

# Sidecar's Future and Other Cavity Concepts

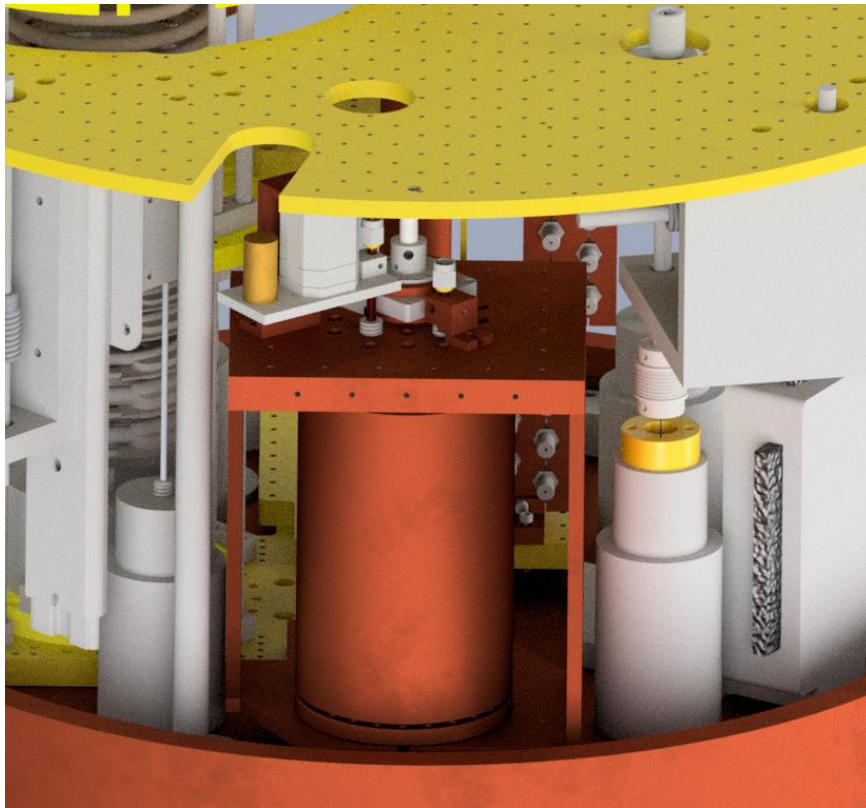
August, 2018

Nathan Woollett



# The Sidecar Space

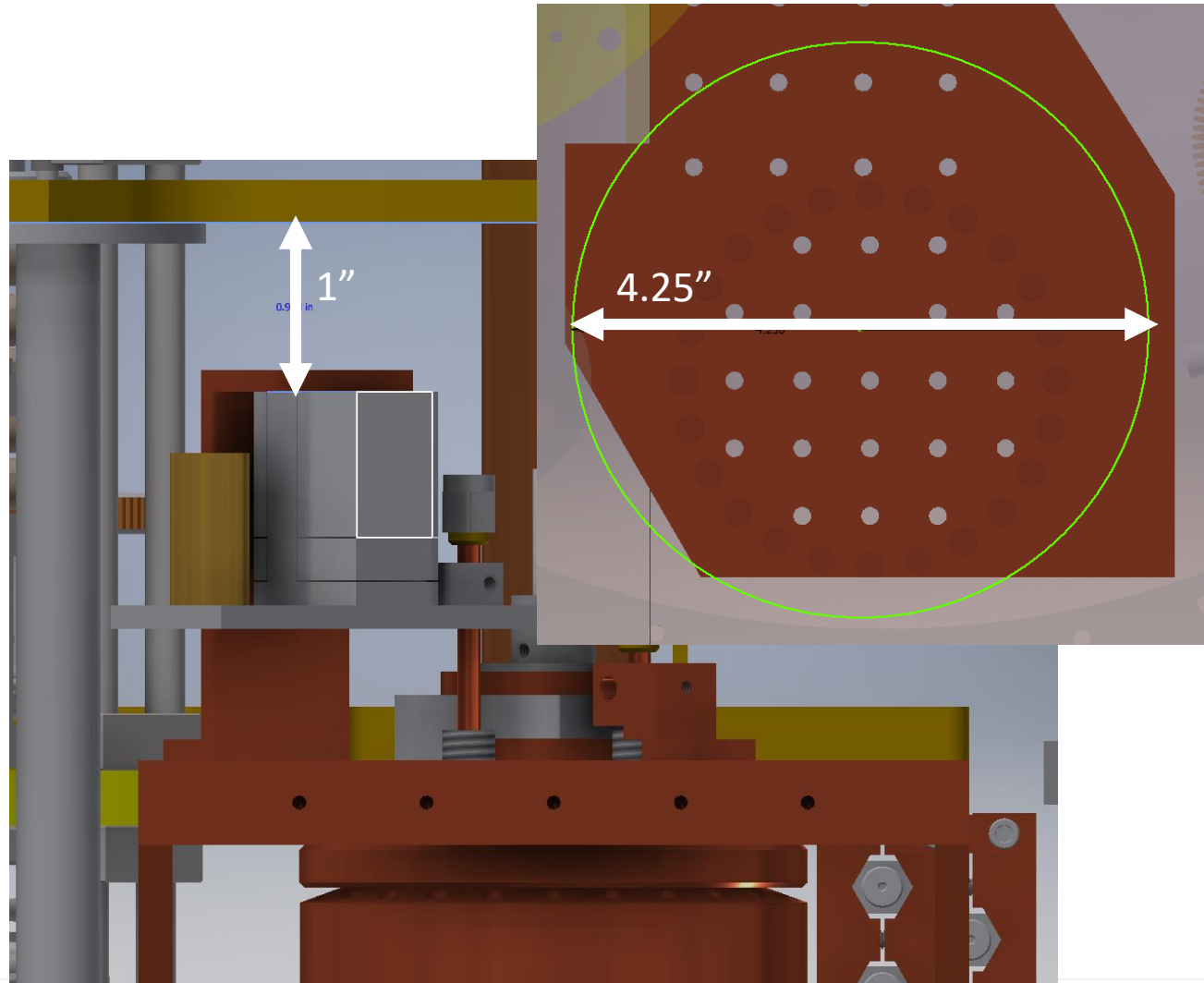
- At the moment the sidecar cavity poorly utilizes the available space.
- The piezo actuators were connected to the millikelvin stage.



