DOUBLE CORE OF G163.82-8.44

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Galactic Cold Cores - Besançon
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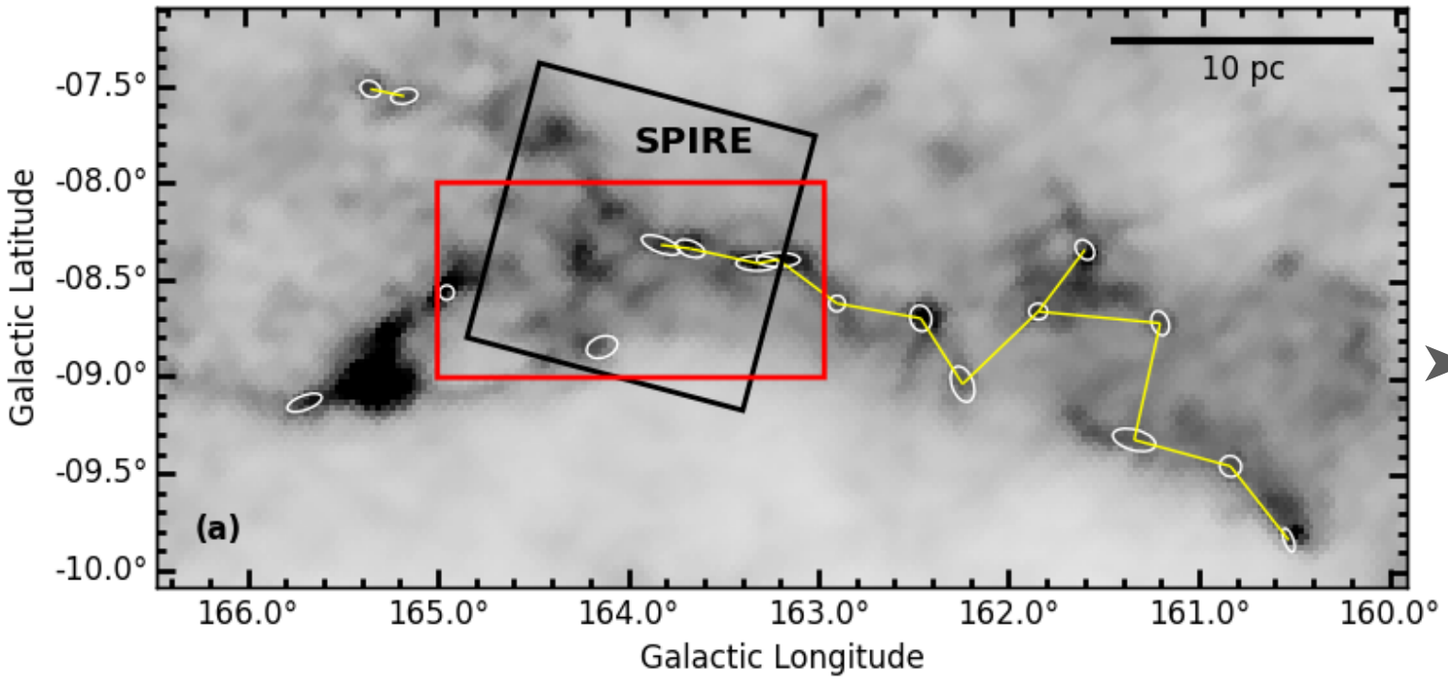
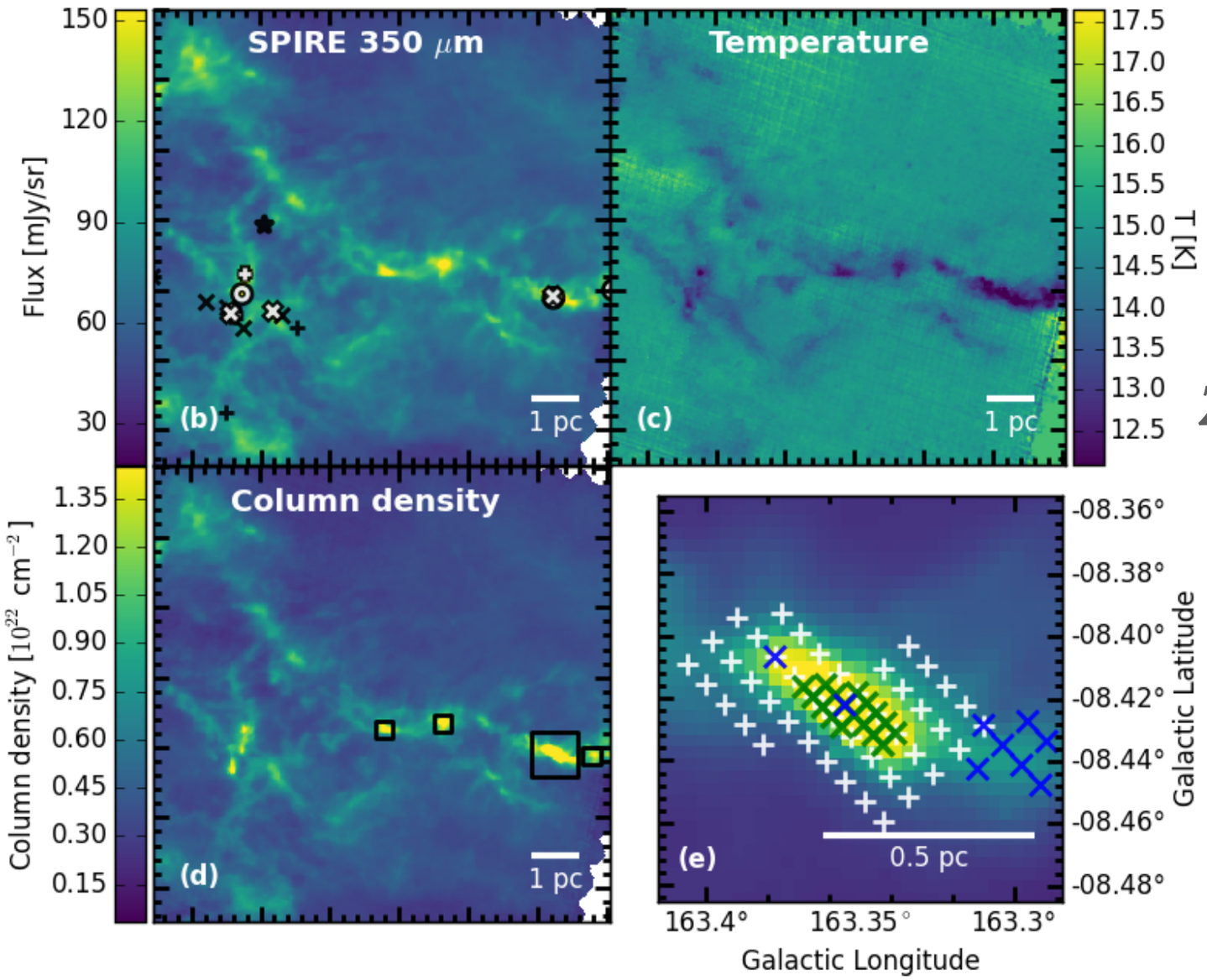
NH_3 (1,1) AND (2,2) FOLLOW-UP ON PLANCK COLD CORES

