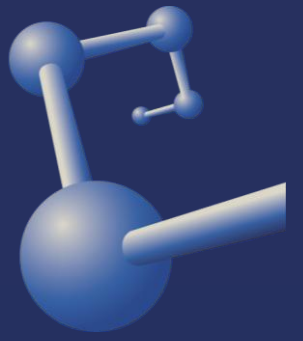


Zeeman Effect in the Forbidden Transition $5P_{3/2} \rightarrow 6P_{3/2}$ in Atomic Rubidium



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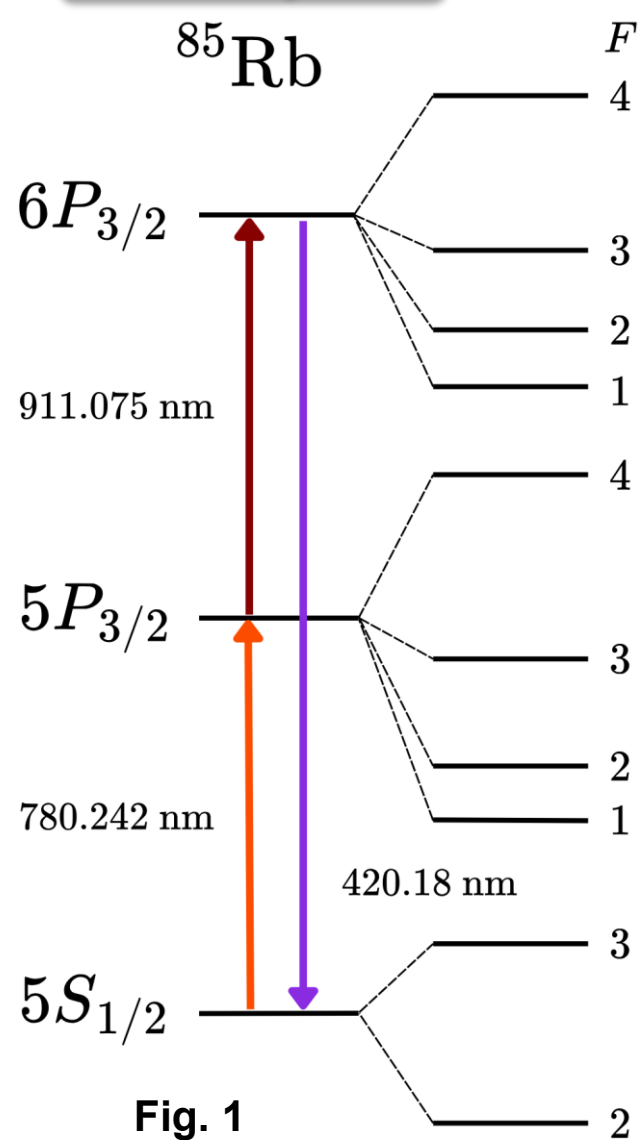
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Introduction

Electric-quadrupole transitions are frequently used in atomic clocks based on optical lattices [1], and for frequency standards in quantum metrology [2].

The forbidden transition $5P_{3/2} \rightarrow 6P_{3/2}$ in Rb was first observed in [3], and now it is studied under the effect of a homogeneous magnetic field.