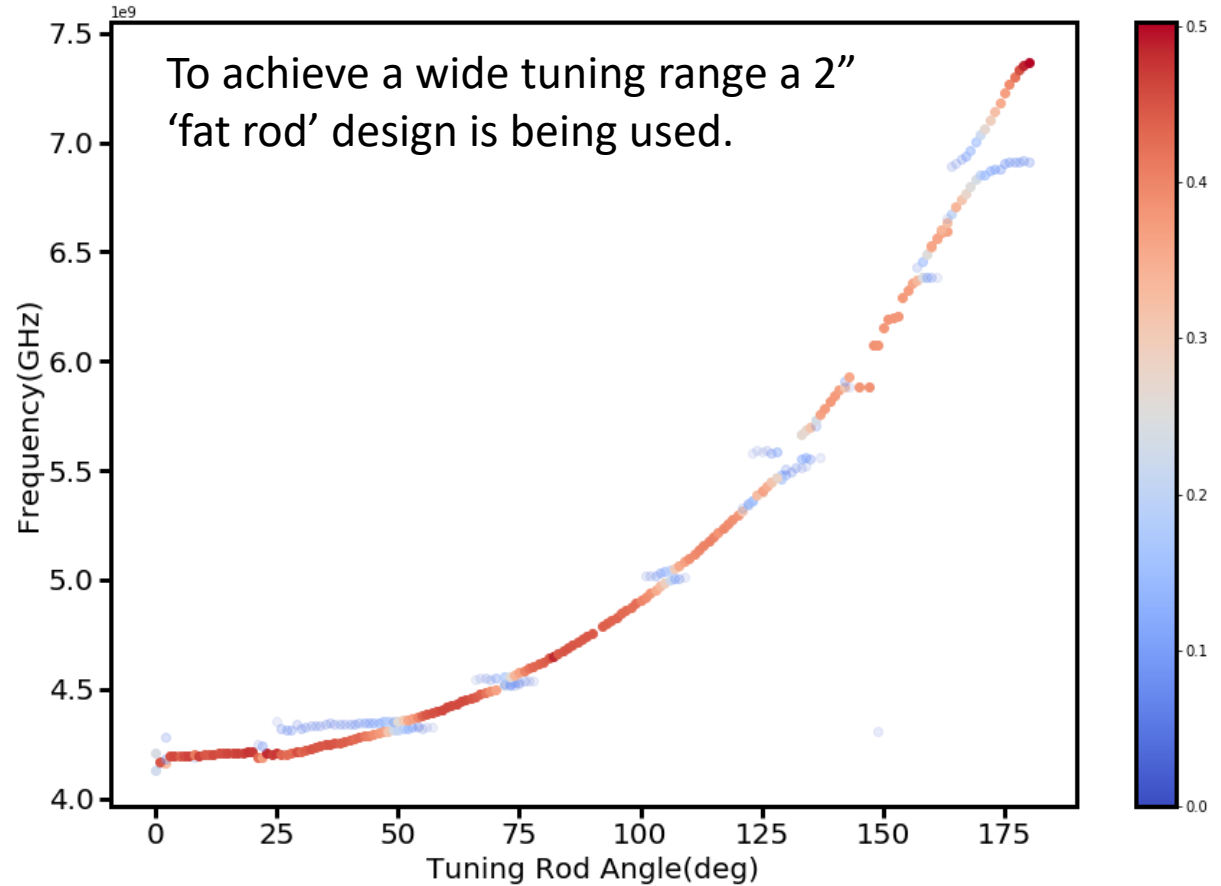
# New Cavity Dimensions

Sidecar original:  
diameter – 2.5"  
Height – 4.75"

