



# The Global Network of Optical Magnetometers for Exotic physics searches (GNOME)

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on behalf of the GNOME collaboration

## Introduction

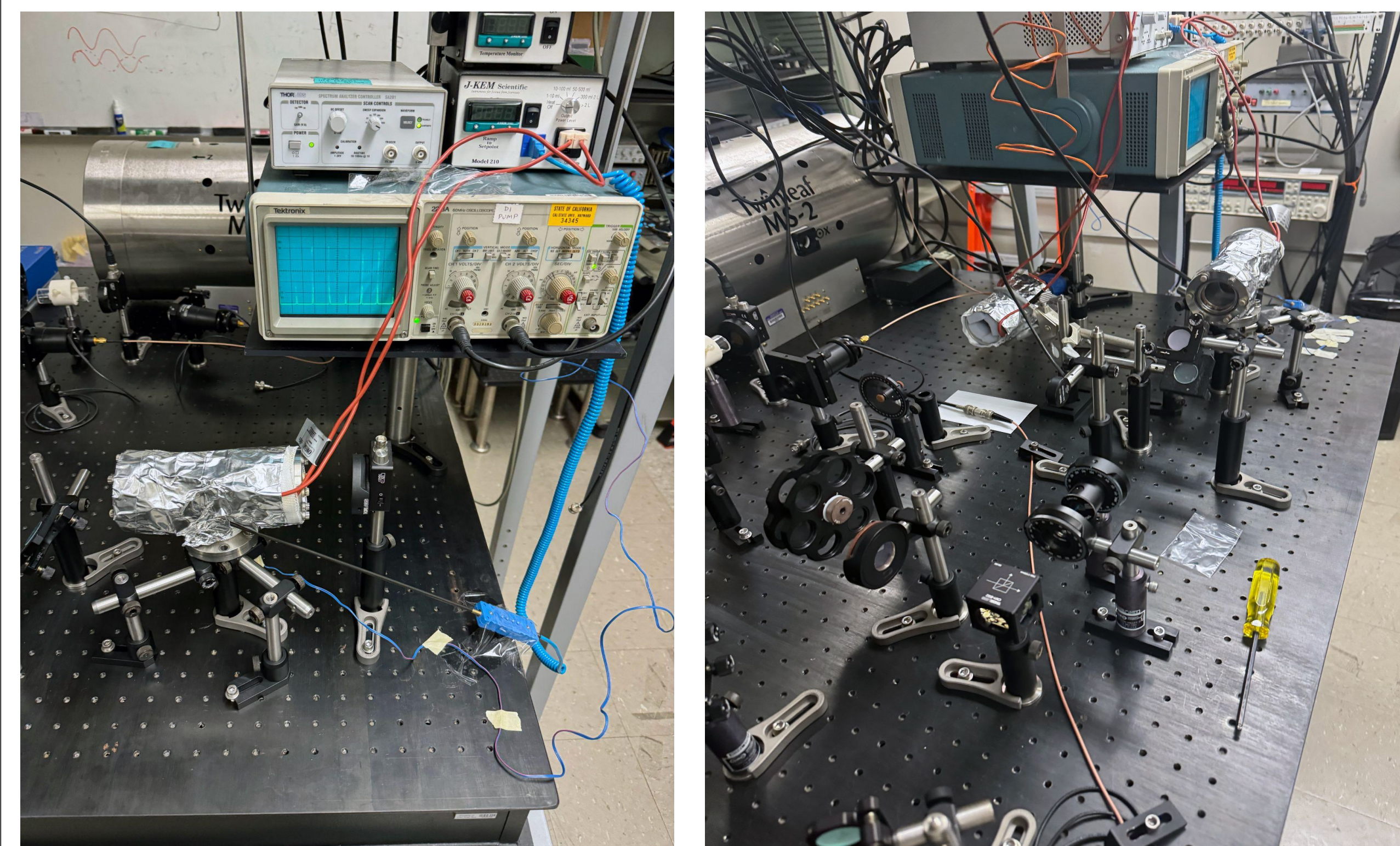
- GNOME constitutes an international network of more than a dozen time-synchronized optical atomic comagnetometers (OAMs) designed to detect correlated signals associated with physics extending beyond the Standard Model. With installations spanning Europe, North America, Asia, the Middle East, and Australia, the data generated by GNOME serves as a significant resource for examining hypotheses pertaining to dark matter and potentially dark energy.