Atomic system



Electric-dipole
 $\Delta F = 0, \pm 1$
 $\Delta M_F = 0$

$$\vec{B} = B_0 \hat{z}$$

Electric-quadrupole
 $\Delta F' = 0, \pm 1, \pm 2$
 $\Delta M_{F'} = \pm 1$

$$\vec{\epsilon}_{780}, \vec{\epsilon}_{911} \parallel \vec{B}$$

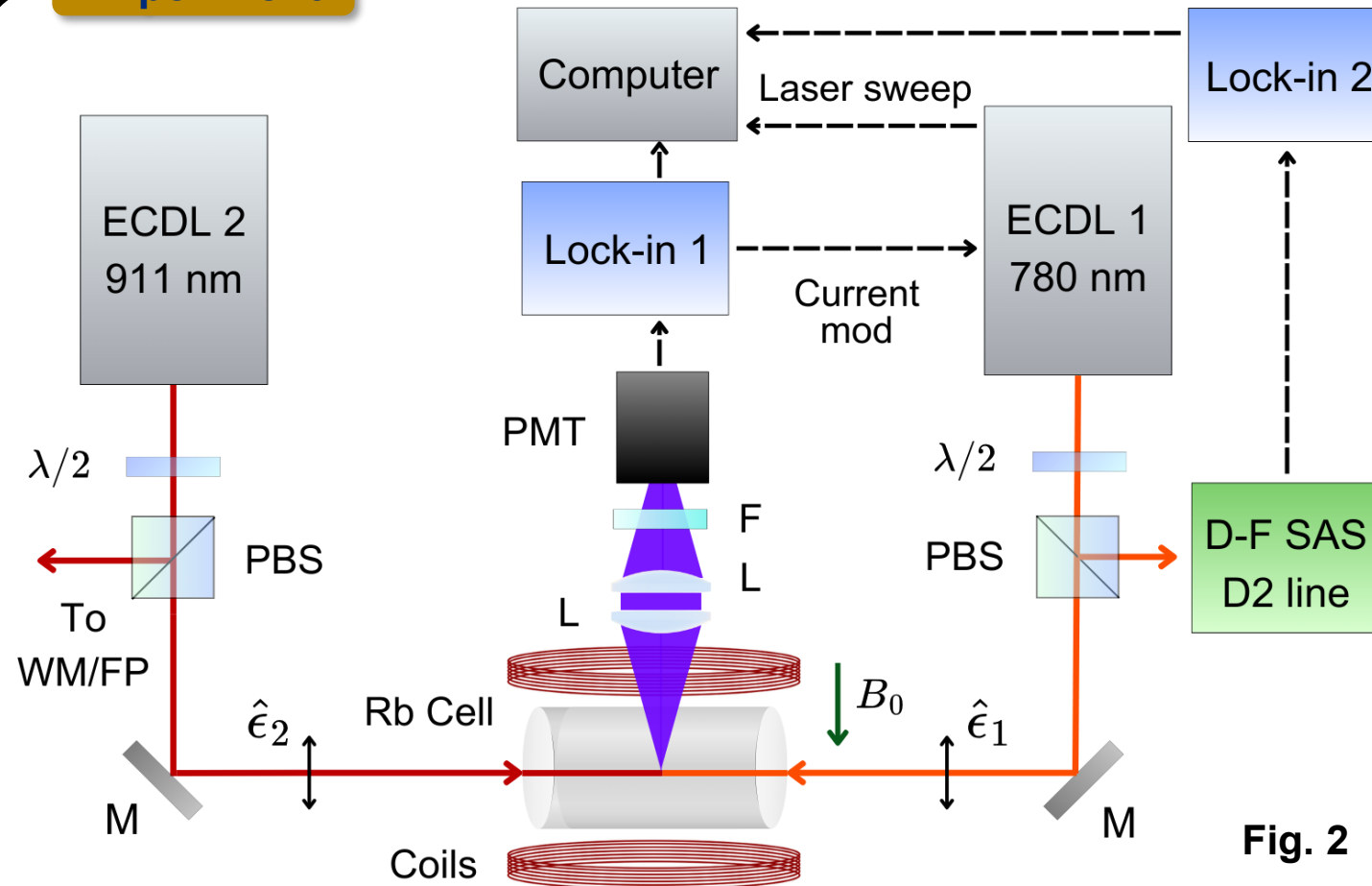
Conclusions

Theoretical prediction of lines positions agreed with the experimental data. In low field limit, the $F_1 = 3 \rightarrow F_2 = 4 \rightarrow F_3$ cyclic transition is dominant. Currently, we are working in the identification of transitions using Breit-Rabi diagrams, and in the calculation of line intensities.