- Effelsberg-100m data, 2012 - 2018, 180+ hours
- 46 clouds/56 clumps observed - 44 detected at 3 > SNR
- will be published in Tóth +in prep.



MEET G163.82-8.44

- in the Auriga-California molecular cloud



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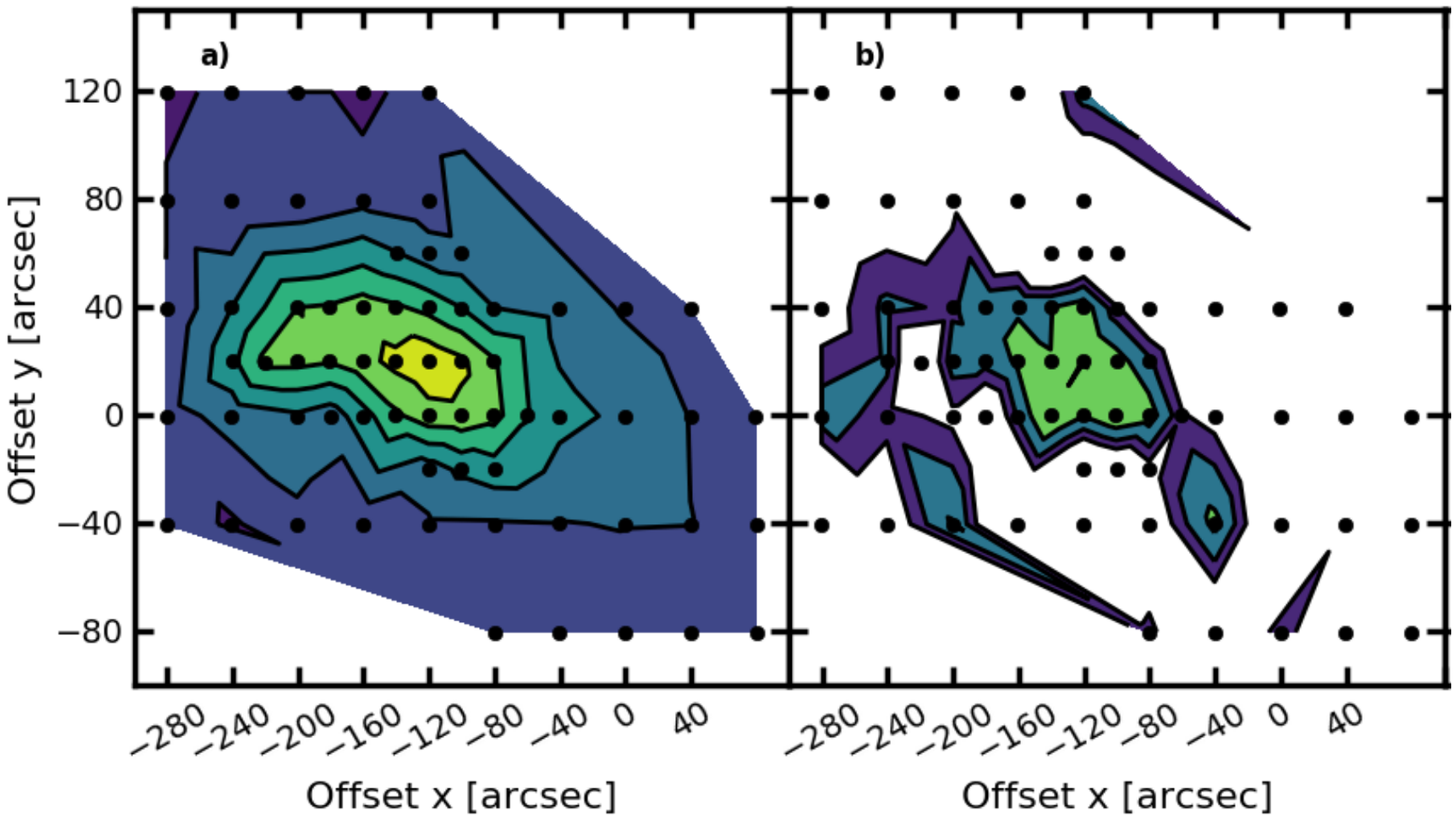

