Characterizing actively forming planets around young stars is important for understanding the detailed physics of planetary accretion. Recent studies have detected gas giants embedded within circumstellar disks at relatively large separations from their host stars. To detect planet formation on solar system scales, innovations in instrumentation and techniques are necessary. The photonic lantern is a fiber-optic device that, combined with the spectro-astrometry technique, has the potential to overcome these observational challenges.

**Circumstellar Disk and Protoplanet Model**

The circumstellar disk model consists of a central star, a gapped gaussian disk around the star, and a hotspot embedded within the disk representing accretion onto a protoplanet.

**Photonic Lantern**

Optical propagation of light in a photonic lantern is linear in the complex electric field, so we can use a transfer matrix to simulate the propagation of the disk image through the photonic lantern.

**Spectro-astrometry**

Spectro-astrometry utilizes the spatially-resolved spectra of a known object to determine the wavelength-dependent position of the object beyond the diffraction limit. Objects with separations smaller than the diffraction limit are unresolvable with traditional imaging techniques, but they can be clearly identified using spectro-astrometry. The hydrogen Pa$\beta$ emission line at 1282 nm is a good indicator of protoplanetary accretion, so we simulate spectro-astrometric observations across that line.

**Parameter Recovery Results with MCMC**

We use a parallel tempered Markov chain Monte Carlo algorithm to recover the parameters that define the model used in the simulated observations.

**Future Work**

The next step is to simulate more observations to constrain the limitations of photonic lantern spectro-astrometry. Understanding the capabilities of this method in detecting accreting protoplanets within disks of varying brightness will help inform on-sky observations in the near future.