Development of Micro Focusing System of UV Vis Spectra of Liquid Jet Samples

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**Introduction**

- Develop microfocused UV Vis system to measure UV Vis spectra of small round liquid jets (<100 microns)
- Liquid jet user experiments encounter problems with sample decay, light sensitivity, or damaged by oxygen exposure that are difficult to track during the experiment
- Multiple beam diameter & optic footprint combinations to ensure the experiment exposure that are difficult to track during

**Design**

- Ensured difficulty with aligning collimator and smaller size focusing assemblies, printed adapter to join them
- Three pairs of different focusing assembly sizes, a pair of optic collimators, and a pair of 50 micron fiber optic cables to create smallest beam size possible
- Needed better way to hold both collimators and focusing assembly in alignment with one another, designed and printed a "u-cage" to hold collimators using SolidWorks and Cura Ultimaker S5 printer
- Discovered that bringing beam into focus while maintaining alignment would be very difficult with rigid design, mounted optical lens on a manual XYZ stage and sample on manual sliding table

**Beam Size**

- Quantitative measurement of spot size at focal length to ensure it would be smaller than the size of the spot with normal artifact
- Encountered problems with sample decay, light sensitivity, or damaged by oxygen exposure that are difficult to track during the experiment
- Multiple beam diameter & optic footprint combinations to ensure the experiment exposure that are difficult to track during

**UV Vis Spectrum**

- Measured UV Vis spectrum of [Fe(bpy)]$^{2+}$ expected to see two different metal-ligand charge-transfer absorption bands at 522 nm and 354 nm
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**Conclusions**

- Microspectrometer produces meaningfully accurate results that can communicate the state of a sample
- Beam size is reliable <50 microns for the smaller focusing assembly, and reliably <60 microns for the larger focusing assembly
- Compact, mobile, and affordable (with developing accuracy and precision), this microspectrometer has the potential to be a helpful and accessible resource to user groups in both online and offline experimentation who wish to verify the state of their sample

**Further Considerations**

- Eliminating the adapter by obtaining properly sized collimators could further reduce the spot size to be reliably <50 microns without sacrificing intensity of the beam
- A more powerful light source, such as a commercial supercontinuum white light laser would increase intensity of beam and quality of UV Vis spectrum
- Optomechanics or computerized motors to control optics would contribute to ease of alignment and repeatability

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