3-D Kinematics in the ONC Core

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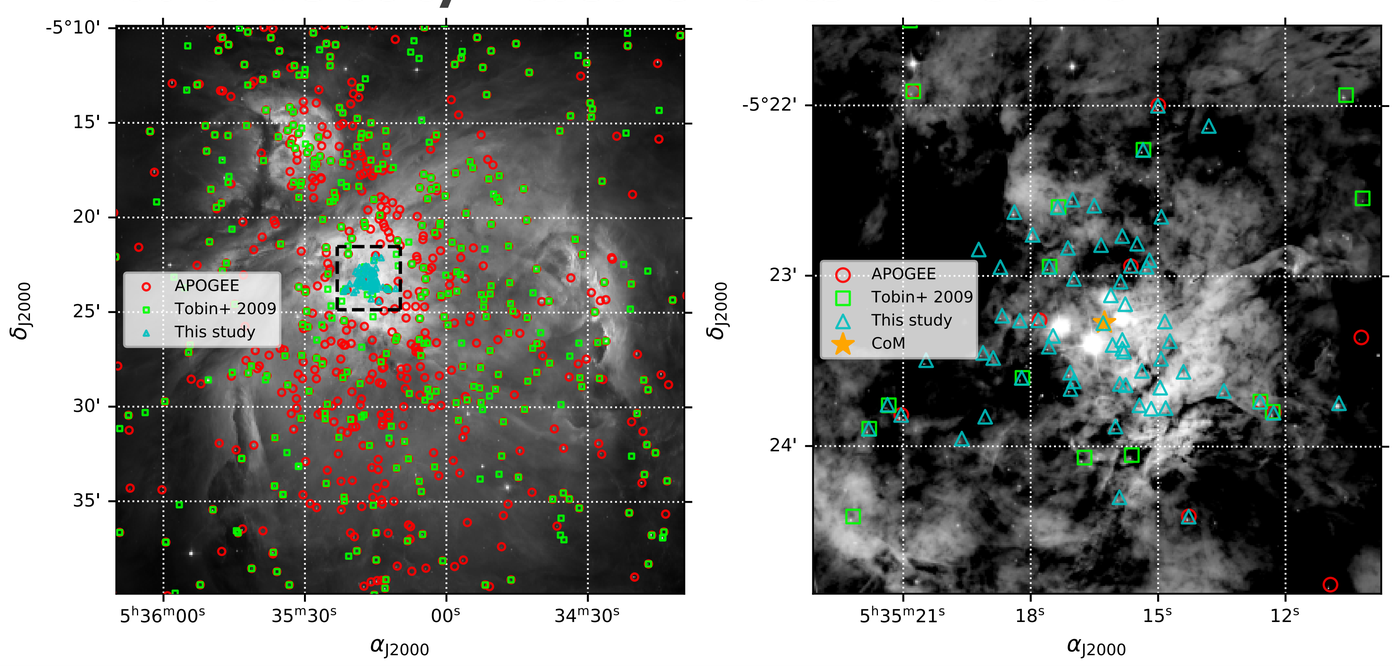
Radial Velocity Measurements in the ONC



