Homework Due 10/16

Intermodulation Fluorescence Spectroscopy

\[ S(t) \]

\[ I_1 = I_0 + I'_0 \cos 2\pi f_1 t \]

\[ I_2 = I_0 + I'_0 \cos 2\pi f_2 t \]

\[ k_1 = -k_2 \quad \text{(counter propagating beams)} \]

A) Using the fact that fluorescence is proportional to \( \Delta N \cdot I \), write an expression for the signal \( S(t, v - \Delta) \).

B) The fluorescence signal is detected with a lock-in amplifier at \( f_1 + f_2 \). [This gives an output \( A = \int_{-\infty}^{+\infty} \cos(2\pi(f_1 + f_2)t) \cdot S(t) \, dt \).]

Show that the spectrum recorded has a resolution of order the natural linewidth, and no Doppler background.