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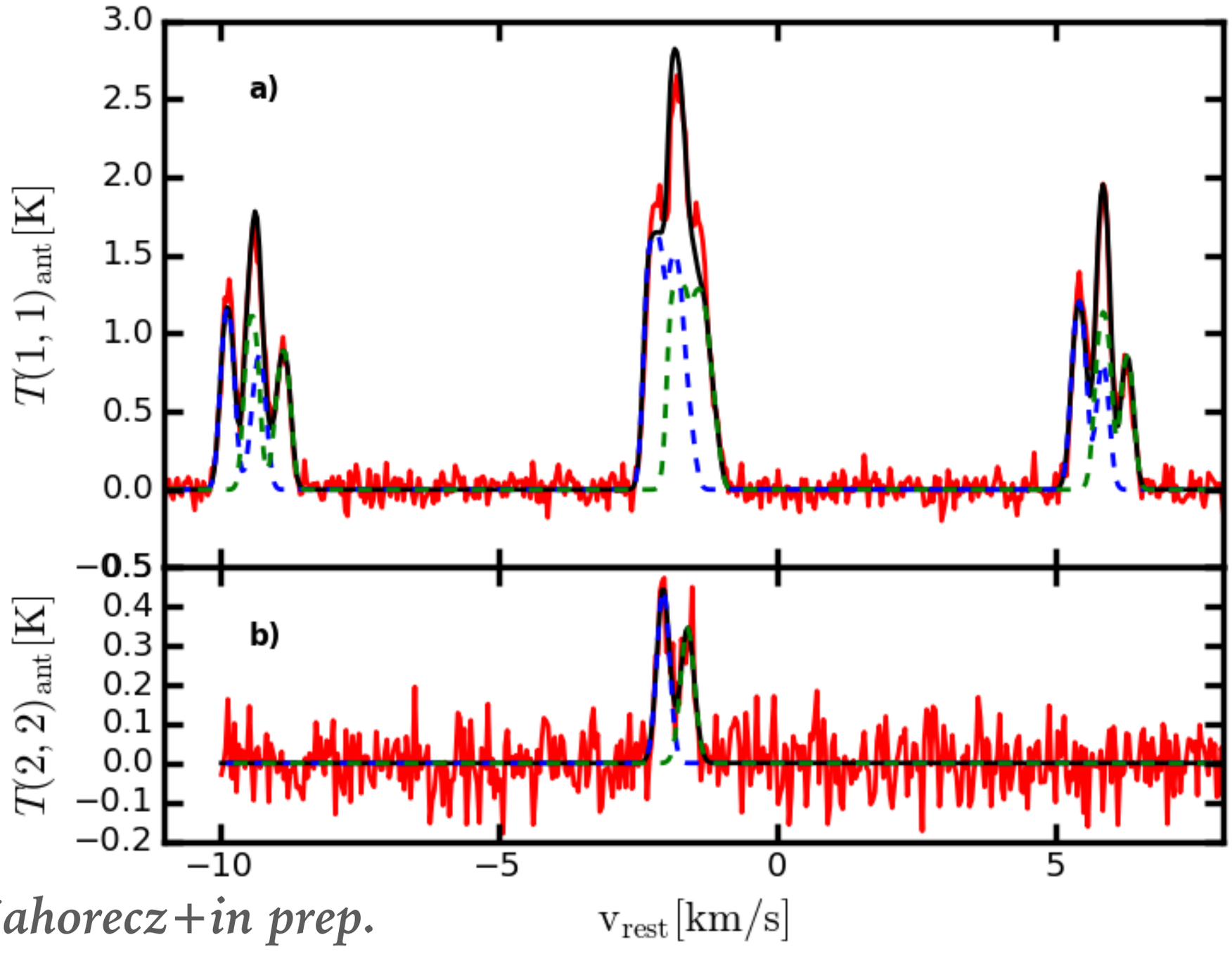
DOUBLE AMMONIA LINE PROFILE



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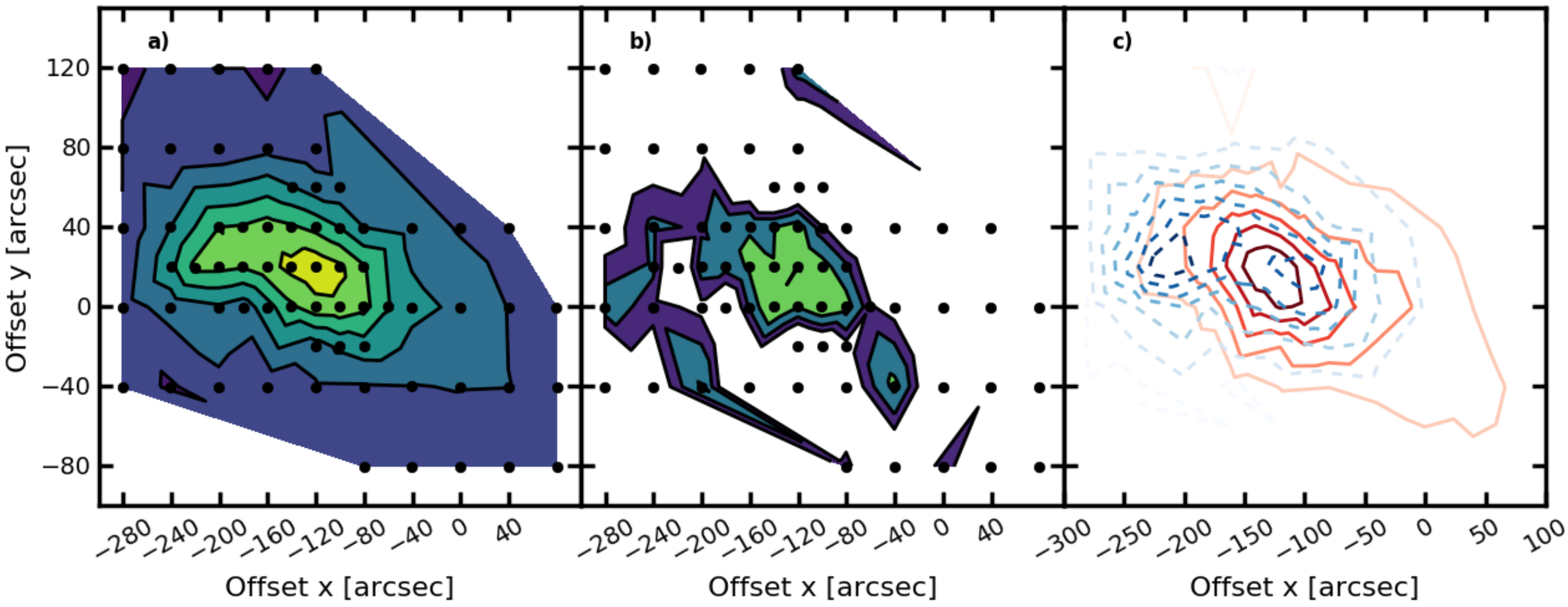

