Hi Professor

This day I figure out some effects which caused the instability of the formic acid laser output power, and by slightly adjust some operation parameters, the output instability would be decrease.

It looks like that CO2 laser standing wave in the resonant tube will results in the instensity instability with thermal expansion ,as I scanning the peak structure on one peak with more narrow steps, I found that there are more small peak structure on the main peak bump, where the peak-peak distance is about 2um,one fourth CO2 laser wavelength .Calvin suggest me to increase the formic acid gas pressure to increase the absorption of the CO2 laser .As I increase the Formic acid gas pressure from 160mTorr to 190 mTorr .the small peak structure would be much small ,and the intensity profile with the cavity shift looks more smooth .

As the FIR intensity always shift before 2 hours after turning on the system. I add a beam splitter to split the output power into two channel, one channel is used for reference channel to measure the FIR intensity ,the other channel is used for scanning channel for measuring the beam profile ,than the measurement error caused by intensity change could be diminished by normalize to the reference channel .

After improving the measurement setup ,next I will measure the beam profile at different local best cavity position to find the best gaussian beam profile .

These days, I identified some factors causing the instability of the formic acid laser output power. By slightly adjusting operational parameters, I was able to reduce this instability.

It appears that the standing wave of the CO2 laser in the resonant tube leads to intensity fluctuations due to thermal expansion. When scanning the peak structure with narrower steps, I observed smaller sub-peaks on the main peak bump. The spacing between these sub-peaks is approximately 2 µm, which corresponds to one-fourth of the CO2 laser wavelength. Calvin suggested increasing the formic acid gas pressure to enhance the absorption of the CO2 laser. By increasing the gas pressure from 160 mTorr to 190 mTorr, the small peak structures became much less pronounced, and the intensity profile with cavity shifts appeared smoother, the change of FIR intensity also become more smoother.

I also discussed the experimental results with Yilun and Jon. This discussion process helped me clarify the problems and identify ways to solve them. Whenever I encounter experimental issues, Jon is always able to resolve them quickly.

Since the FIR intensity consistently shifts during the first two hours after turning on the system, it causes measurement errors when I scan the beam profile. To address this, I added a beam splitter to divide the output power into two channels: one channel serves as a reference to measure the FIR intensity, and the other channel is used for measuring the beam profile. This setup allows me to normalize the measurements to the reference channel, thereby minimizing errors caused by intensity shift during measurement.

With the improved measurement setup, my next step is to measure the beam profile at different optimized cavity positions to identify the position that yields the best Gaussian beam profile.

Have a good weekend！

Best regards

Xinhang