Sidecar 2:  
Diameter – 3.625"  
Height – 5.5"

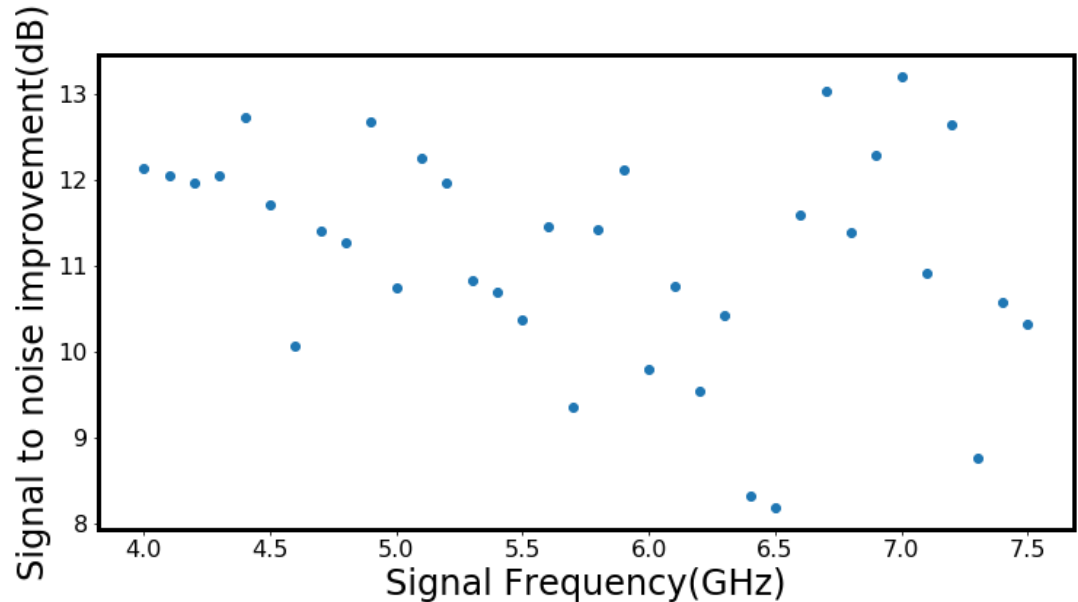
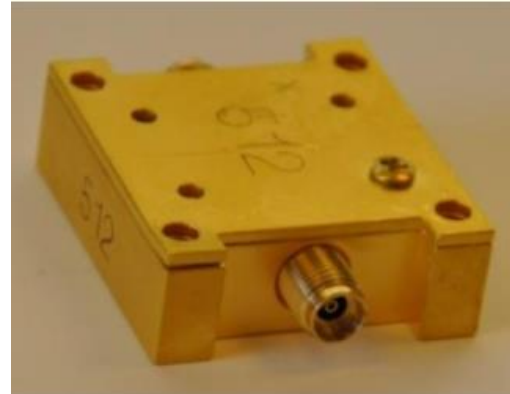


