Organic complexity in protostellar disk candidates: Supporting information

Jennifer B. Bergner,[*,†] Rafael Martín-Doménech,[‡] Karin I. Öberg,[‡] Jes K. Jørgensen,[¶] Elizabeth Artur de la Villarmois,[¶] and Christian Brinch[§]

†*Harvard University Department of Chemistry and Chemical Biology, Cambridge, MA 02138, USA*

‡*Harvard-Smithsonian Center for Astrophysics, Cambridge, MA 02138, USA*

¶*Centre for Star and Planet Formation, Niels Bohr Institute and Natural History Museum of Denmark, University of Copenhagen, Øster Voldgade 5-7, 1350 København, Denmark*

§*Research Group for Genomic Epidemiology, National Food Institute, Technical University of Denmark, 2800 Kgs. Lyngby, Denmark*

E-mail: jennifer.bergner@cfa.harvard.edu

Moment zero map parameters

Table 1 lists the rms values and velocity ranges used to make the moment zero maps shown in Figures 1 and 2 in the main text.

Table 1: Velocity ranges and rms values used for the integrated intensity maps (Figures 1 and 2) in the main text. For clarity, only upper state quantum numbers are used to identify each line; refer to Table 3 in the main text for full identifiers.

	Ser-emb 1		Ser-emb 7		Ser-emb 8		Ser-emb 15		Ser-emb 17	
	Vel. (km/s)	rms (mJy)	Vel. (km/s)	rms (mJy)	Vel. (km/s)	rms (mJy)	Vel. (km/s)	rms (mJy)	Vel. (km/s)	rms (mJy)
$C^{18}O$ 2	6.7–10.5	4.1	6.0–12.0	5.4	6.0–10.7	5.6	8.2–12.5	4.4	4.7–10.5	5.7
CH_3OH $5_{1,4}$	2.6–11.6	6.8	6.2–11.6	4.1	2.6–14.0	6.5	8.6–12.2	3.2	2.0–13.4	7.5
CH_3OH $10_{2,8}$	7.0–10.2	2.9	...	...	4.5–12.7	5.4	...	...	5.1–10.8	3.5
CH_3OCH_3 $13_{0,13}$	6.4–12.1	3.7	...	...	3.2–12.1	5.5	...	...	4.5–12.1	4.3
CH_3OCHO $19_{4,15}$	5.7–9.5	3.4	...	...	5.7–12.6	5.0	...	...	4.4–10.1	4.1
NH_2CHO $12_{1,12}$	6.8–9.8	3.2	...	...	6.2–12.8	5.2	...	...	5.0–12.8	5.3
CH_2CO $12_{1,11}$	5.6–12.1	4.7	...	...	4.4–12.1	5.4	...	...	4.4–12.1	5.1

Spectral line fits

Figures 1–4 show Gaussian fits to the observed lines of each COM, analogous to Figure 3 in the main text.

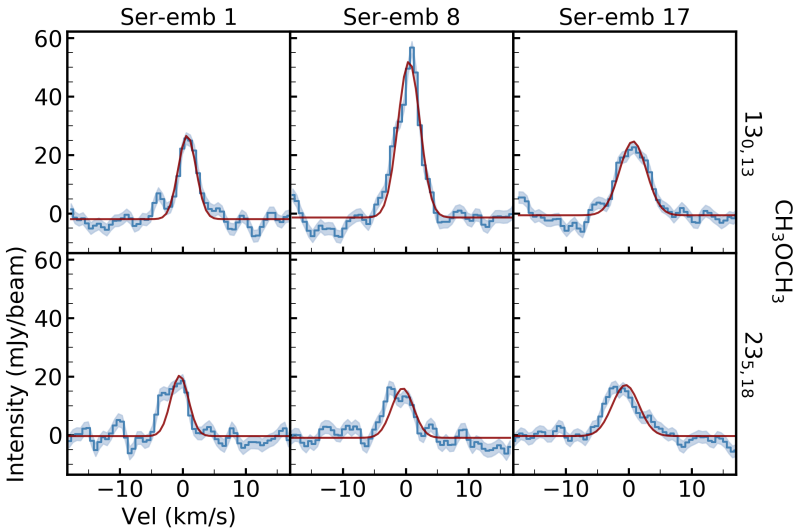

Figure 1: CH_3OCH_3 spectral lines. Blue lines show the spectra extracted from the continuum peak pixel, and shaded regions represent the rms. Red lines show Gaussian fits to the data.