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RADIATIVE TRANSFER MODELING

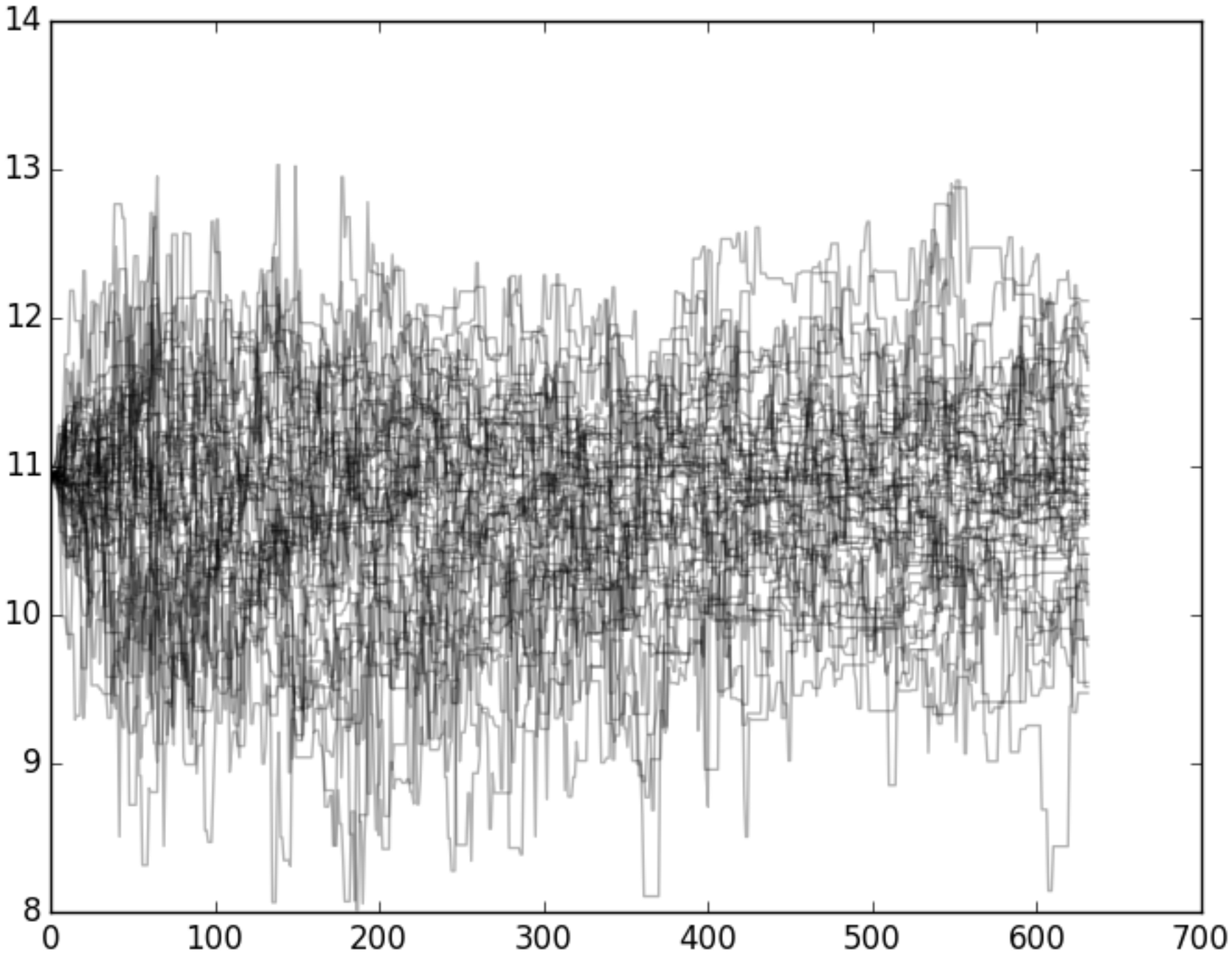
- **goal**: improved measurement of the cores' physical properties
- **model**: CPPSIMU (Juvela 97) - synthetic observed spectra from gas in a model cube with some density and temperature distribution, kinematics, etc.
- **our model**: two isothermal spheres with Plummer* density profiles

$$\rho(r) = \rho_c \left(1 + \frac{r}{r_c}\right)^{-1}$$

- model parameters optimised with an MCMC approach using the open source EMCEE PYTHON package (Foreman-Mackey +13)