**Goal:** To evaluate vapor cells produced by TwinLeaf with the aim of optimizing the K/Rb atomic density ratio.

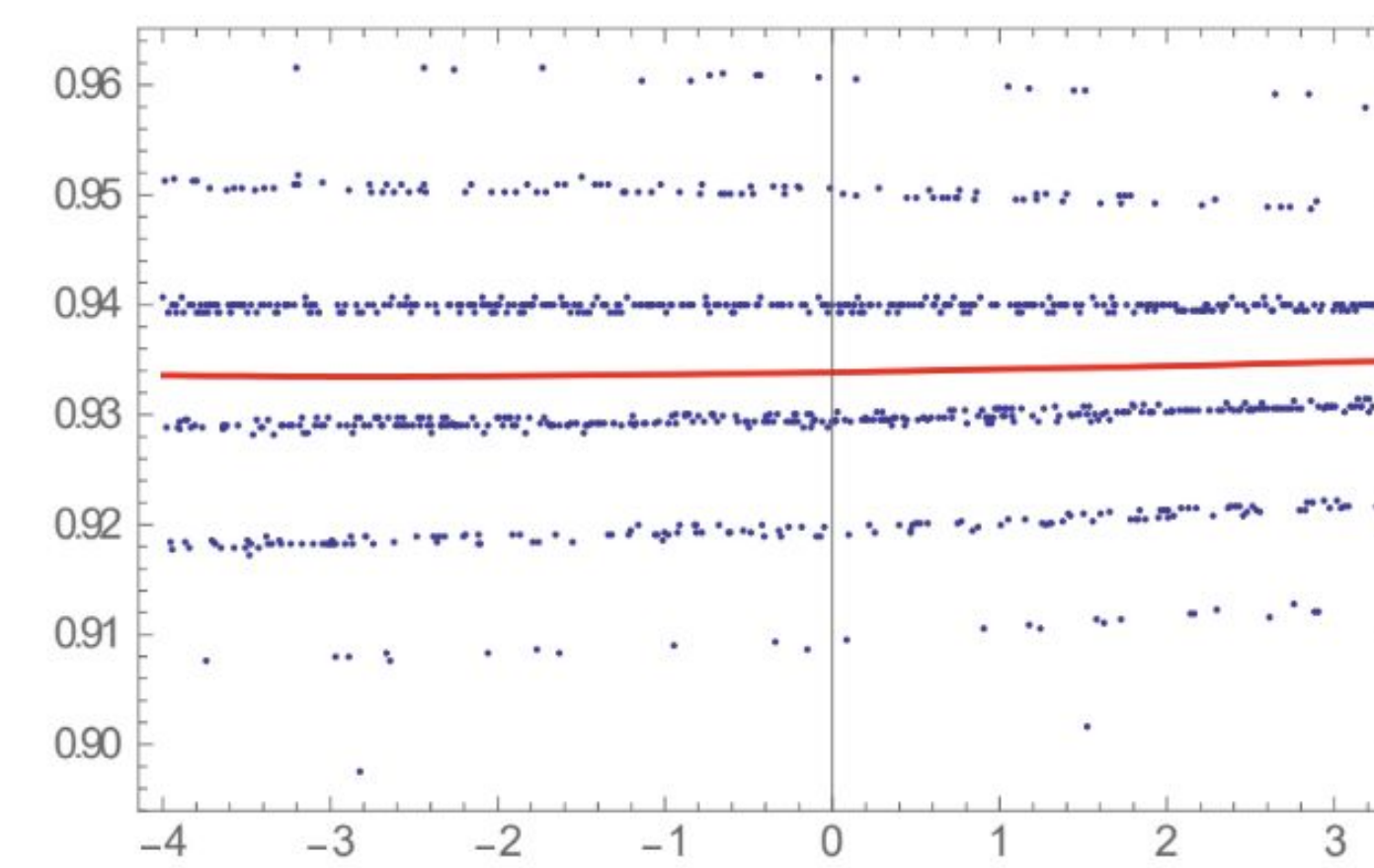
## Methods

- Measure absorption spectra at various cell temperatures and aligning the data with calculated spectra to determine the densities of K and Rb.
- Determine the pressure broadening of spectral lines resulting from collisions with He-3 to ascertain the density of He-3.

