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Practicalities of Atomic Tritium for Project 8

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Atomic tritium promises to circumvent the major systematic limitation on direct neutrino mass experiments, enabling Project 8 to reach a sensitivity of 40 meV. Building such an apparatus requires splitting copious quantities of tritium into atoms, and no existing atom source that is compatible with tritium can reach our required flux.
In Mainz, we have built a high-flow hydrogen/deuterium test facility and measured the output of a commercial tungsten-capillary atom source to a flow 20 times larger than previously published. Combined with supporting efforts across the Project 8 collaboration, we have developed new experimental methods to study intense atom sources. Our latest test stand now permits stable, long-duration experiments with outstanding signal to noise. I will recount the progression of the test stand, discuss some of the methods we have designed, and show recent results.
We are using these results to map out previously unknown shortcomings of the existing atom-source theory at high flow, and to guide the design of a new generation of custom atom sources to achieve high efficiency, high atom flux, and reliable operation with tritium. Such a source will support the Project 8 Atomic Tritium Demonstrator, including its full-flux cold atom beamline and cubic-meter atom trap.

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