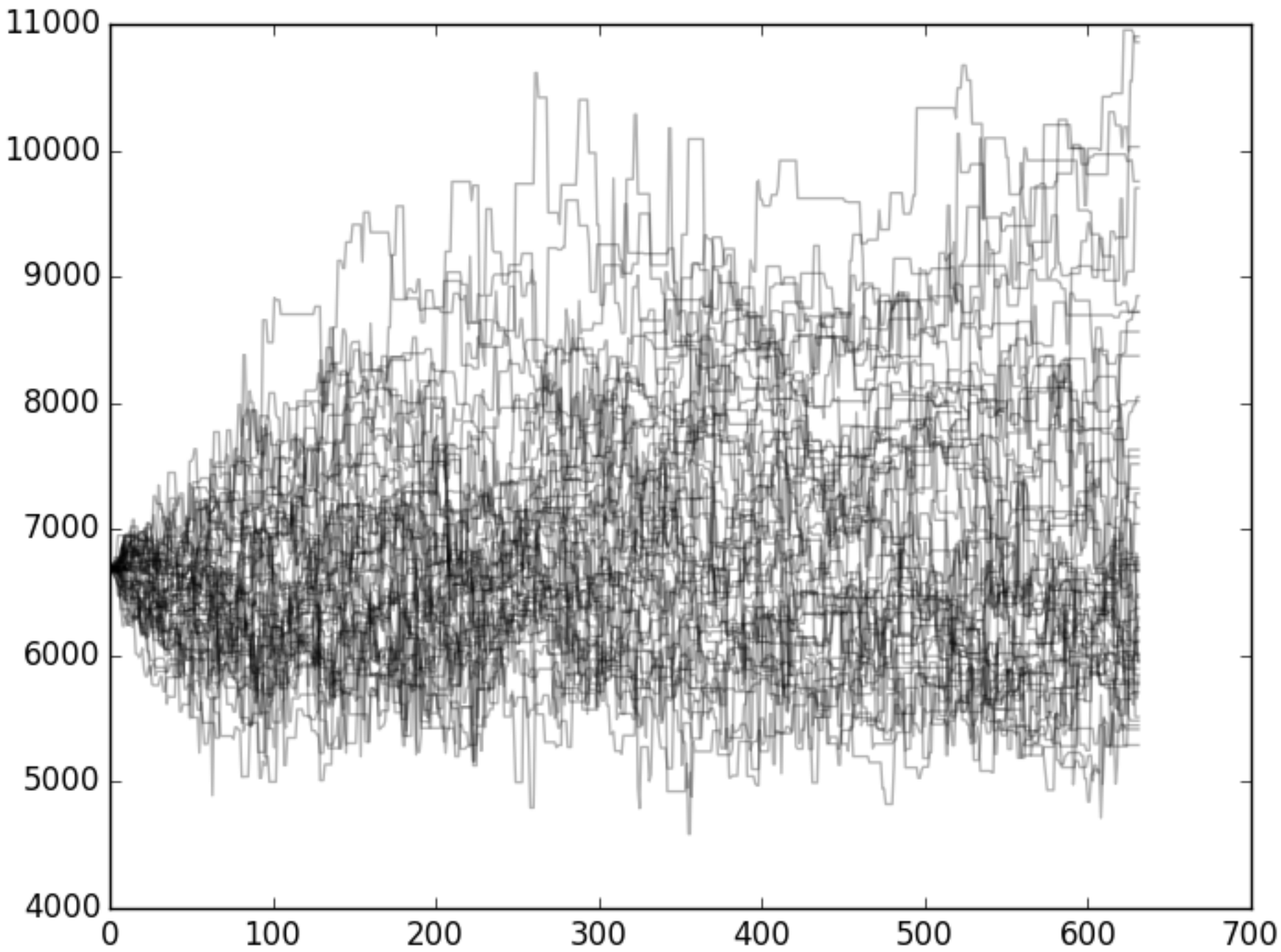
core masses from Bonnor-Ebert spheres are consistent within 1 sigma

