Connection of action-angle variables to quantum mechanics comes from the correspondence principle:

$$\left\langle \mathbf{n}' \middle| \hat{A} \middle| \mathbf{n} \right\rangle = (2\pi)^{-F} \int_0^{2\pi} d\mathbf{q} \, A_{\text{cl}}(\bar{\mathbf{n}}, \mathbf{q})$$