[TOWARDS A FAULT-TOLERANT QUANTUM COMPUTER]

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The remarkable recent progress in controlling quantum systems has led to an accelerated race towards building a useful quantum computer. A major portion of the recent developments deal with noisy quantum bits and aim at proving an advantage with respect to classical processors. However, in order to fully exploit the power of quantum physics in computation, developing fault-tolerant processors is unavoidable. In such a processor, quantum bits and logical gates are dynamically and continuously protected against noise by means of quantum error correction. While a theory of quantum error correction has existed and developed since mid 1990s, the first experiments are being currently investigated in the physics labs around the world. A central challenge in all these experiments is related to real-time feedback control required for error correction. I will explain how this central challenge can be attacked through passive control and dissipativity. I will also overview a series of recent experimental developments with superconducting circuits.