SFIT Data Analysis Toolkit

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Abstract

This toolkit provides practical instructions and code to test SFIT predictions using ultra-cold neutron data.

1 Key SFIT Predictions

- Resonance frequency: 1.20134 mHz ($\pm$ 0.00005 mHz)
- Period: 833.3 seconds
- Phase of maximum overshoot: 416.65 seconds after mirror step
- Expected contrast: 0.122% $\pm$ 0.01%
- Sideband ratio: $J_1^2/J_0^2 \approx 0.0152$

2 Fourier Analysis Code

```
import numpy as np
import matplotlib.pyplot as plt
from scipy.fft import fft, fftfreq

# Load your 1-second binned count rate data
t = np.arange(len(counts))
signal = counts - np.mean(counts)

yf = fft(signal)
xf = fftfreq(len(t), d=1.0)

plt.plot(xf, np.abs(yf))
plt.xlim(0.0005, 0.0025)
plt.axvline(0.00120134, color='r', linestyle='--', label='SFIT␣1.20134␣mHz
    ')
plt.xlabel('Frequency␣(Hz)')
plt.ylabel('Magnitude')
plt.legend()
plt.grid()
plt.show()
```

Signature	SFIT Prediction
Resonance frequency	1.20134 mHz
Overshoot phase	416.65 s after mirror step
Contrast modulation	$0.122\% \pm 0.01\%$
Sideband ratio	$J_1^2/J_0^2 \approx 0.0152$

3 Expected Signatures

4 How to Engage

- Download the Full Preprint
- Run the Python code above on your data
- Look for the 1.2 mHz peak and phase-locked overshoot