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Neutrinoless double-beta decay search with CMOS pixel charge plane in gainless TPC

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High pressure gaseous Time Projection Chamber (TPC) provides a unique combination of excellent energy resolution, event tracking for background discrimination, and scalability, which are ideal for neutrinoless double-beta decay searches. To harness the power of such a TPC, a suitable charge readout scheme has to be realized. We are developing a pixelated charge readout plane filled with an array of CMOS sensors. Each CMOS sensor has an exposed metal patch for direct charge collection, and integrates charge sensitive amplifiers as well as signal processing and digitization/transmission circuitry. The electronic noise is suppressed to a point that no additional electron-gas avalanche gain is necessary. It provides competitive energy resolution while improves on tracking capability, stability, complexity and scalability compared to alternative readout schemes. Moreover, ions drifting in the gas can be read directly since the otherwise prohibitive avalanche gain is unnecessary. It enables the use of alternative gases and double-beta decay candidate isotopes such as $^{82}SeF_6$ gas, in which only ion drifting is possible.

With moderate modifications, such a readout plane could be used in liquid noble gas and organic liquid TPCs for a broad range of applications.

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