BEST-FIT MODEL

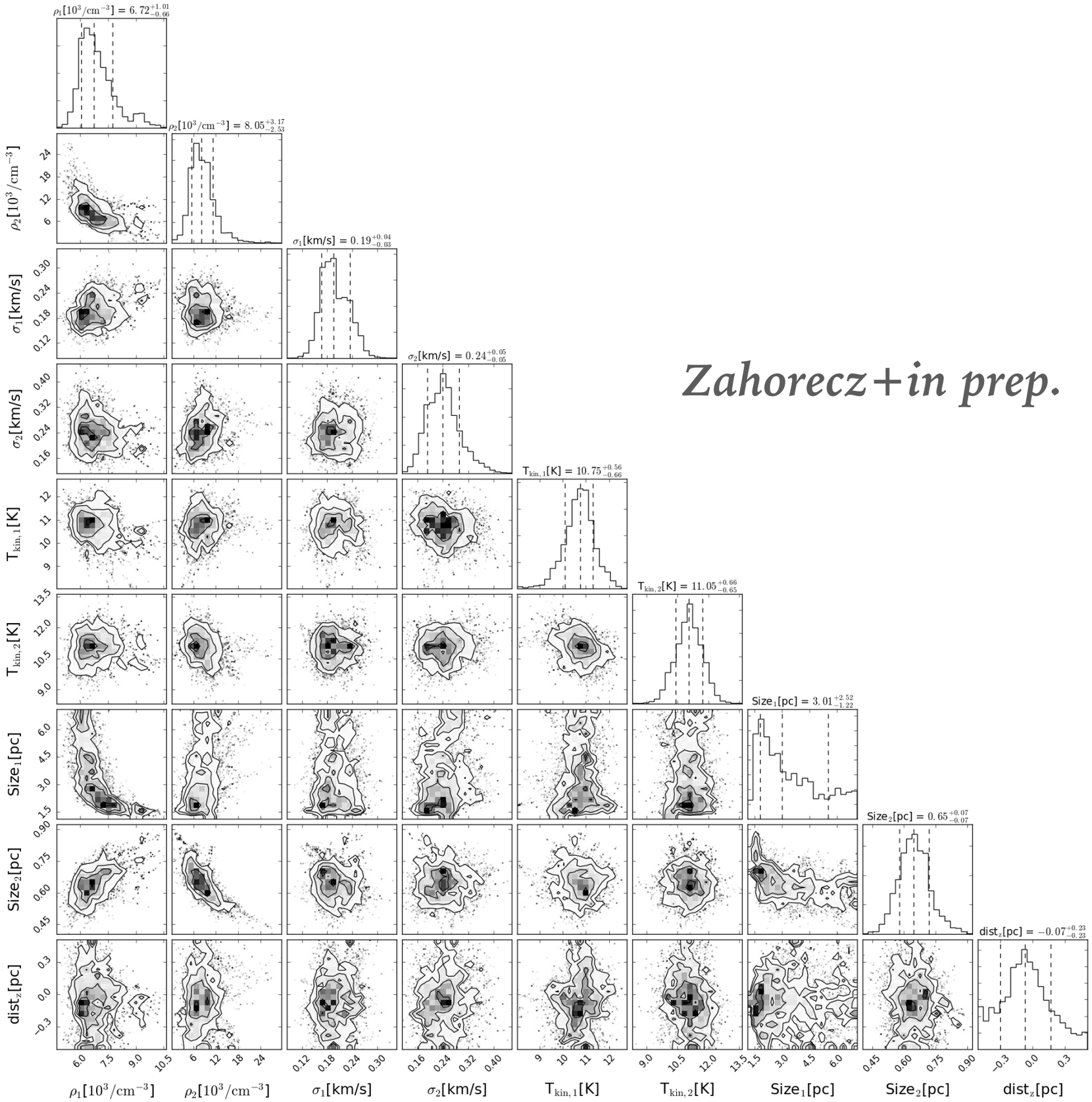


BEST-FIT MODEL

$dens_1$



BEST-FIT MODEL



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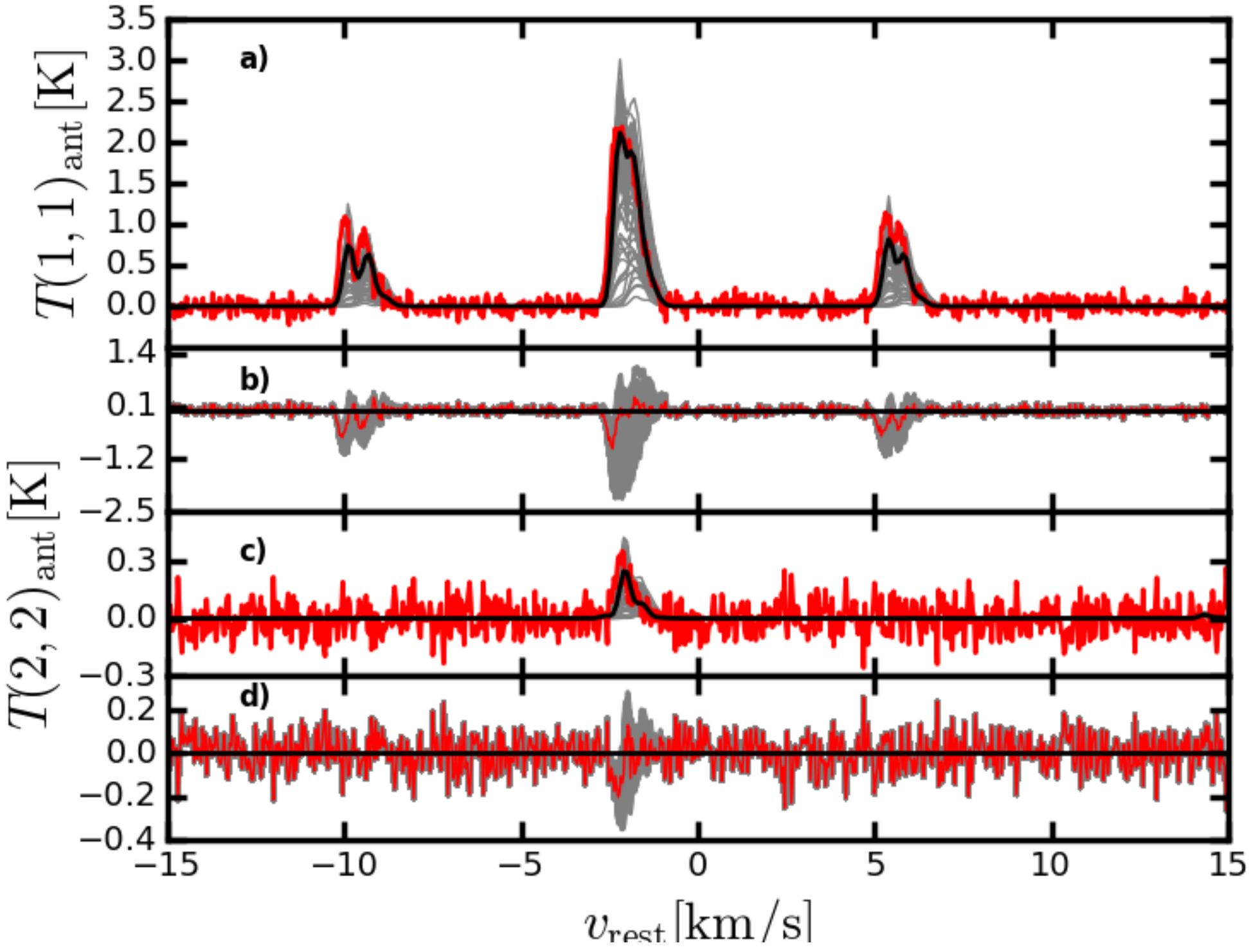

