

Abstract Submitted
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Customizing a CRDS Trace Gas Analyzer for Dark Matter Experiments JARED THOMPSON, KARA KEETER, Black Hills State University — Some proposed dark matter detectors require large amounts of noble gases with ultra-low levels of impurities such as H₂O, O₂, and N₂. There are no commercially available gas analyzers sensitive enough to detect these impurities at the low levels required by these detectors (<1 ppb). In order to reach the required impurity detection limits we will customize a Cavity Ring-Down Spectroscopy system. CRDS involves trapping monochromatic light between two highly reflective supermirrors placed on both sides of the sample chamber, leading to an extremely long (>1 km) effective path length through the sample. By comparing the decay rates of light intensity at a resonance frequency of the impurity with that of light that is off-resonance, the concentration of absorbing material (the impurity) is obtained. We will gain improved sensitivity over existing technology by lengthening the gas cavity, optimizing the gas-flow routes, and enhancing the laser and detection electronics. The BHSU CRDS system will first be used for the depleted argon-based dark matter detectors DARKSIDE and MAX. The system will then also be available for xenon-based dark matter detectors such as LUX. This system may also be of interest commercially.

Kara Keeter
Black Hills State University

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