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Experimental study of Ar ion drift and feedback from gas to liquid phase

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A large positive volume charge can distort the drift field and quench the charge signal in a massive argon time projection chamber, thus the study of the dynamics of the positive ions created by particle interactions in liquid argon is essential for the characterization of the new generation of experiments planned for the dark matter direct search and neutrino physics. We have constructed a 1 L liquid argon chamber (ARION: ARGon ION experiment), which is able to produce a sizeable volume charge by injecting, in a controlled manner, an ion current into the argon drift region. This chamber allows the space charge effects to be studied systematically by reading the charge collected in different locations using a multichannel digital picoamperimeter. In this talk, new experimental results regarding positive ion dynamics in LAr are presented with the direct demonstration of ion feedback from the gas to the liquid. In addition, a novel technique to measure the drift velocity of the argon ions is introduced.

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