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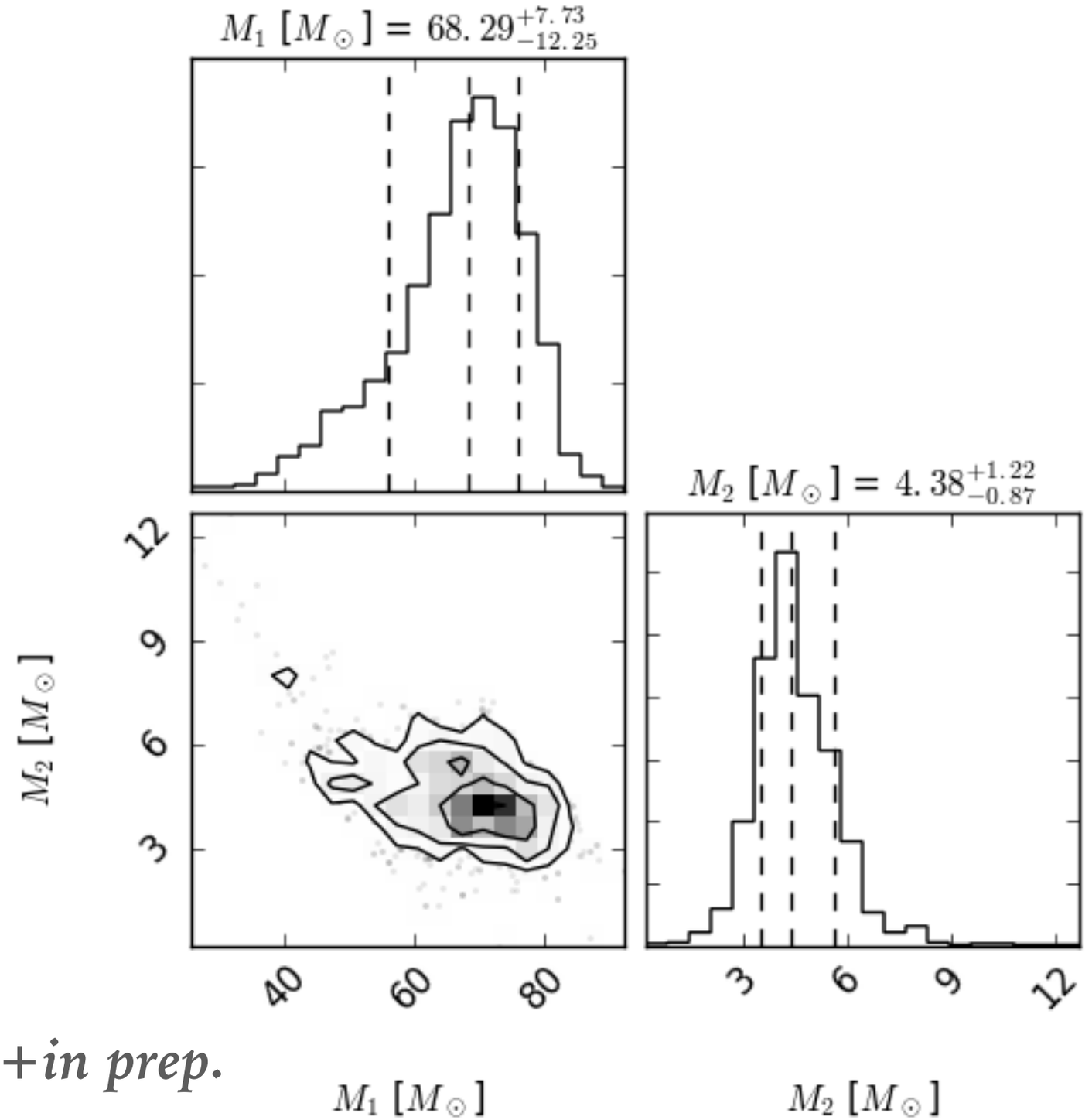
BEST-FIT MODEL

- **central densities:**
  - $dens_1 = 7+-1 \times 10^3\ cm^{-3}$, $dens_2 = 8+-3 \times 10^3\ cm^{-3}$
- **temperatures:**
  - $T_1 = 10.8 +- 0.6\ K$, $T_2 = 11.0 +- 0.7\ K$
- **turbulent velocities:**
  - $sigm_1 = 0.19 +- 0.04$ km/s, $sigm_2 = 0.24 +- 0.05$ km/s
- **sizes:**
  - $R_1 = 3\ +3\ -1$ pc, $R_2 = 0.65 +- 0.07$ pc

CORE MASSES BOOTSTRAPPED



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ADDITIONAL ERROR TERMS

- Flux calibration uncertainty (taken as 10 %)
- Distance uncertainty (450+-23 pc)
- Estimated error contribution by two re-runs of the fit (increased intensity and distance)
  - not dominant contribution to MCMC-derived errors

- **Final masses with total error: $M_1 = 68\ ^{+11}_{-15}\ M_\odot$, $M_2 = 4\ ^{+2}_{-1}\ M_\odot$**

STABILITY

- Virial mass from the MacLaren +88 formula (ask Orsi for details)

$$M_{vir} = k_2 R \Delta v^2$$

  - virial masses: $\mathbf{M_{1,vir} = 254+218-114\ M_\odot}$ and $\mathbf{M_{2,vir} = 70+-18\ M_\odot}$

- Both cores are significantly above the virial mass - *unbound*

ITEMS IN THE MAKING FOR PAPER DISCUSSION

- connection to the wider environment
  - envelope's mass (CO and Herschel data)
  - filaments
  - YSOs
- mass ratio of cores - typical of binaries?
- compare gas mass from dust measurements and our estimate (i.e. are 10^8 NH_3 abundances consistent)

SUMMARY

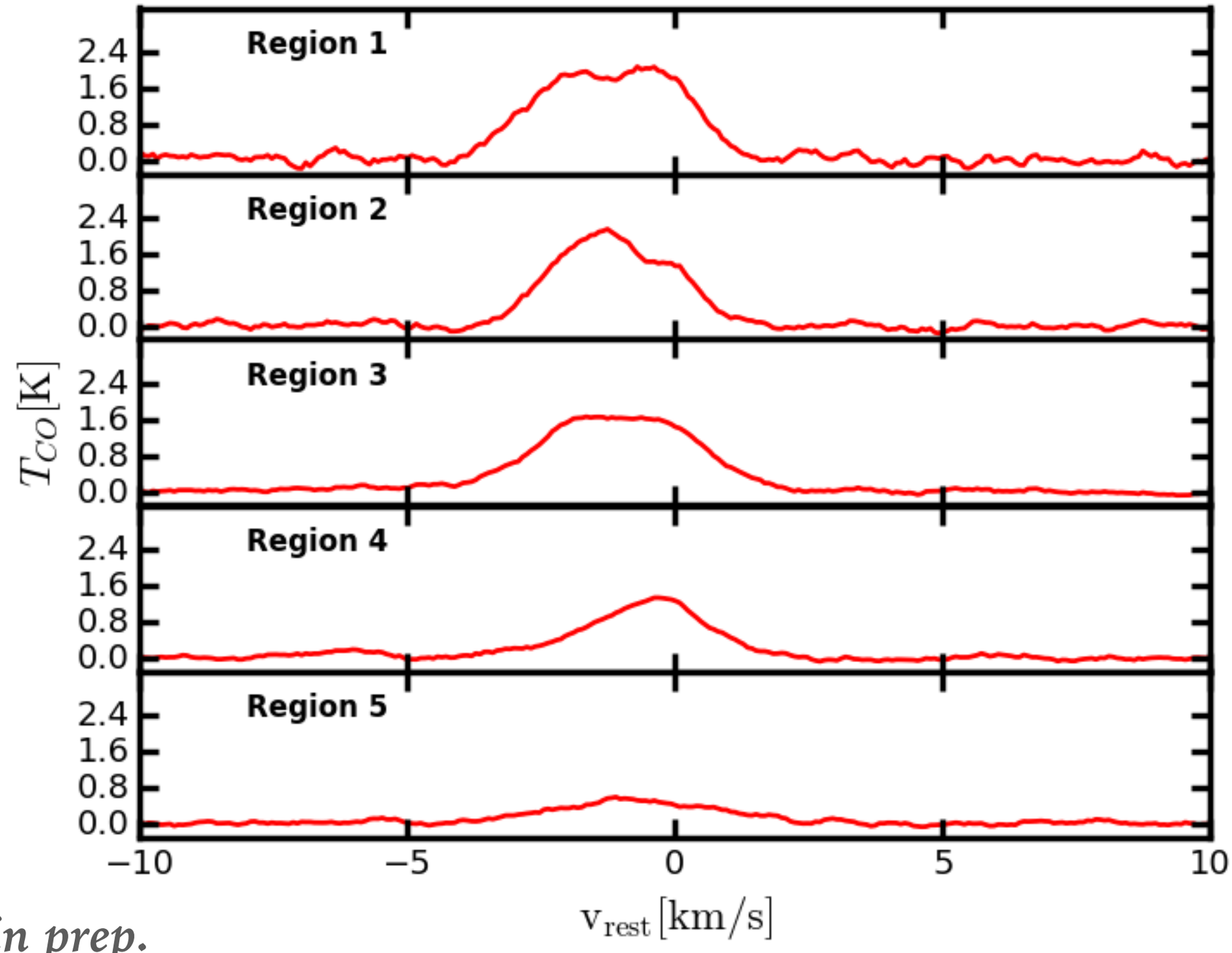
- double ammonia (1,1) and (2,2) line emission detected at several positions in G163.82-8.44
- we fitted a **two isothermal sphere model** and measured various physical properties
- core masses (**68 and 4 $M_\odot$**) both significantly below the virial mass (**254 and 70 $M_\odot$**) - ***gravitationally unbound cores***