# New Cavity Dimensions



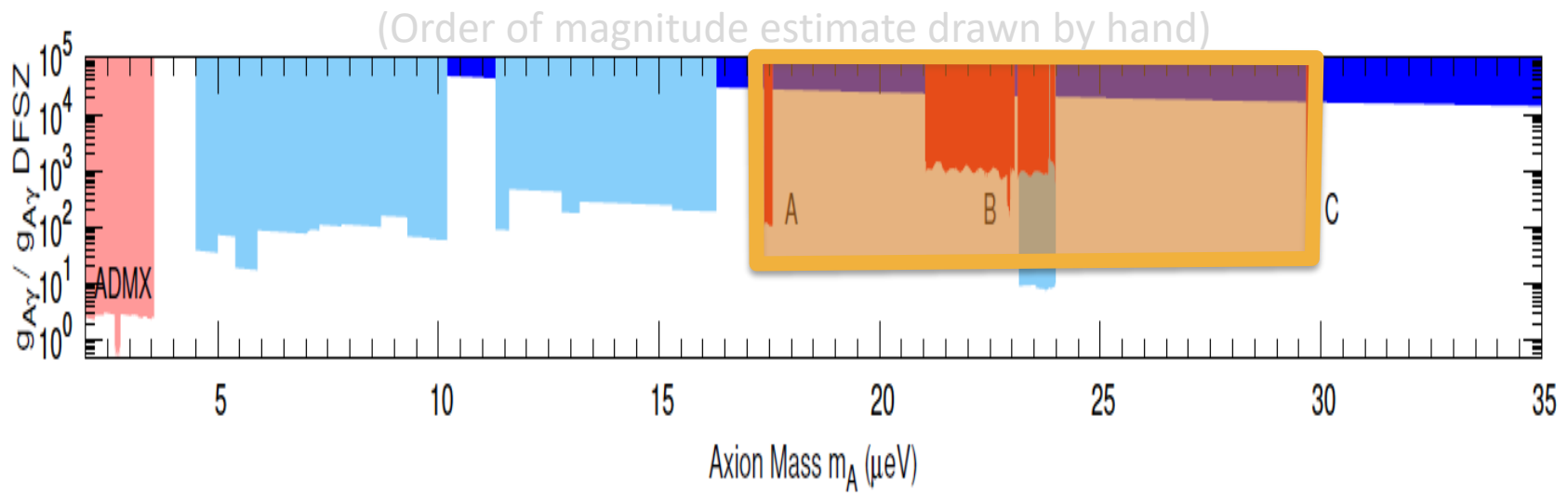
# Parametric Amplification

- Low noise first stage amplification decreases overall noise temperature significantly.
- TWPAs can provide broad band, low noise parametric amplification.
- Enables the experiment to search multiple GHz in a single run.