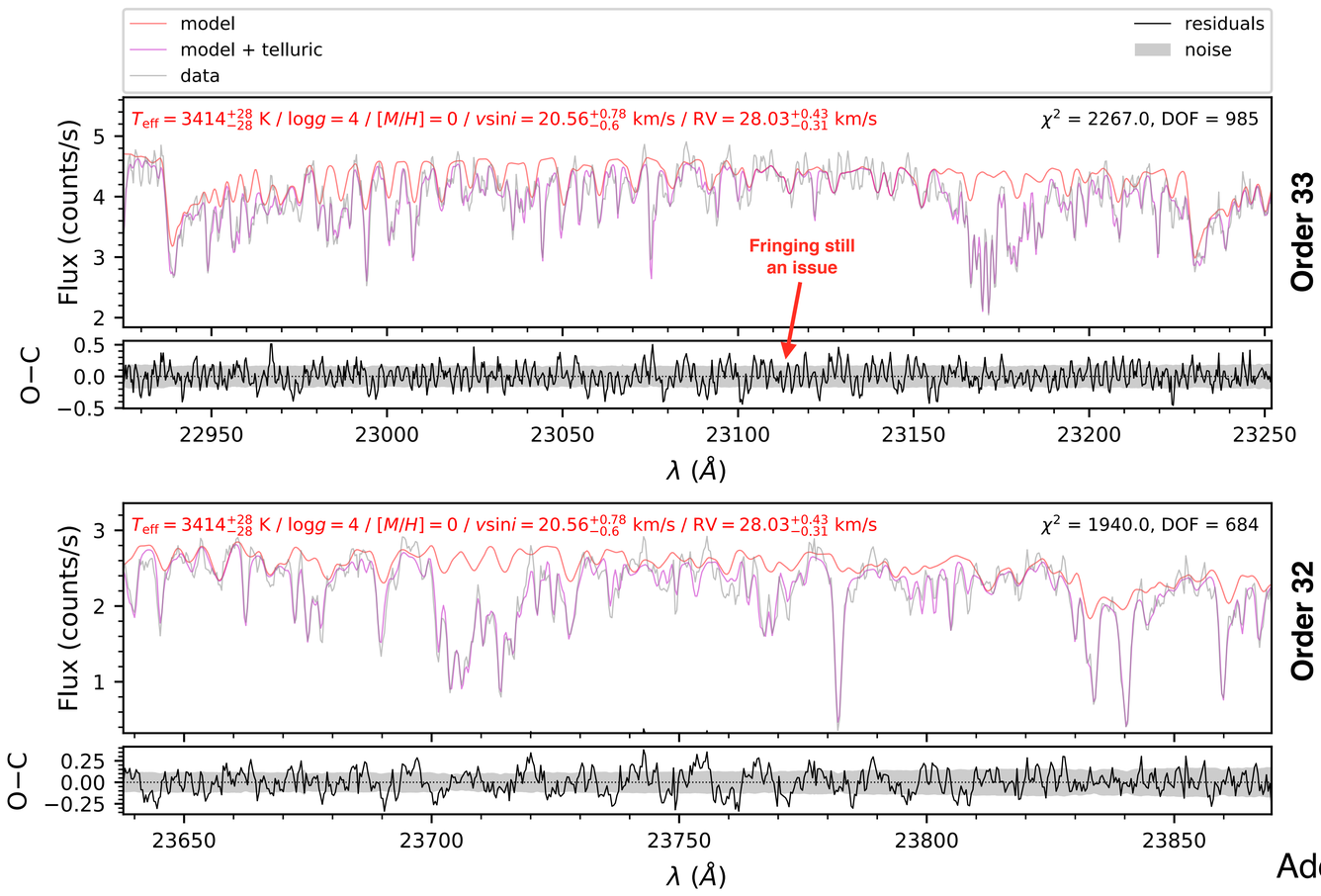
We are building the largest sample of high-precision (< 0.5 km/s) radial velocity measurements in the core of the ONC (within 2' of the Trapezium).

We are using NIRSPEC[1,2] on Keck II. This offers a resolution of $R \sim 24000$ and broad coverage across the *K*-band.

To date, we have measured 56 sources, targeting the reddest/lowest-mass sources[3].

