In this talk, I will discuss two separate topics of our recent study in Van der Waals material based memory devices and new ultrafast imaging research, respectively. In the first part, our recent work in developing high performance ferroelectric tunneling junction based on the layered ferroelectric CuInP$_2$S$_6$ (CIPS) with asymmetric semi-metallic graphene and Cr contact. A record giant TER above $10^7$ is obtained due to the large Fermi level shift in monolayer graphene in synergy with the flipping of the ferroelectric polarization in CIPS. The large Fermi level shift (barrier height modulation (BHM), $\sim$1 eV) is attributed to the low density of states and quantum capacitance near the Dirac point of semi-metallic graphene. The vdW structure further enhances the TER due to the large carrier effective mass of the CIPS layer along its out-of-plane crystal direction. This new approach for achieving ultrahigh TER in FTJ memory based on atomically-thin semimetal graphene contact is also promising for high density integration with silicon electronics. In the second part of the talk, I will discuss our recent collaborative work reporting the first real-time spatial-temporal imaging of an optical chaotic system, which is of both fundamental scientific importance and practical relevance in key photonic applications such as laser optics and optical communication, by utilizing the recently developed compressed ultrafast photography. The time evolution of the system’s phase map is imaged at 100 billion frames per second without repeating measurement. We also demonstrate the ability to simultaneously control and monitor optical chaotic systems in real time. Our work introduces a new angle to the study of non-repeatable optical chaos completely different from the traditional time-averaged static imaging or spectral measurement, paving the way for fully understanding and utilizing chaotic systems in various disciplines.