = A_1 - A_2$ and $V_r = \mathbf{e}_1 \cdot (\mathbf{e}_2 \times \mathbf{e}_3)$ the volume of the parallelepiped defined by the vectors $\mathbf{e}_i, i = 1, \ldots, 3$ (Yamamoto, 1992*b*).

4.6.3.3.3.4. *Intensity statistics*

The radial structure-factor distributions of the 3D Penrose tiling decorated with point scatterers are plotted in Fig. 4.6.3.35 as a function of parallel and perpendicular space. The distribution of $|F(\mathbf{H})|$ as a function of their frequencies clearly resembles a centric

references