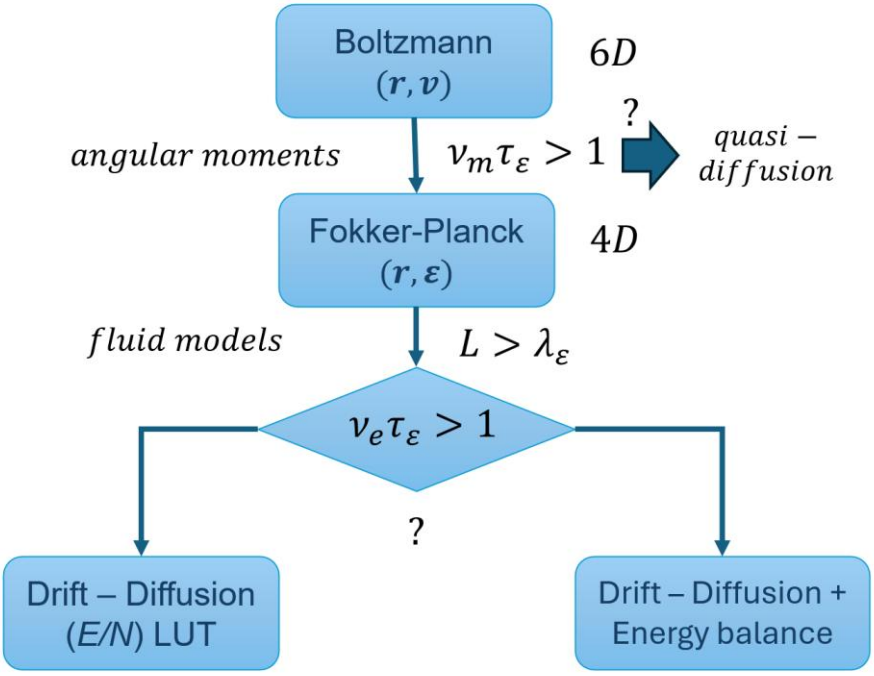
Hybrid kinetic-fluid methods of plasma modeling

A hierarchy of models for electrons in low-temperature plasma, depending on the characteristic temporal and spatial scales



ν_m is the momentum relaxation (transport collision) frequency

ν_e is the frequency of Coulomb collisions

τ_ε is the energy relaxation time

λ_ε is the energy relaxation length

L is the characteristic spatial scale

Two types of fluid models could be justified for non-Maxwellian EEDF at $L > \lambda_\varepsilon$:

At $\nu_e \tau_\varepsilon < 1$, drift-diffusion approximation for electrons with EEDF and transport coefficients depending on the local value of the reduced electric field, E/N, where N is the local gas density, using E/N Look-up Tables (LUTs)

At $\nu_e \tau_\varepsilon > 1$, an additional equation for the energy balance of electrons with transport coefficients and chemical reaction rates depending on the local value of the electron temperature (using $T_e(E/N)$ LUTs).