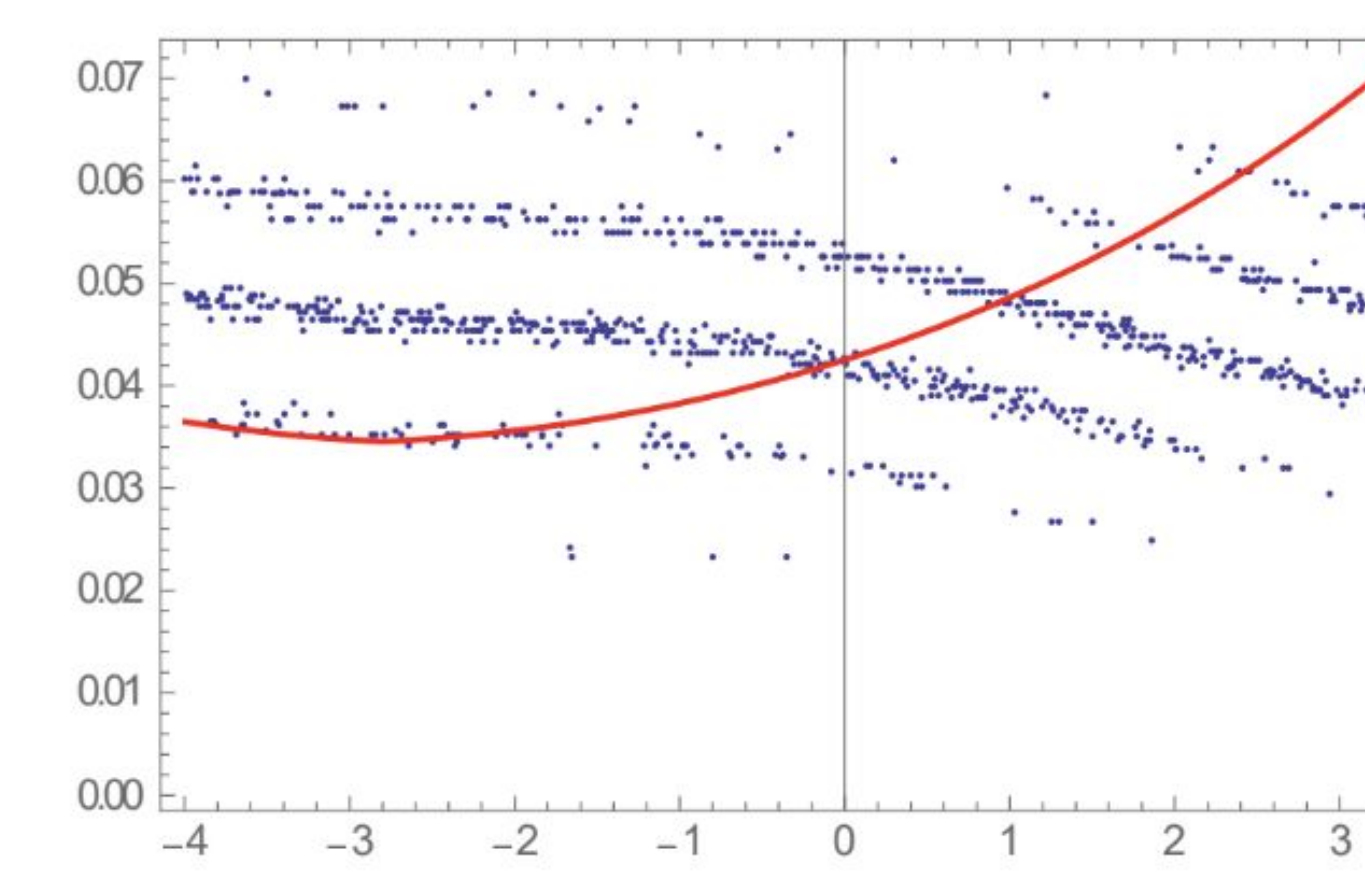


## Results

