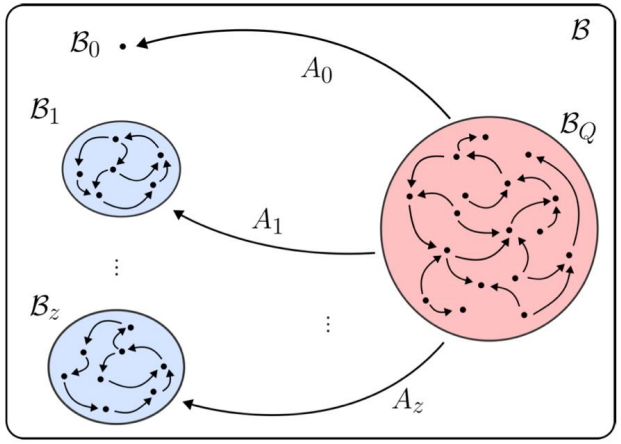
5 - Concentration in noisy PQC

QML + noise

Test the effect of non-unital noise for BP.
Change the absorption on from B_0 to B_1 with a customize ansatz (we will provide guidance and initial support). Measure the contribution to the variance with numerics or analytical solution



$$\mathbb{V}^{\infty}_{\rho,H} = \sum_z \frac{(\ell_\rho)_z (\ell_H)_z}{d_z} + \frac{(\ell_\rho)_z (A\ell_H)_z}{d_z}$$

- Reference:
  https://arxiv.org/pdf/2410.01893
  https://pennylane.ai/blog/2021/05/how-to-simulate-noise-with-pennylane

TO DO:

- Reproduce the numerics (see App E2, F)
- Expand the results using a different absorption

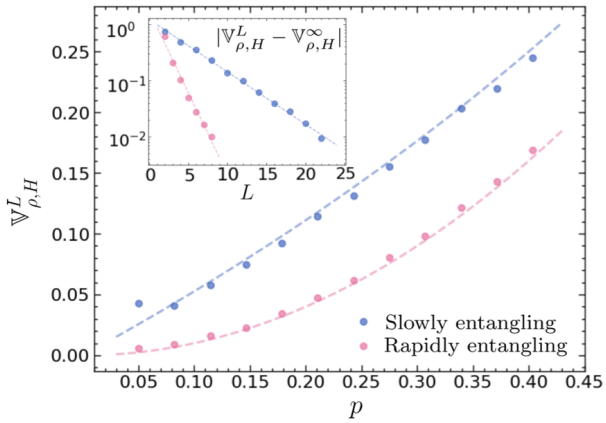


FIG. 3. Scaling of $\mathbb{V}^L_{\rho,H}$ as a function of the noise strength and the entangling power of the intermediate channel. The main figure illustrates the scaling of $\mathbb{V}^{\infty}_{\rho,H}$ with noise strength p for both rapidly entangling (pink) and slowly entangling (light blue) channels, using $L = 8$ and $L = 20$, respectively. The dotted lines represent the theoretical predictions of Eq. (25) and Eq. (24) The inset verifies the exponential convergence of $\mathbb{V}^L_{\rho,H}$ to $\mathbb{V}^{\infty}_{\rho,H}$ at $p = 0.1$, justifying the chosen number of layers. The dotted lines represent an exponential fit to the numerical data. All plots are obtained using a $n = 10$ qubit system.