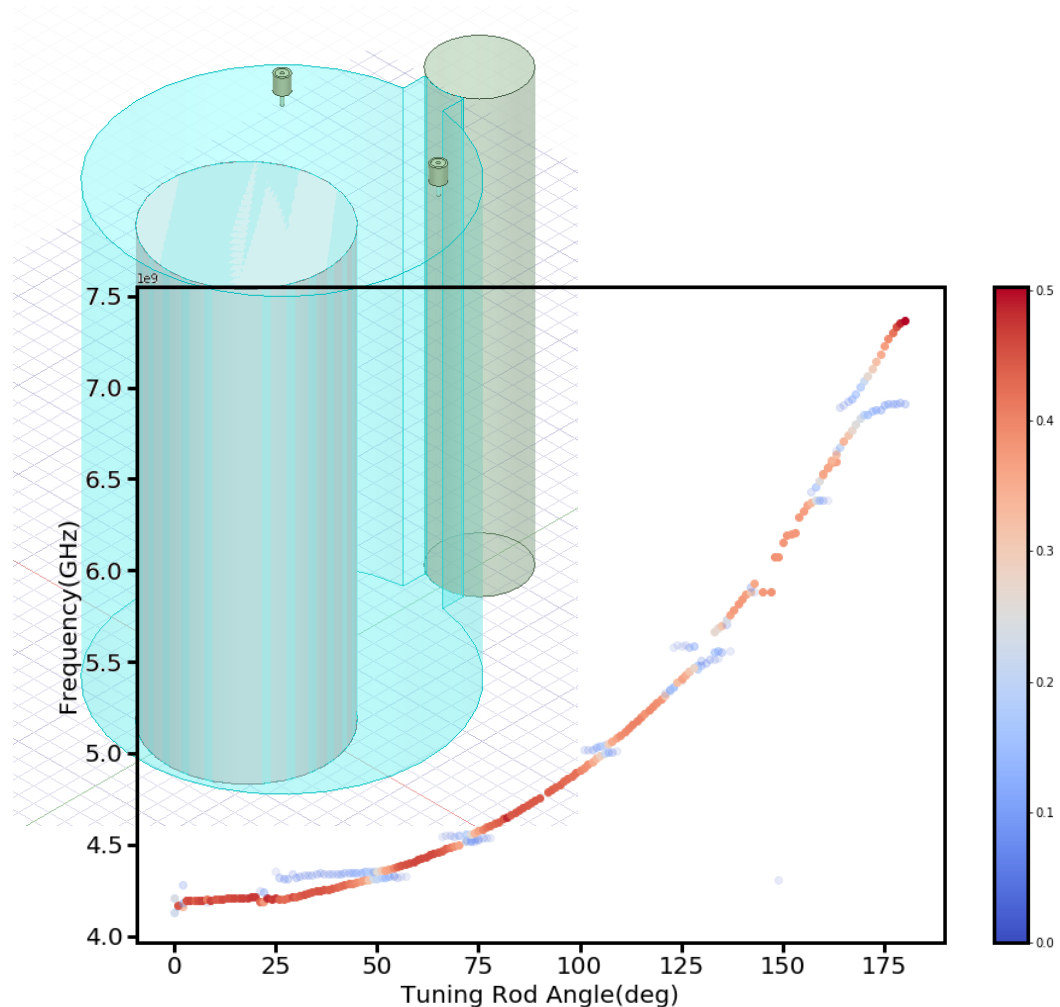
# Expected Exclusion

- Sidecar will run in parallel with the main experiment throughout 2019
- KSVZ is still out of reach to a maximum frequency range approach will be deployed.

