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ELECTRON TRANSPORT IN SIMPLE LIQUID MIXTURES

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Abstract. The study of low-energy electrons in structured fluid systems, such as dense gases and liquids, underpins many areas of technology and scientific research. The 2021 European Committee for Future Accelerators Detector Research and Development Roadmap [Colaleo *et al.*2021] highlighted the importance of liquid detectors to dark matter searches, neutrino physics and astroparticle experiments. The use of dopants and liquid mixtures to improve detector operation is an active area of research and requires models of electron transport in liquid mixtures.

The behaviour of low-energy electrons in liquids is substantially more complex than in dilute gaseous systems. For example, when the de Broglie wavelength of the electrons (near thermal) energies is comparable to the interatomic spacing of atoms in the medium, scattering occurs from multiple (correlated) scattering centres simultaneously. This coherent scattering was incorporated into a kinetic theory framework by Cohen and Lekner [Cohen and Lekner 1967, Lekner 1967] and can lead to orders-of-magnitude difference in the calculated transport properties.

In a recent paper [Boyle *et al* 2023], the framework of Cohen and Lekner for pure liquids was extended to simple liquid mixtures, which accounted for the correlation between medium atoms of different types. In this work we investigate the dependence of transport properties, such as drift velocity and diffusion coefficients, on the structure of simple liquid admixtures, which nevertheless demonstrate complex relationships. We discuss the implications of using dopants and liquid mixtures in the development of liquid time projection chambers.

References

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