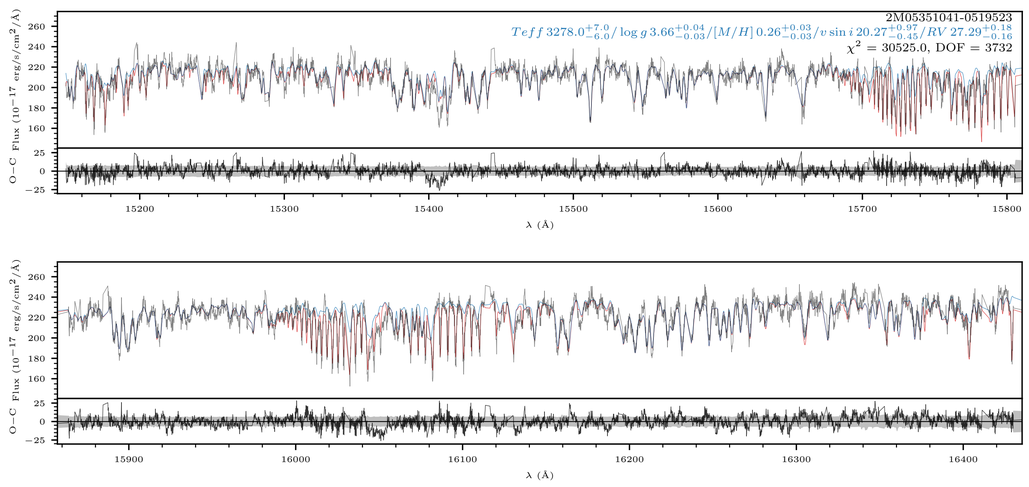
Forward-Modeling NIR Data

All sources are simultaneously fit for stellar (Teff, logg, vsini, RV, veiling), telluric (airmass, PWV), and instrumental parameters (LSF) using the *emcee*[4].



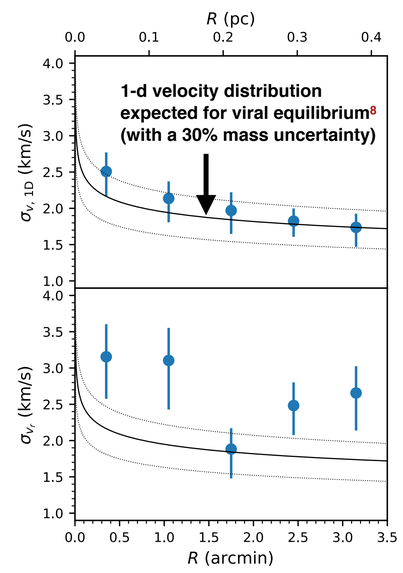
NIRSPEC Data are reduced using a custom version of the NIRSPEC Data Reduction Pipeline (NSDRP)[5].

Fringing is still an ongoing modeling issue (looking at *K*-band). There is also a degeneracy between temp/logg/veiling.
Also see the poster by Dino Hsu!



Additionally forward-modeling APOGEE *H*-band data of ONC sources[6]!

Results and Future Prospects



Is the ONC expanding?

Combined with proper motions[7] and the distance to the ONC, we have 3-d velocities to understand the kinematics of the ONC core.

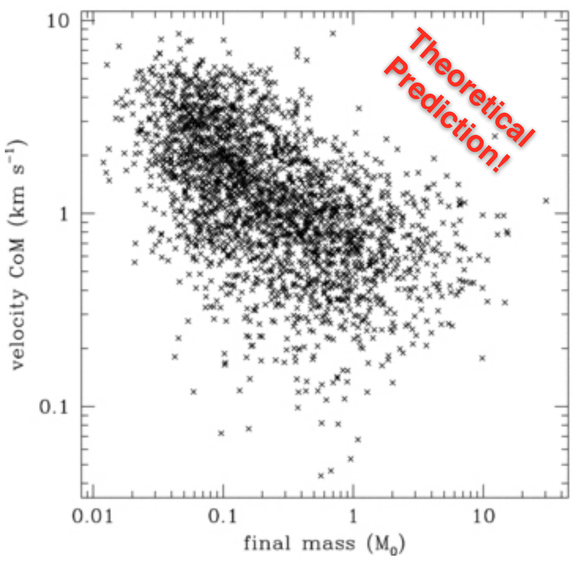
1-d velocities follow the expectation for a virialized cluster (similar to previous studies[7]).

The RV velocities deviate from a virialized state, but line-of-sight velocities likely suffer from complications due to unresolved binaries.

Does competitive accretion set the mass function?

Accurate temperatures (a proxy for masses) will allow us to test theories of brown dwarf formation[9] when combined with 3-d kinematics.

This requires us to break/quantify the degeneracies with veiling. We are currently looking into other sampler methods more robust to multimodal probability distributions (e.g., MULTINEST[10]).



ACKNOWLEDGEMENTS

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(5) Tran et al. 2012, in proc SPIE, Vol 8451
(6) Kounkel et al. 2018, AJ, 156, 84
(7) Kim et al. 2019, AJ, 157, 109
(8) Da Rio et al. 2014, ApJ, 795, 55
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New NSDRP available on GitHub