References

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- [3] Ponciano-Ojeda, F., et al. (2015). Observation of the $5p_{3/2} \rightarrow 6p_{3/2}$ electric-dipole-forbidden transition in atomic rubidium using optical-optical double-resonance spectroscopy. Physical Review A, 92

Experiment



ECDL: external cavity laser diode, PMT: photomultiplier tube, WM: wavemeter, FP: Fabry-Pérot interferometer, PBS: polarized beam splitter, M: mirror, L: lens, F: 420 nm filter.

- ECDL 1 is frequency-swept to observe the $5S_{1/2} F_1 = 3 \rightarrow 5P_{3/2} F_2 = 2, 3, 4$ transitions.
- ECDL 2 is tuned to the $5P_{3/2} \rightarrow 6P_{3/2}$ transition.
- The 420 nm fluorescence emitted by the $6P_{3/2}$ decay to $5S_{1/2}$ is monitored by current-modulated phase detection.
- Rb cell is at 40 °C

Results

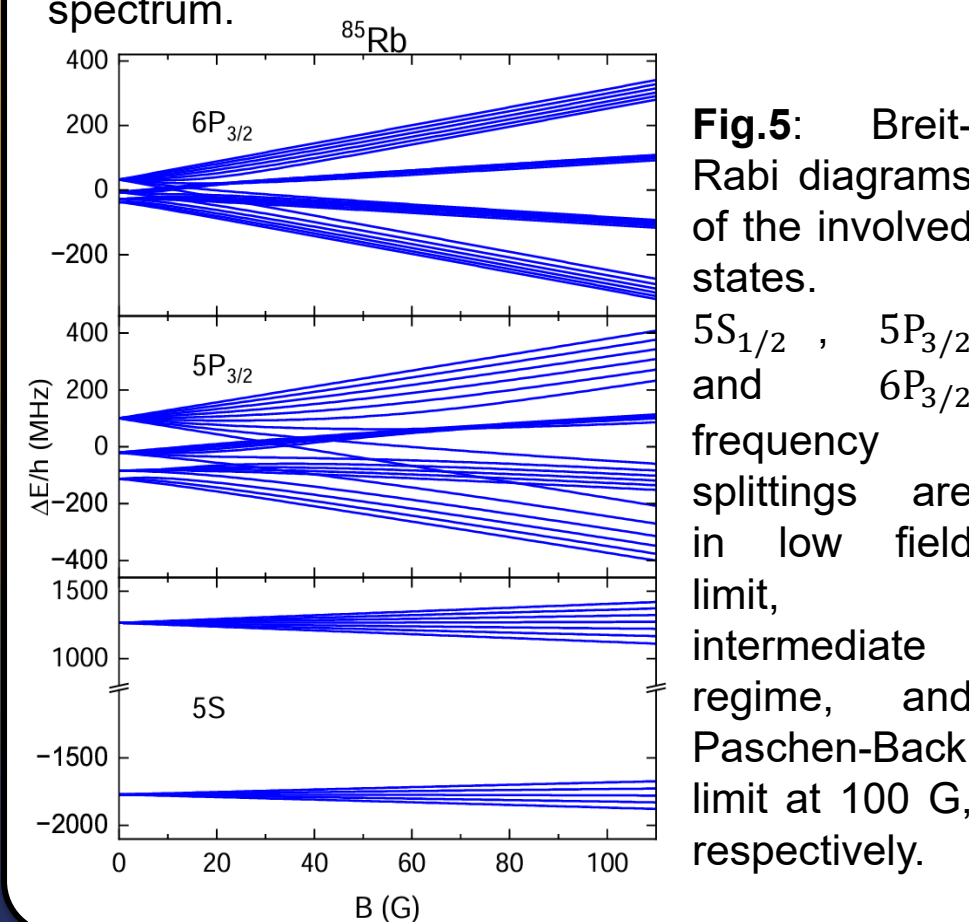
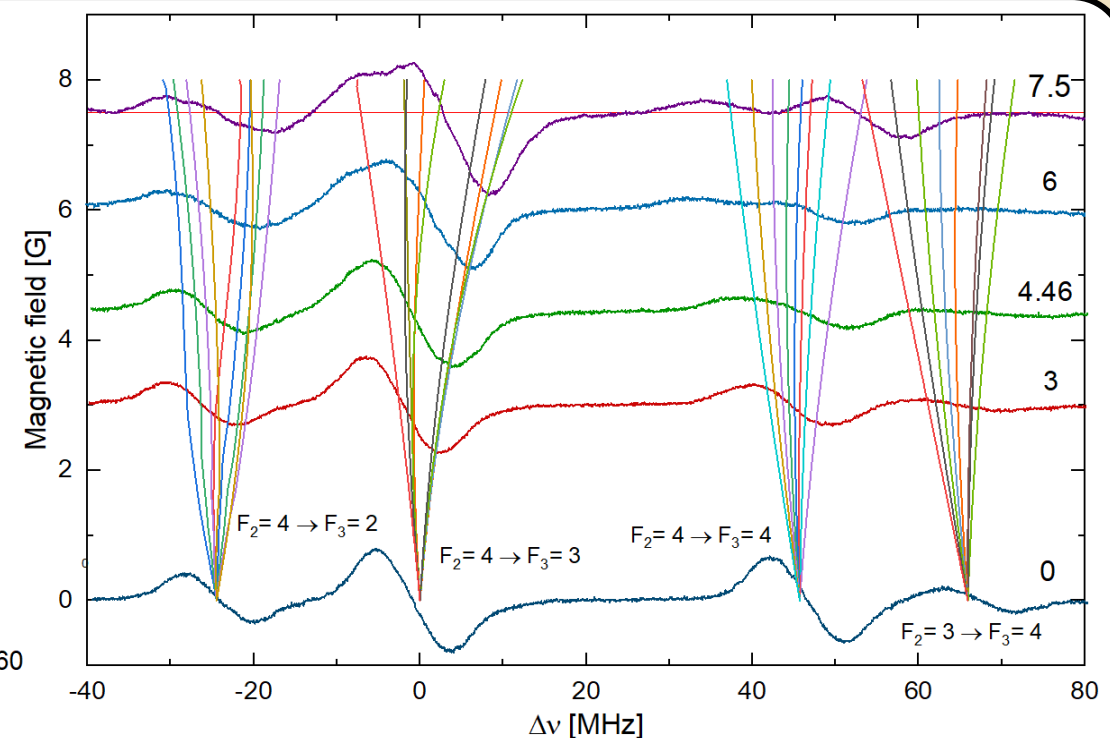
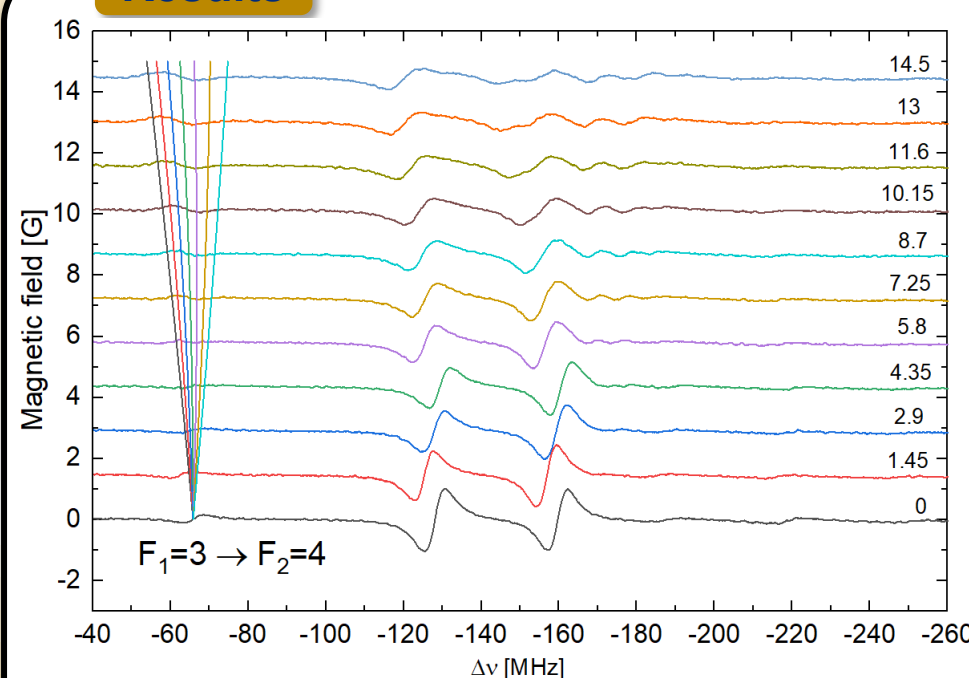
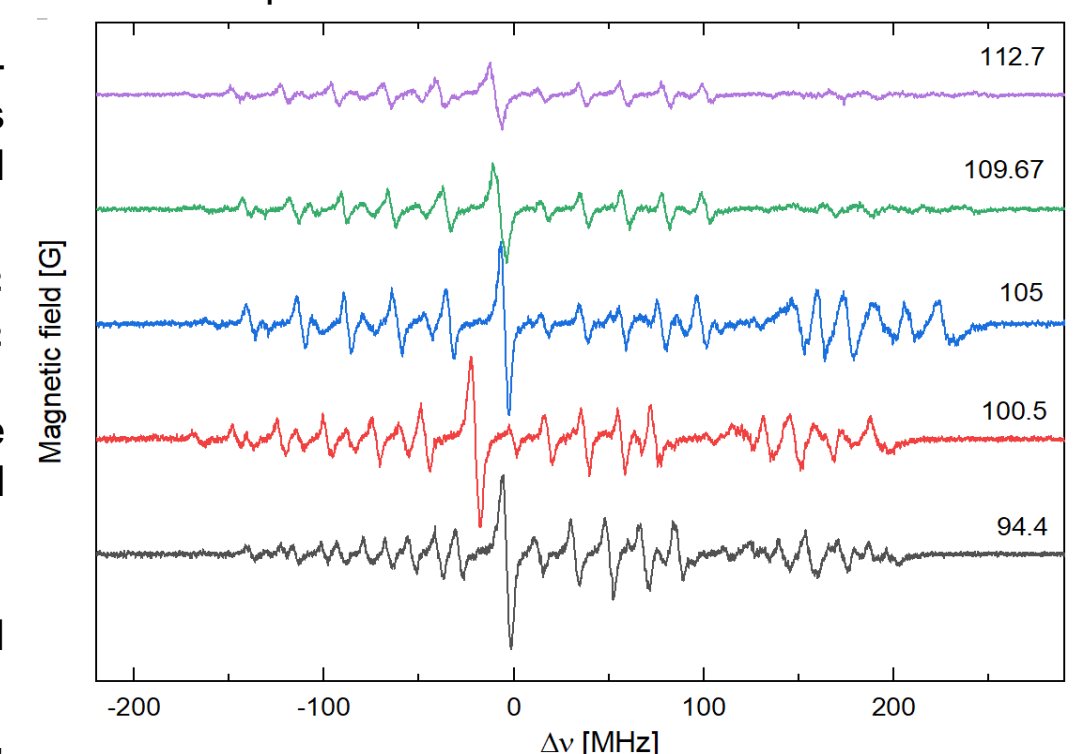


Fig. 6: Forbidden transition $5P_{3/2} \rightarrow 6P_{3/2}$ spectra in the Paschen-Back limit. The plot shows magnetic field [G] vs detuning Δv [MHz] for various F2 to F3 transitions.



Acknowledgements

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