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Abstract for an Invited Paper
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Unconventional superconductivity in bilayer transition metal dichalcogenides[1]

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Two dimensional layered materials, such as graphene and transition metal dichalcogenides, have revealed rich physical phenomena due to the interplay between different degrees of freedom, including spin, valley and layer degrees. In this talk, we will discuss unconventional superconductivity in bilayer transition metal diachalcogenides and show how multiple degrees of freedom in this system can lead to unconventional superconductivity. We find that intra-layer singlet pairings (A_{1g} and A_{1u} pairing) and inter-layer triplet pairing (E_u pairing) are possible to be stable in the phase diagram, depending on the relative strength of intra-layer and inter-layer interactions. Furthermore, by applying an in-plane magnetic field, we predict that the superconducting state with intra-layer singlet pairing will evolve to an inhomogeneous helical Fulde-Ferrell-Larkin-Ovchinnikov phase due to the presence of a new linear gradient term, which also linearly depends on magnetic fields, in the Landau free energy. We also discuss the experimental relevance of our results and possible experimental signatures to identify the helical state. Reference: [1] Unconventional superconductivity in bilayer transition metal dichalcogenides, Chao-Xing Liu, arXiv: 1608.04139, 2016.

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