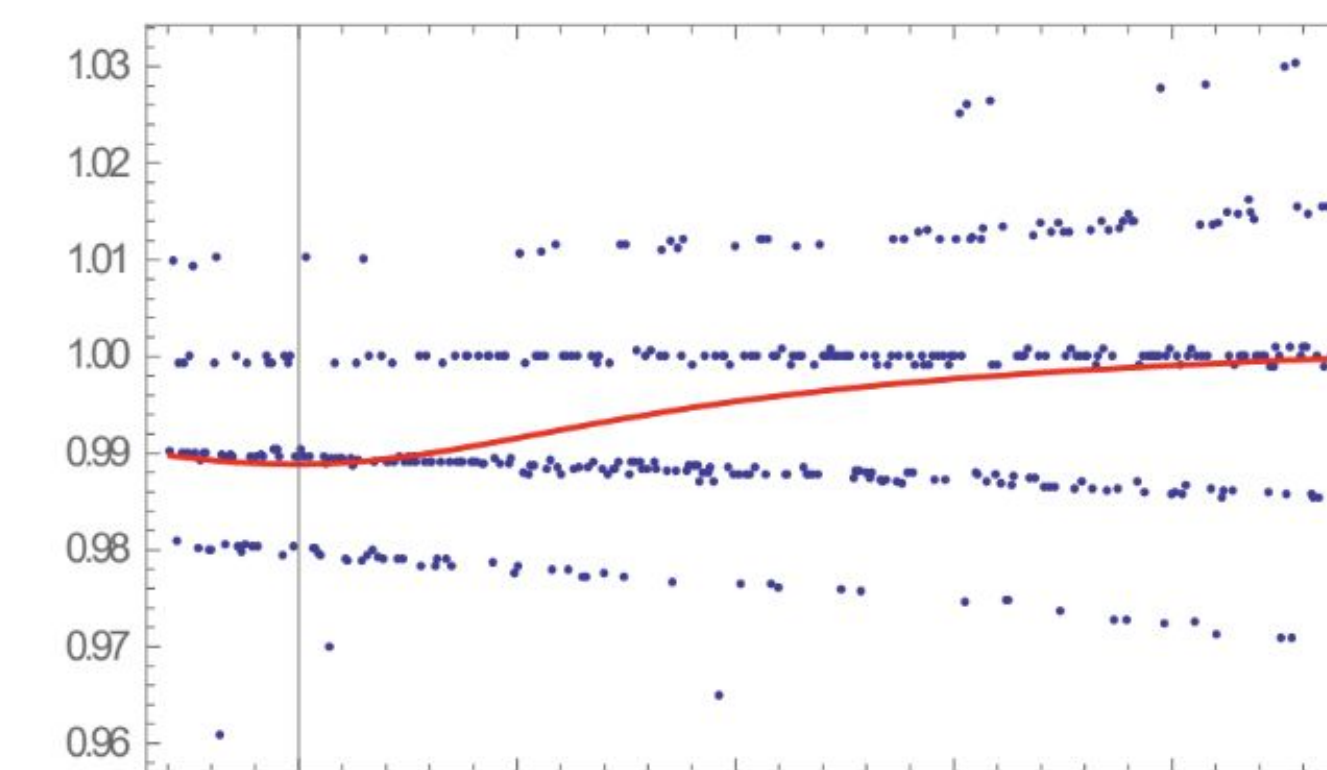
K= 45.8°C



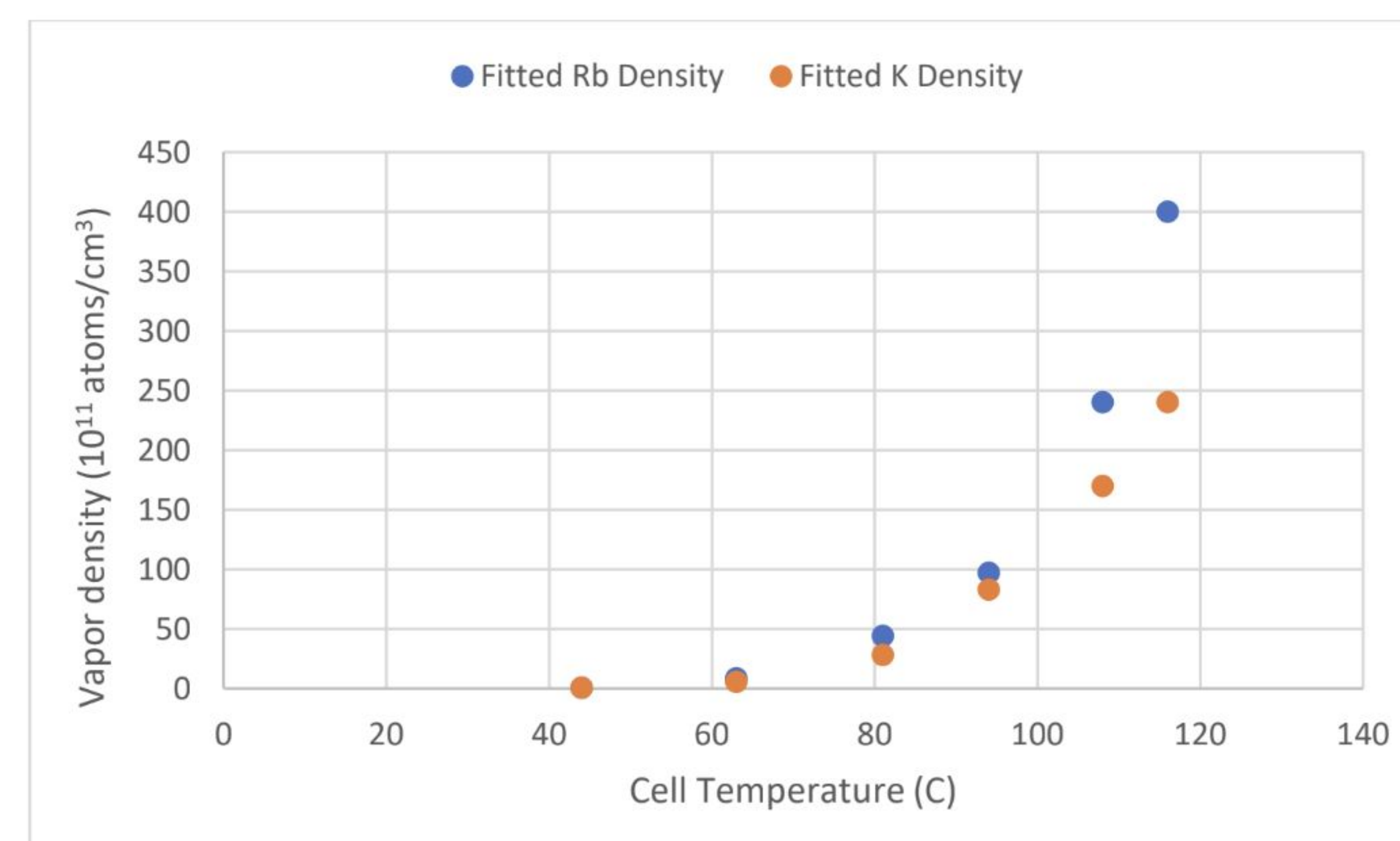
