Monte Carlo Integration

$$\int \mathrm{d}x\, f(x)g(x) = \left\langle \frac{1}{\rho(x)} f(x)g(x) \right\rangle_{\rho(x)}$$

This average will give us the integral,
but how to do it efficiently?

Choosing $\quad \rho(x) = \dfrac{|f(x)|}{N_f} \qquad N_f = \displaystyle\int \mathrm{d}x\, |f(x)|$

$$\int \mathrm{d}x\, |f(x)|\, e^{i\phi_f(x)} g(x) = N_f \left\langle e^{i\phi_f(x)} g(x) \right\rangle_{|f(x)|}$$

A Special Integrand

$$\int \mathrm{d}x\, A(x)B(x)C(x)$$

- *A(x)* is cheap
- *B(x)* is somewhat expensive
- *C(x)* is **very** expensive