# MONTE CARLO FLUX SIMULATIONS OF ELECTRONS IN $CO_2$

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**Abstract.** A boost in the investigation of $CO_2$ plasmas has been recently motivated by a possible application to carbon capture and utilization. Numerical models describing the interplay between electron and heavy particles kinetics require accurate and fast computational approaches. In particular, in $CO_2$, deviations from a two-term solution of the electron Boltzmann equation (EBE) are expected already at low/moderate reduced electric fields ($E/N$). Moreover, a common assumption is to avoid the accurate description of excited states or to neglect the velocity distribution of the background gas (or both). In this work, approximations that are usually employed in the study of electron kinetics in $CO_2$ are analyzed, together with strategies to overcome them.

Electron kinetics in $CO_2$ is described by means of a fully native Monte Carlo Flux (MCF) code. The MCF method provides detailed calculations of the Electron Velocity Distribution Function through a highly efficient variance reduction technique. In this work, the MCF code takes into account the thermal velocity distribution function of gas molecules. This extension, together with an accurate description of rotational and vibrational excited states, provides a better agreement with measured transport coefficients at low $E/N$. At moderate $E/N$, MCF calculations are benchmarked against multi-term solutions of the EBE, showing excellent agreement and limitations of the two-term approximation.

## References

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