$$P(\mathbf{r}, \omega) = |\phi_n(\omega)|^2 \sum_{\mu, \nu} \exp\left[i(\mathbf{k}_{\mu} - \mathbf{k}_{\nu}) \cdot \mathbf{r}\right] \left(\mathbf{M} \mathbf{M}^{\dagger}\right)_{\mu\nu}$$