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TRISTAN: A pixelated silicon drift detector array for the KATRIN experiment to search for sterile neutrinos

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The Karlsruhe Tritium Neutrino (KATRIN) experiment currently measures the effective mass of the electron anti-neutrino by investigating the spectral endpoint of tritium β-decay. Recently, based on the first two high-activity tritium measurement campaigns, the collaboration published the first sub-eV limit on m_ν with a value of $m_\nu < 0.8\,\mathrm{eV}$ (90% CL). Given the ultra-luminous tritium source, KATRIN is a unique instrument to also search for sterile neutrinos in a wide energy range. However, this exploration requires a novel detector system capable of performing a high-rate electron spectroscopy. To this end, we have developed a silicon drift detector (SDD) array with about 1500 pixels, called TRISTAN detector. Taking full advantage of the SDD technology, we achieve an excellent energy resolution of better than $300\,\mathrm{eV}$ (FWHM) for electrons with an energy of $20\,\mathrm{keV}$ at high input count rates of 10^5 counts per second per pixel.
This contribution gives an overview of the development and characterization of the detector system. A special emphasis is put on assessing multi-pixel effects which will play an important role in the highly integrated detector system.

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