Mathematical and computational aspects of quantum information theory

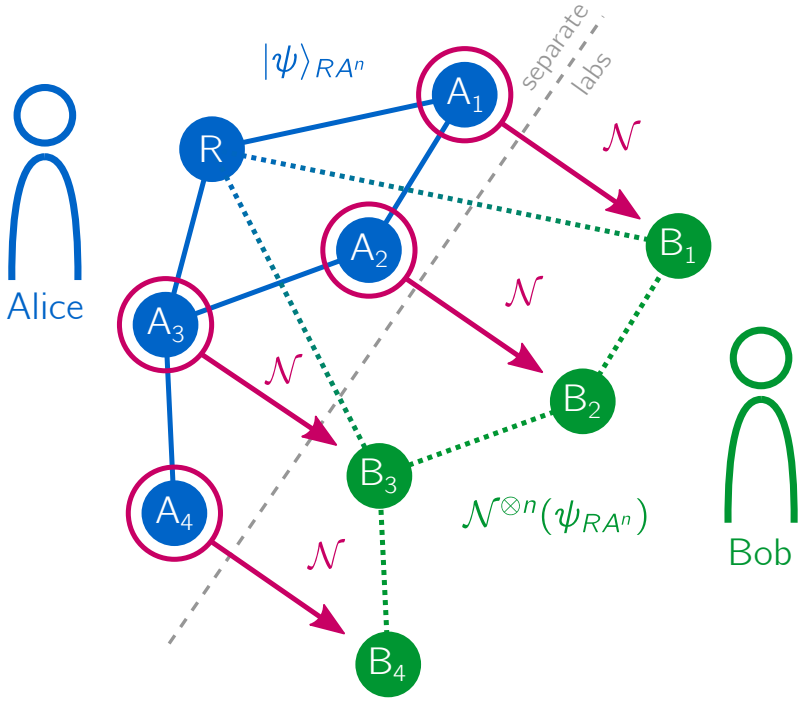
Felix Leditzky, *Department of Mathematics, UIUC*
felix.leditzky@gmail.com
felixleditzky.info

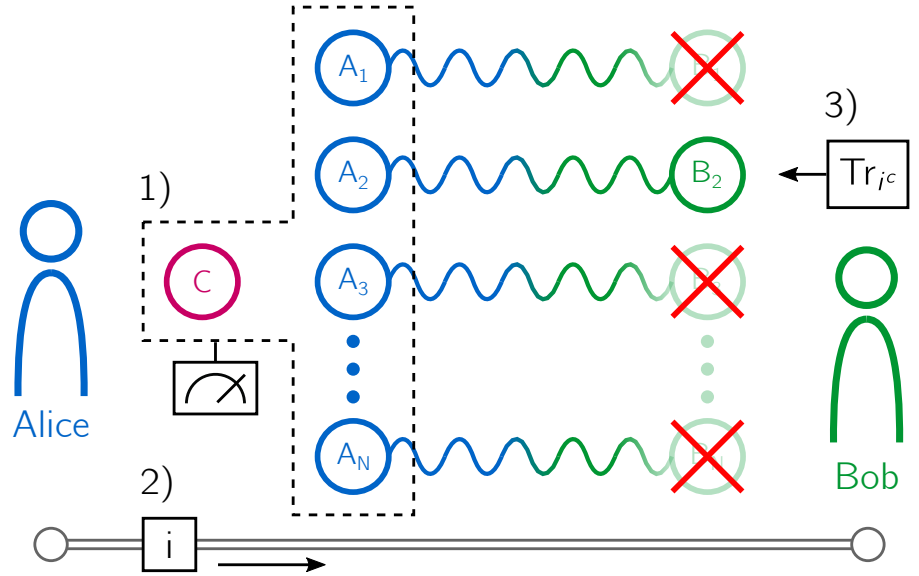
I study quantum information-theoretic tasks using a variety of mathematical and computational tools such as representation theory, group theory, convex and global optimization techniques, and neural networks methods. Among other things, I am interested in quantum channels and their capacities, and teleportation protocols.

Quantum channels and superadditivity

When **sending quantum information through a quantum channel**, the achievable communication rates can be increased by using entangled quantum codes. This effect is called **superadditivity**, and a direct consequence of the **multipartite entanglement** in the code state. But these codes are hard to find because of the exponential growth in dimension of the Hilbert space. Therefore, I am interested in using code ansätze such as **graph states** or **neural network states**.

Publications: arXiv:1806.08327, arXiv:1806.08781, arXiv:1910.00471





Symmetries of teleportation protocols

Quantum teleportation is a fundamental quantum information-processing task, achieved by using an entangled state together with classical communication to **send quantum information** between spatially separated parties. A recent variant called **port-based teleportation** (shown above) uses a multipartite entangled state as the resource state. The natural **permutation and unitary symmetries** of the protocol enable an elegant description in terms of **representation theory** and **semidefinite programming**.

Publications: arXiv:1809.10751, arXiv:2008.11194