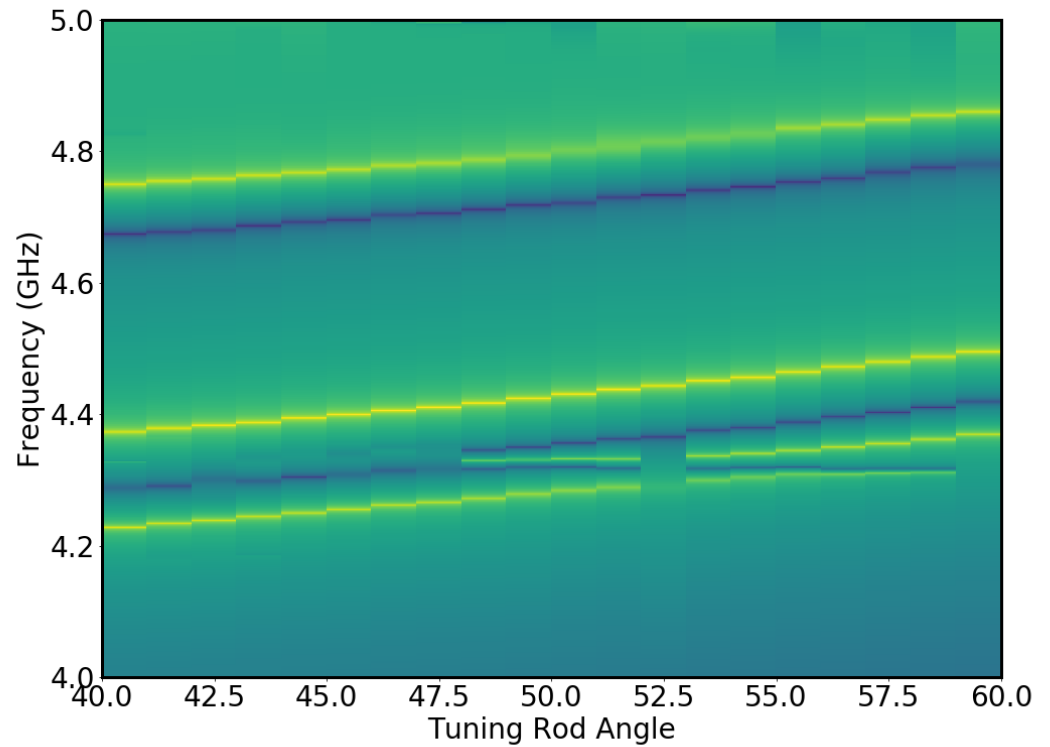
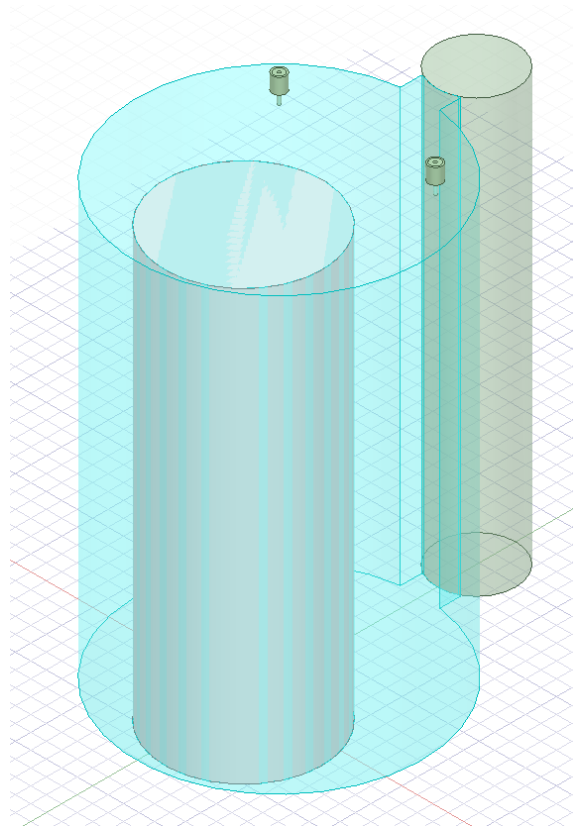


# The Slotcar

- Fatrod designs introduce a high number of mode crossings. Can we avoid them?
- The slotcar is designed to ruin the Q of TE modes and minimize the size of crossings.



# The Slotcar





# Summary

- Sidecar will provide useful R&D to guide the main ADMX experiment.
- Real science results are being produced with an ambitious 2018/2019 run plan
- Keep an eye out for our upcoming paper.

## Piezoelectrically Tuned, Multi-mode Cavity Search for Axion Dark Matter

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**PARTICLE SEEKERS**  
 scientists University of Washington, Seattle  
 researchers The ADMX detector, which is designed to detect dark matter particles called axions. The experimental particles may account for the dark matter that is supposed to make up about 85% of the matter in the universe. (Clockwise from top left) Josh Kohler, Michael Chen, and Paul Schaffner; (clockwise from top right) Michael Chen, Josh Kohler, and Paul Schaffner; (clockwise from bottom left) Michael Chen, Josh Kohler, and Paul Schaffner; (clockwise from bottom right) Michael Chen, Josh Kohler, and Paul Schaffner.

ADMX G2 at U. Washington, Scientific American, 2015

## Collaborating Institutions: UW, UFL, PNNL FNAL, UCB, LLNL LANL, NRAO, WU, Sheffield

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