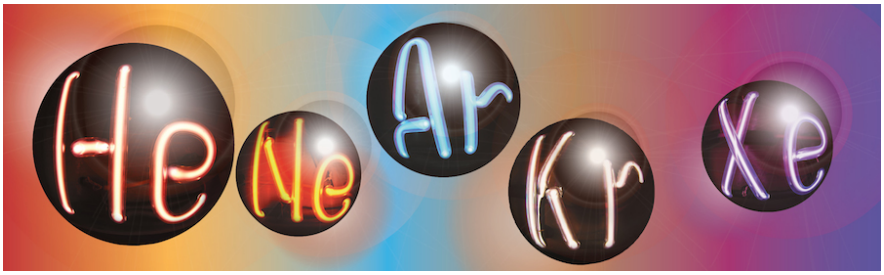

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Light and charge yield model from first principles for Sub-keV energies up to 1 MeV

Friday, 24 October 2025 10:00 (20 minutes)

Liquid noble time proportional chambers (TPCs) are one of the most widely used scintillators in particle detection due to their low cost, high availability, and excellent scintillation properties. Many experiments in the neutrino and dark matter sectors are based on this detection technique. Here, we present a first principles study of the total quanta yield for liquid noble elements and the recombination process. We use inter-atomic potentials and the solution of the integro-differential Lindhard equation for atomic motion with electronic straggling. We introduce, from the electronic stopping cross section, the electronic scaling length as a fundamental parameter. We will study the energy and electric field dependence of the exciton-to-ion ratio for nuclear recoils based on the Bates–Griffing atomic process and spin interactions. The results for light and charge yield will be presented in terms of recombination probability within the Thomas-Imel box model, using just one fit parameter, rather than the NEST model or other models that use more than ten parameters. We will provide an explanation and comparison with recent measurements of the box size electric field dependence for LAr, LXe and LNe.

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