Tunable Berry curvature and topological Nernst effect in biased bilayer WSe_2

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We investigate the Berry curvature and anomalous thermoelectric transport in bilayer WSe_2 with broken inversion symmetry, e.g., due to a gate electric field, regardless of time-reversal symmetry. In the presence of spin-orbit coupling and a valley-contrasting Berry curvature, anomalous spin and valley Nernst responses are generated. We find that 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. The anomalous valley Nernst coefficient is enhanced with increasing electric field strength. We also analyze the orbital magnetization and the orbital magnetic moment. 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.