Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **4216** Type: **Invited Speaker / Conférencier(ère) invité(e)**

Sliding ferroelectricity in layered semiconductors: from slip avalanche to non-volatile optical switch

Wednesday 29 May 2024 13:30 (30 minutes)

The tunability of the stacking order in van der Waals materials provides a new and powerful method to engineer their physical properties. In parallel-stacked transition metal dichalcogenides, also known as the rhombohedral stacking order, the equilibrium atomic structure is asymmetric between layers, leading to a spontaneous electrical polarization across the vdW gap. Under an external electric field, the layer configuration and its associated polarization can be switched - a phenomenon recently termed as sliding ferroelectricity. We experimentally measured the polarization strength and its spatial distribution in chemically synthesized rhombohedral MoS2. We observed that the domain size distribution follows a power-law distribution, suggesting that the shear strain occurring during the mechanical exfoliation can induce an avalanche of domain wall motion. These pre-existing domain walls were found to be crucial for the polarization switching behavior and we leveraged them to achieve a non-volatile control over the optical response of these layered semiconductors.

Keyword-1

2D materials

Keyword-2

Sliding ferroelectricity

Keyword-3

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Session Classification: (DCMMP) W3-7 Fluctuations, interactions and Disorder in Condensed Matter | Fluctuations, interactions et désordre dans la matière condensée (DPMCM)

Track Classification: Symposia Day (Wed May 29) / Journée de symposiums (Mercredi 29 mai): Symposia Day (DCMMP - DPMCM) - Fluctuations, interactions and Disorder in Condensed Matter / Fluctuations, interactions et désordre dans la matière condensée