Abstract: Further scaling of complementary metal-oxide-semiconductor (CMOS) dimensions will soon lead to a tremendous rise in power consumption while limited gain in the performance of integrated circuits. “Beyond-CMOS” devices, based on new materials, device concepts and architectures, can potentially overcome these limitations and further improve the performance, reduce energy consumption, and add novel functionalities to the CMOS platform. In this talk, I will present nanoscale electronic and photonic devices based on two-dimensional (2D) materials and ferroelectric materials. In particular, I will discuss the logic devices, RF devices, photodetectors, plasmonic devices, and tunneling devices based on graphene and transition metal dichalcogenides. I will also present our recent results on non-volatile memories and ferroelectric tunneling junctions (FTJs) based on ferroelectric hafnium oxide and 2D ferroelectric indium selenides.