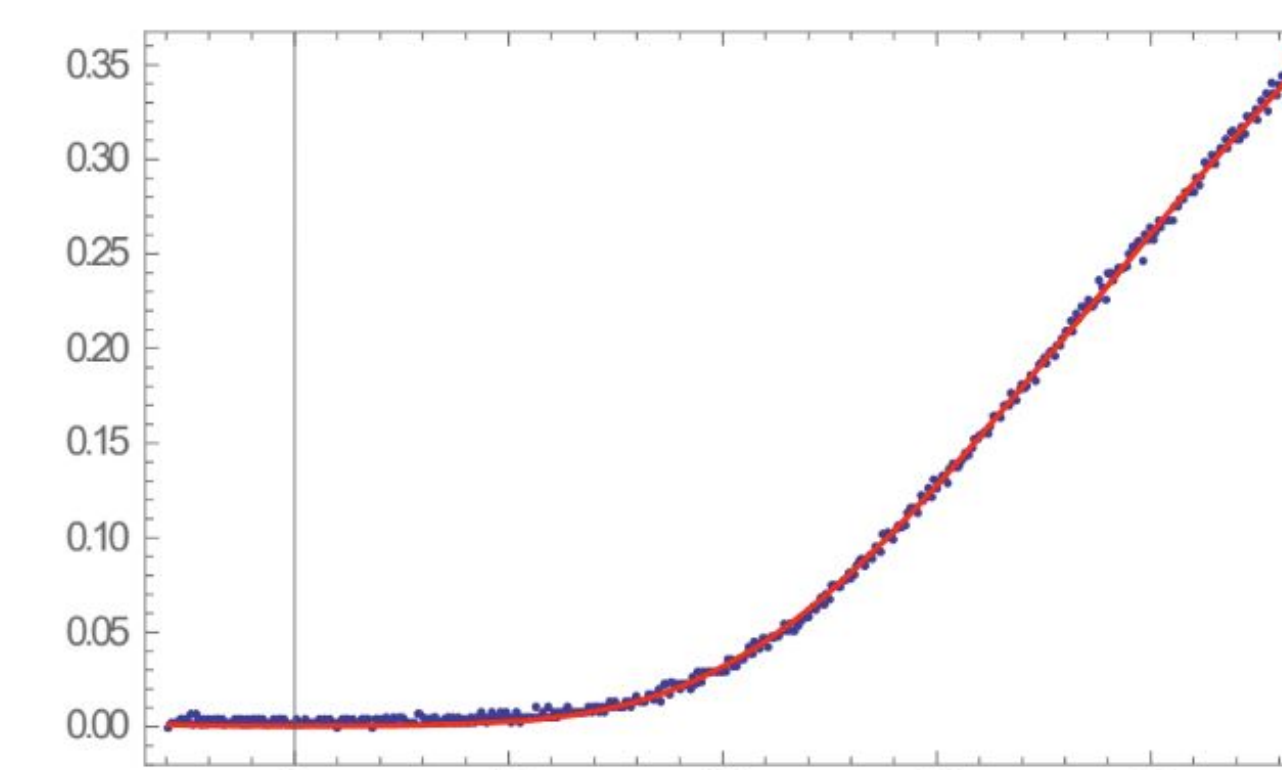
K= 116.6°C



