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1P09 - Electron emission in liquids

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Discharge formation and breakdown in water have critical implications for water sterilization and biomedical applications [1]. Several studies demonstrate current scaling in liquids following field emission by the Fowler-Nordheim law (FN) and space charge-limited emission (SCLE) by the Mott-Gurney law (MG) with collisions [2]. Recent theoretical work for gases has unified the asymptotic solutions of FN and MG with the Child-Langmuir law (CL) for SCLE at vacuum, even demonstrating a triple point where all three as [2]. This presentation assesses the feasibility of applying a similar unification of MG and FN for liquids. Experimental implications will be discussed.

1. J. E. Foster, "Plasma-based water purification: Challenges and prospects for the future,"Phys. Plasmas, vol. 24, no. 5, 2017, Art. no. 005501.
2. K. Dotoku et al., "Field emission into nonpolar organic liquids,"J. Chem. Phys., vol. 69, no. 3, pp. 1121-1125, 1978.
3. A. M. Darr, A. M. Loveless, and A. L. Garner, "Unification of field emission and space charge limited emission with collisions,"Appl. Phys. Lett., vol. 114, no. 1, 2019, Art. no. 014103.

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