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Title of presentation: Berry curvature and topological Nernst effect in biased bilayer WSe_2

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Abstract

We investigate the anomalous thermoelectric transport in bilayer WSe_2 with broken inversion symmetry, due to a gate electric field, regardless of time-reversal symmetry. We compare the cases in which the spin-orbit coupling (SOC) is absent or present. In the presence of SOC and of a valley-contrasting Berry curvature, anomalous spin and valley Nernst responses are generated. The Nernst signals exhibit peaks and dips, as the chemical potential is varied, that have the signs of the Berry curvatures of the bands and are proportional to their magnitudes. In the absence of SOC but with an electric field present, the Nernst responses are the same in the conduction and valence bands due to particle-hole symmetry. The anomalous valley Nernst coefficient is enhanced by increasing the electric field strength. When time-reversal symmetry is violated, e.g., upon using an insulating magnetic substrate, the total Nernst coefficient is finite and exhibits a dip-peak feature. We also analyze the orbital magnetization and the orbital magnetic moment. In the absence of a gate electric field the magnetization vanishes due to the spin degeneracy of the bands. In the presence of electric field, the magnetization and its two contributions, one due to the magnetic moment and one due to the Berry curvature, are calculated and interpreted in terms of opposite circulating currents of the bands in the two layers. The results are pertinent to other transition metal dichalcogenides and future caloritronic applications.