OUTLOOK

- paper draft will be circulated **very soon**
- Máté Krezinger will investigate G92, a rotating cloud core with a similar approach to modelling

APPENDIX - ENVIRONMENT

With Osaka telescope



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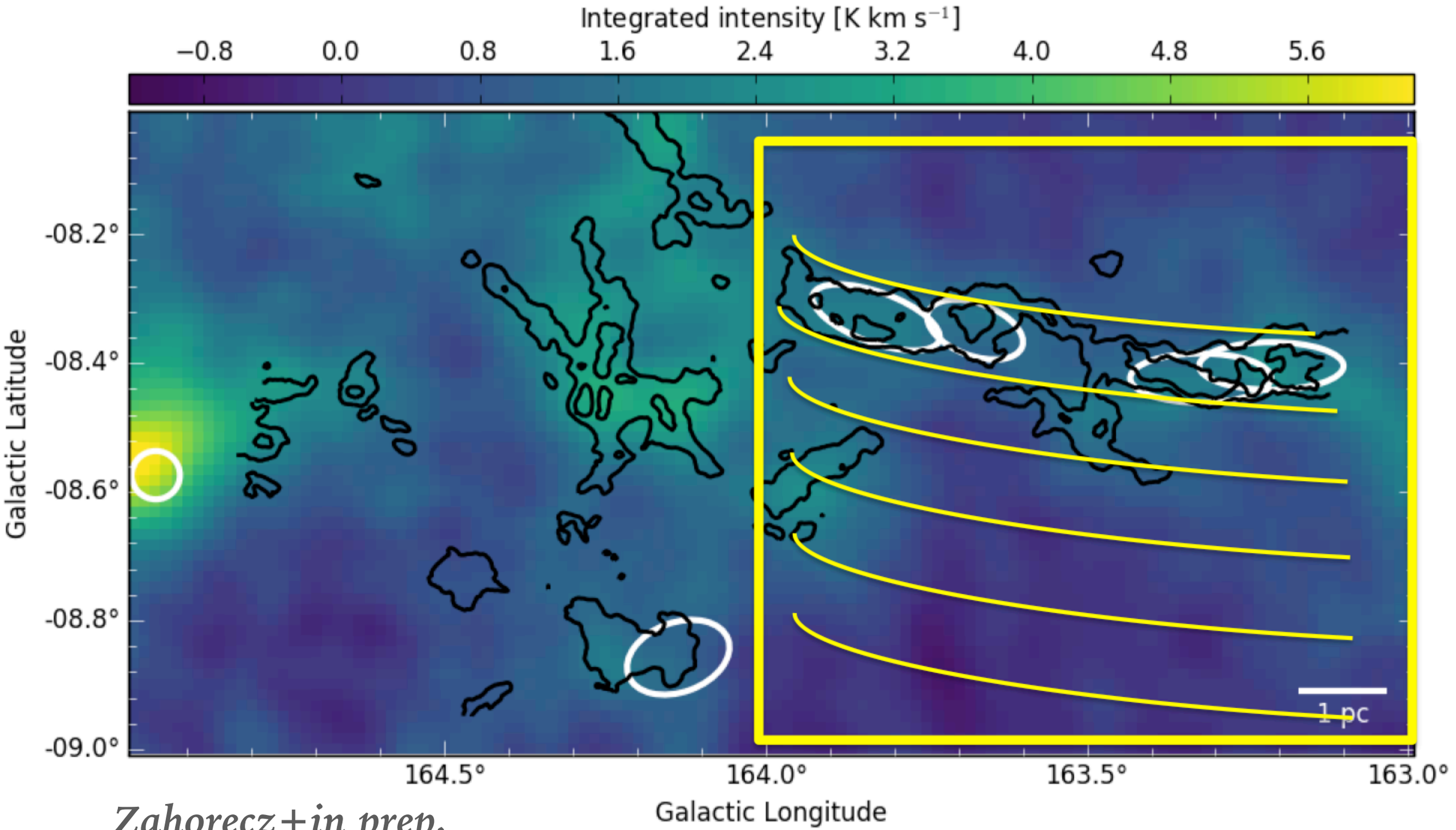

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