

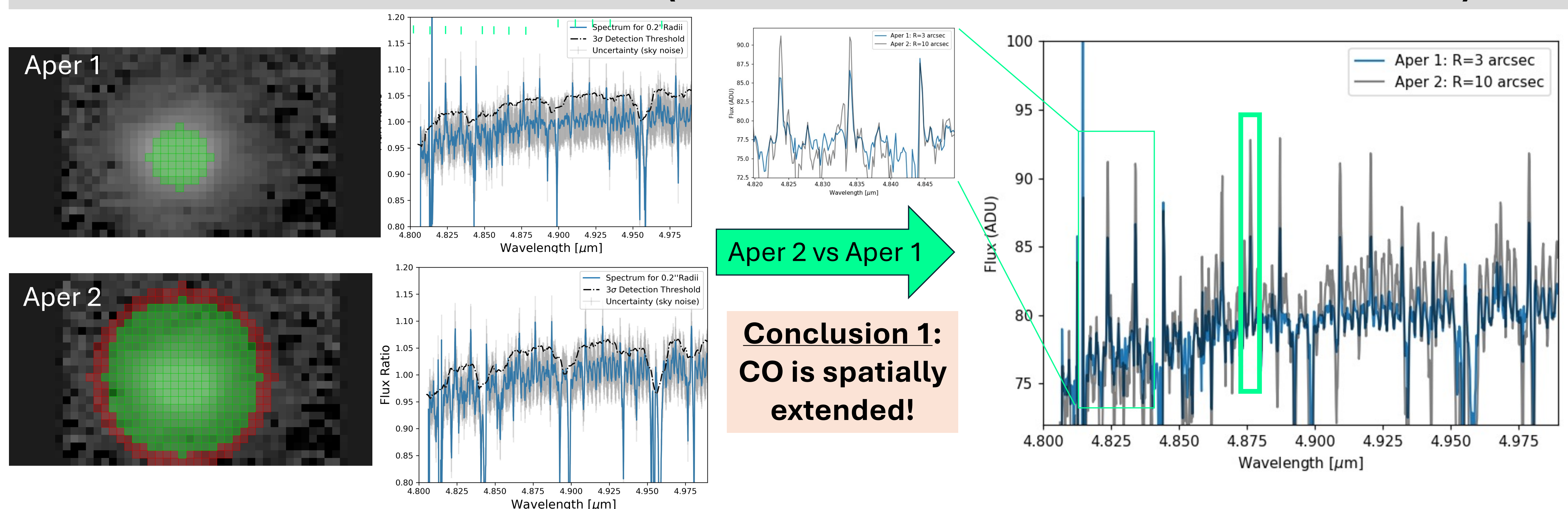
Mapping Planet-Forming Disks with Gemini/GNIRS HR-IFU: Gas and Spiral Motions in the AB Aurigae Protoplanetary Disk and Lessons from Commissioning Data

Cicero X. Lu^{1,2*}, Damian Mast¹, Thomas Gabelle¹, Emanuele Farina¹, Brian Lemaux¹, Sean Brittain³, Winston Wu², Bin B. Ren⁴, Hyewon Suh¹, Atsuko Nitta¹, Andy Adamson¹ and Scott Dahm¹

Introduction:

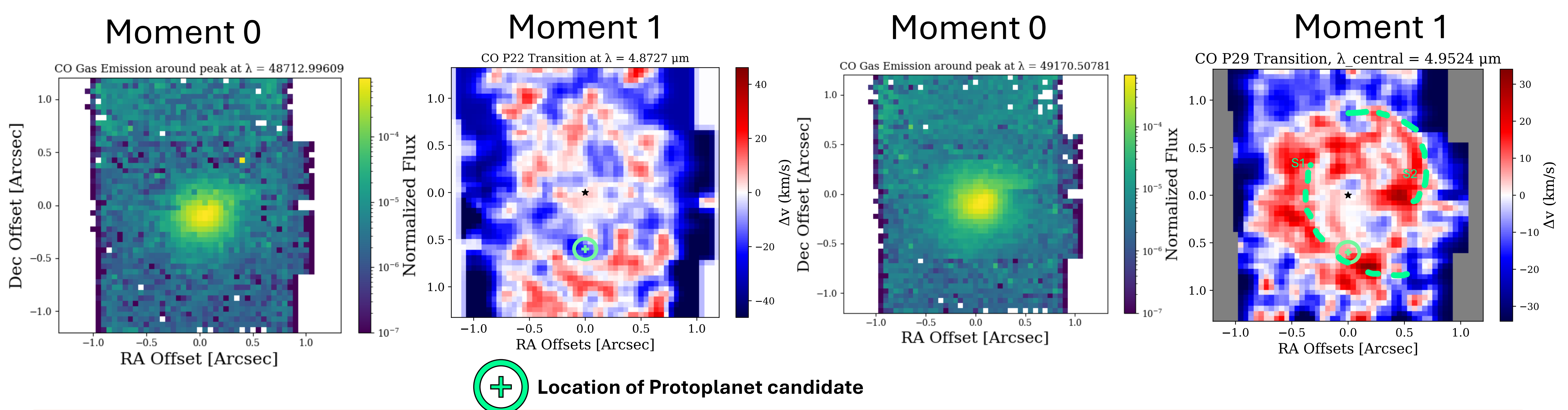
AB Aurigae is a protoplanetary disk with kinematic evidence of planet formation. Multiwavelength observations reveal a potential protoplanet candidate embedded in the disk. During commissioning, we observed AB Aurigae with Gemini/GNIRS High-Resolution Integral Field Unit to spatially resolve the warm and cool CO gas in the inner ~ 2 arcsec (300 AU) in the vicinity of the protoplanet. Using a combination of official Gemini IRAF and our custom-developed data reduction tools, we present the CO velocity maps in the NIR with AB Aurigae and various warm and cool temperature components in the disk. This is the first time that kinematics of gas and spiral motion have been directly imaged in the NIR.

Methods: Telluric Correction for IFU (Determine Uncertainties and Reliable Lines)



Spectral differential imaging (SDI) technique to calculate moment 0 maps of CO gas.

We use a velocity mask (systemic radial velocity at the location of the star) to calculate moment 1 maps.



Conclusion 2: Warm CO falls towards midplane in the vicinity of the putative AB Aur b.

Takeaway: We present a new capability of mapping kinematics of gas at various temperatures in a protoplanetary disk using GNIRS HR-IFU in the M band.

3 Important Lessons

- 1. New Venue:** We open a new venue to search for protoplanets, and probe their formation.
- 2. Efficiency:** NIR is much more sensitive than mm (ALMA observations, 6 mins on-source vs a few to tens of hours)
- 3. Synergy:** Confirm leading science results from JWST (etc) with high resolution IFU.

1. Gemini Observatory/NSF's NOIRLab, 670 N. A'ohoku Place, Hilo, HI 96720, USA
 2. University of Hawaii at Hilo, 200 West Kawili St, Hilo, HI, 96720, USA
 3. Clemson University, Clemson, SC, USA
 4. Université Côte d'Azur, Observatoire de la Côte d'Azur, CNRS, Nice cedex 4, France

* Science Fellow, cicero.lu@noirlab.edu