Rb= 45.8°C

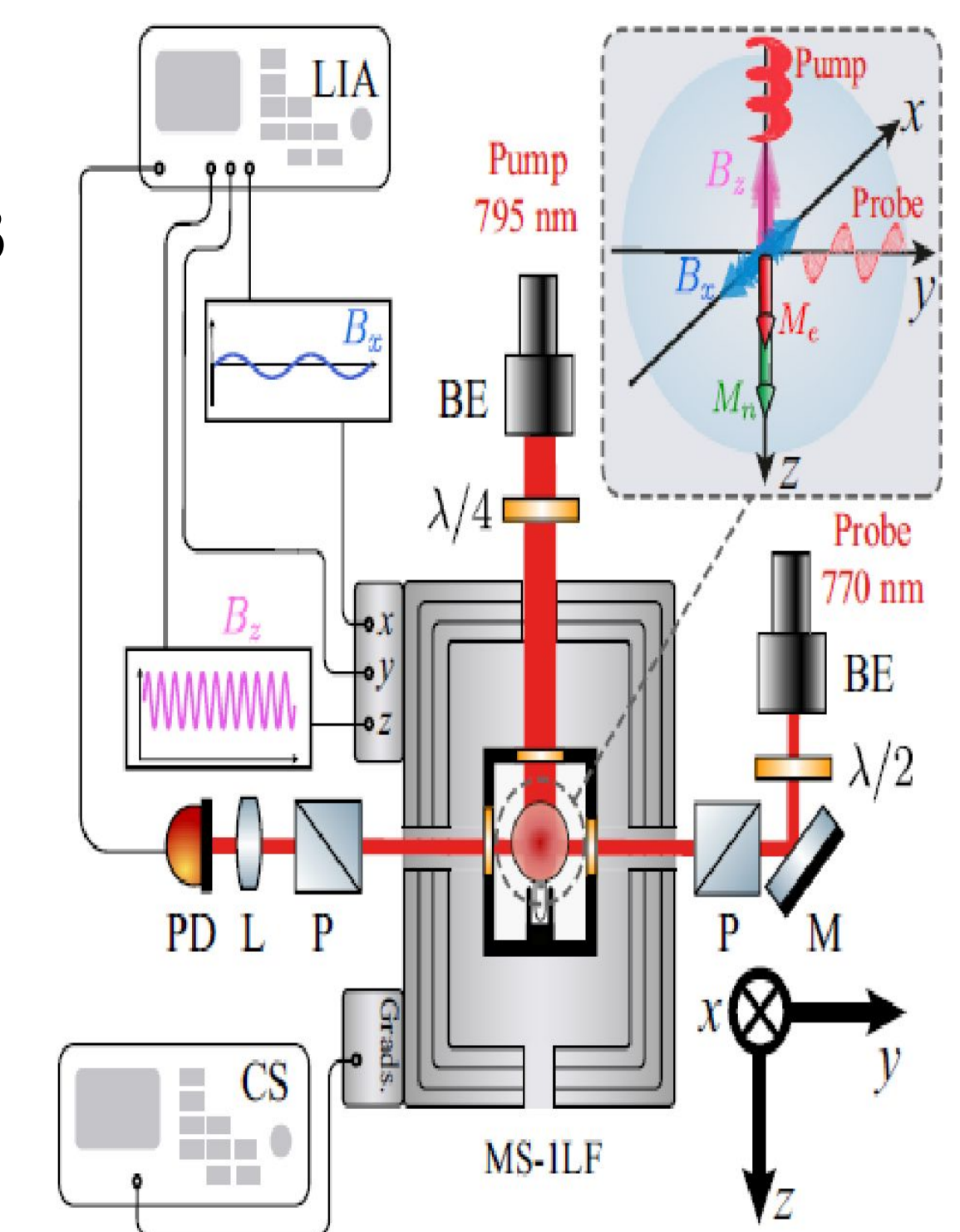


Rb= 116.6°C



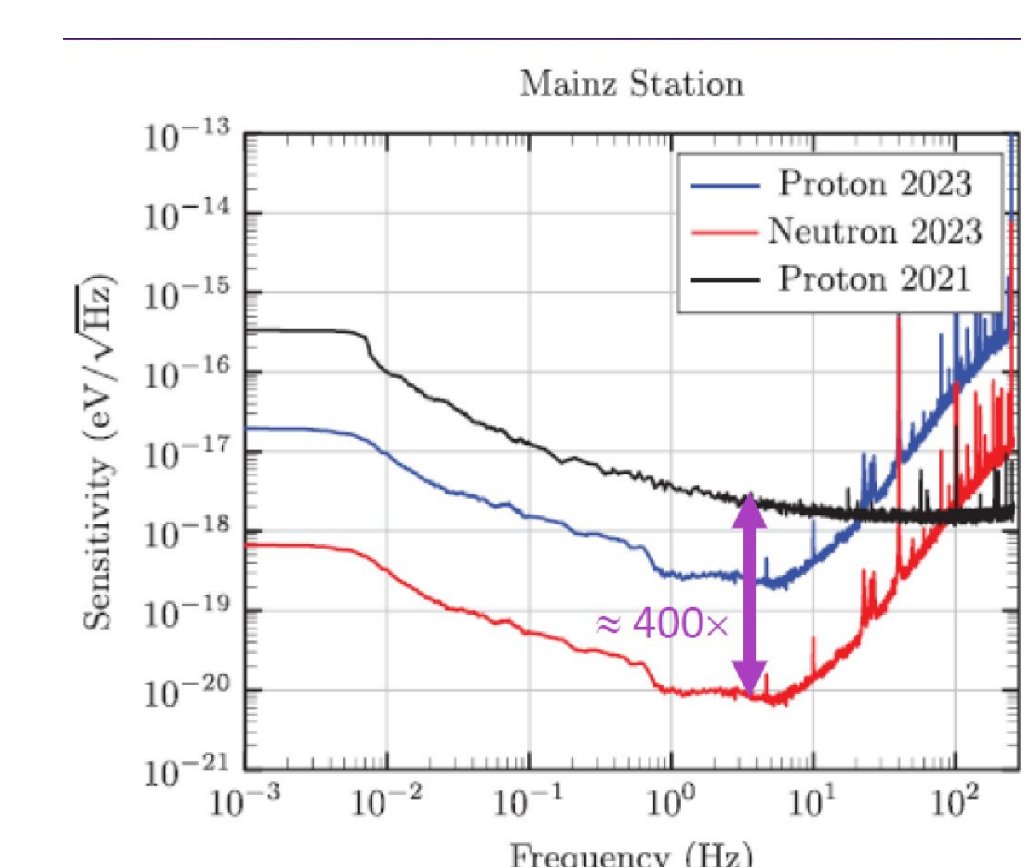
## Future Experiment Setup

- The GNOME dark matter sensor features a three-species comagnetometer. The central vapor cell contains high-density (3 atm) He-3 gas. The alignment of He-3 spins is achieved through collisions with laser-polarized Rb atoms. Should dark matter influence the He-3 spins, these, in turn, affect the K spins. We track the K spins by observing the optical rotation of 770 nm laser light, which is tuned close to the K D1 transition.



## Conclusion

- The GNOME lab has analyzed the vapor cells to optimize the density ratio of K/Rb.
- Next Step:** The GNOME lab will be examining the identical K/Rb vapor cells to assess whether they have remained stable or undergone any changes. This analysis could offer significant insights into the behavior of these cells.



## Acknowledgement

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