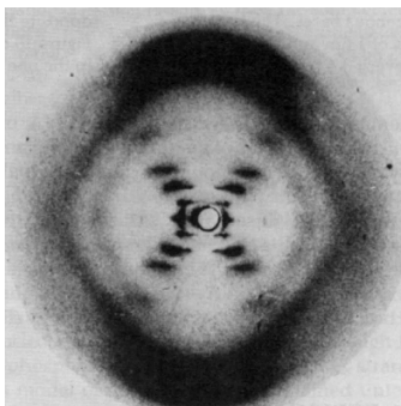
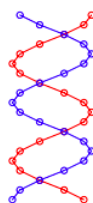


5.6: Simulating DNA's Diffraction Pattern - Short Version



Sugar-phosphate groups per strand: $A = 20$ Strand radius: $R = 1$ Phase difference between strands: 0.8π

$$\begin{aligned} \text{First strand: } m &= 1..A & \Theta_m &= \frac{4\pi m}{A} & y_m &= m & x_m &= R \cos(\Theta_m) \\ \text{Second strand: } m &= 21..40 & \Theta_m &= \frac{4\pi(m-A)}{A} & y_m &= (m-A) & x_m &= R \cos(\Theta_m + 0.8\pi) \\ m &= 1..20 & n &= 21..40 \end{aligned}$$



Coordinate space wave function:

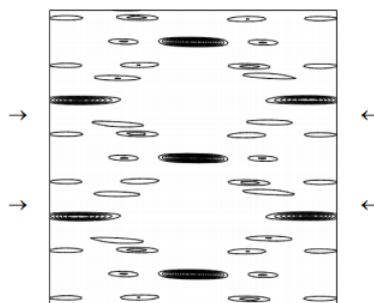
$$|\Psi\rangle = \frac{1}{\sqrt{N}} \sum_{i=1}^N |x_i, y_i\rangle$$

Momentum space wave function:

$$\Phi(p_x, p_y) = \frac{1}{2\pi} \sum_{m=1}^{40} \exp(-ip_x x_m) \exp(-ip_y y_m)$$

$$\Delta = 8 \quad N = 200 \quad j = 0..N \quad px_j = -\Delta + \frac{2\Delta j}{N} \quad k = 0..N \quad py_k = -\Delta + \frac{2\Delta k}{N}$$

$$\text{DiffractionPattern}_{j,k} = (|\Phi(px_j, py_k)|)^2$$



DiffractionPattern

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