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Role of wave-particle interaction in parallel transport along open magnetic field[1] ZEHUA GUO, XIANZHU TANG, Los Alamos National Laboratory — Ambipolar electric field is crucial in parallel transport such as the plasma flow. Our study shows that, for low-collisionality boundary plasmas in the low-recycling regime, the sheath potential does not obey the Bohm's relation (or its variations), but strongly couples to wave-particle interactions via electromagnetic instabilities. Unlike the collisional limit, trapped electrons due to finite ambipolar potential and source injection can only be de-trapped by the wave-particle scattering processes at steady state. Therefore, to reduce trapped electrons from the source and access a stronger instability drive, the absolute value of ambipolar potential decreases. The dispersion analysis of whistler waves driven by the sharp gradient of electron distribution at the trap-passing boundary shows more robust instability than the conventional temperature anisotropy driven mode. The detailed electron scattering process in given whistler waves is then analysed to account for the necessary de-trapping particle flux and the associated energy flux. Combined effects of wave-particle interaction and collisions on the ambipolar potential have also been investigated with a scan of collisionality using VPIC simulation.

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