Contribution ID: **247** Contribution code: **NAT-7** Type: **Oral Presentation**

# Further Development of Manganese-53 AMS Nuclear Science Laboratory at the University of Notre Dame

*Monday, 21 October 2024 14:10 (20 minutes)*

$^{53}$Mn is a rare, radioactive isotope with a half-life of 3.74 million years which has astrophysical applications as an early solar system chronometer and as a test of nucleosynthesis models of supernovae and asymptotic giant branch (AGB) stars. In addition, $^{53}$Mn has geological applications in determining the exposure and burial age of ferromanganese minerals. To fully exploit the capabilities of $^{53}$Mn as a chronometer, a sensitivity to the $^{53}$Mn/$^{55}$Mn ratio of $1 \times 10^{-13}$ is necessary. Due to this low ratio, and interference from the naturally abundant $^{53}$Cr isobar, Accelerator Mass Spectrometry (AMS) is the only technique sensitive enough to make these isotopic ratio measurements. However, $3 \times 10^{-13}$ is the detection limit among active facilities[1]. At the University of Notre Dame's Nuclear Science Laboratory (NSL), work is ongoing to develop $^{53}$Mn AMS capability using a 10 MV FN tandem accelerator and a Browne–Buechner Spectrograph operated as a gas-filled magnet. During previous experiments, meteoric samples with $^{53}$Mn/$^{55}$Mn ratios between $10^{-10}$ and $10^{-8}$ were measured. This presentation discusses the results of varying the experimental parameters on the detection limit.
This work is supported by the National Science Foundation Grant No. NSF PHY-2310059.

1) Wallner, A., Fifield, L. K., Froehlich, M. B., Koll, D., Leckenby, G., Martschini, M., Pavetich, S., Tims, S. G., Schumann, D., & Slavkovská, Z. (2023). Accelerator mass spectrometry with ANU's 14 million Volt Accelerator. Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms, 534, 48–53. https://doi.org/10.1016/j.nimb.2022.10.021

## Student Submission

Yes

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**Session Classification:** New and Advanced AMS Techniques

**Track Classification:** New and Advanced AMS Techniques