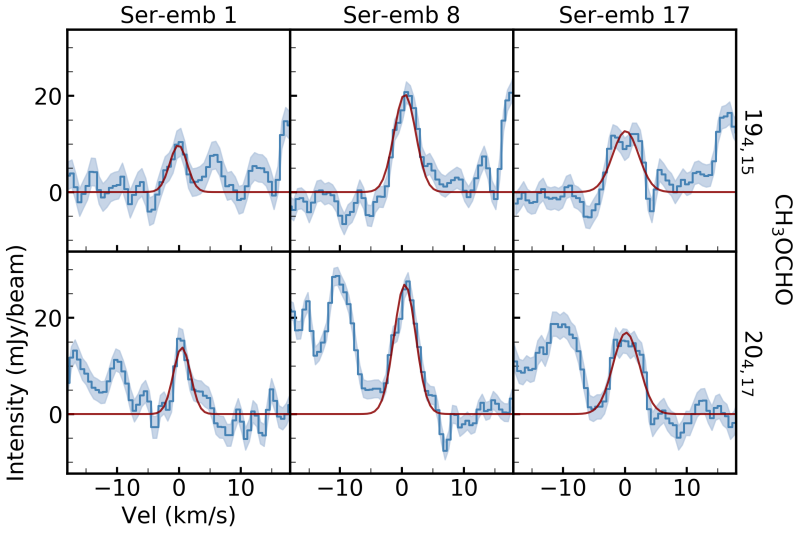

Figure 2: CH_3OCHO spectral lines. Blue lines show the spectra extracted from the continuum peak pixel, and shaded regions represent the rms. Red lines show Gaussian fits to the data.

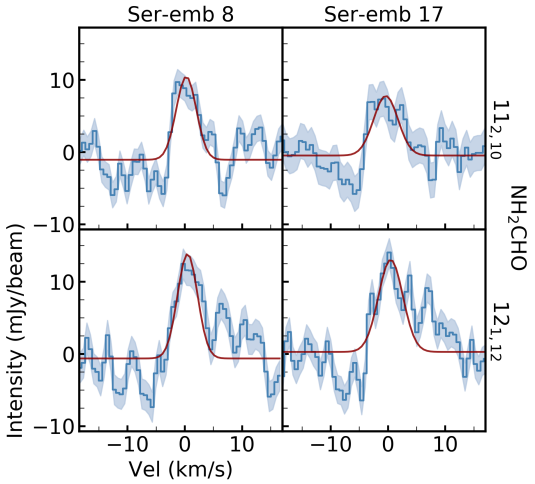

Figure 3: NH_2CHO spectral lines. Blue lines show the spectra extracted from the continuum peak pixel, and shaded regions represent the rms. Red lines show Gaussian fits to the data.

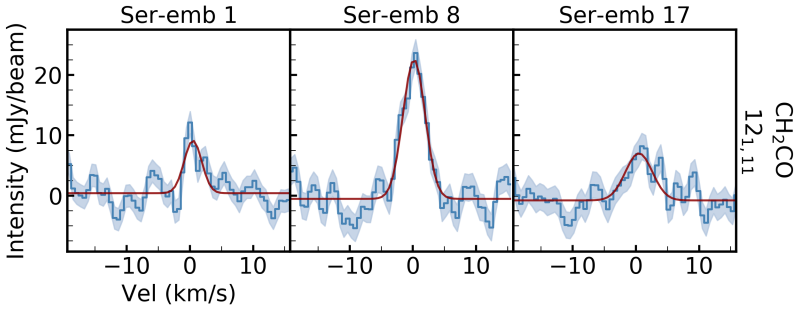

Figure 4: CH_2CO spectra lines. Blue lines show the spectra extracted from the continuum peak pixel, and shaded regions represent the rms. Red lines show Gaussian fits to the data.

Full spectra

Figures 5–8 show the full spectra extracted from the continuum peak pixel in Ser-emb 1, 7, 8, and 15, analogous to Figure 5 in the main text. For Ser-emb 1 and 8 (Figures 5 and 7) colored lines show the synthetic spectra of COMs detected in each source.

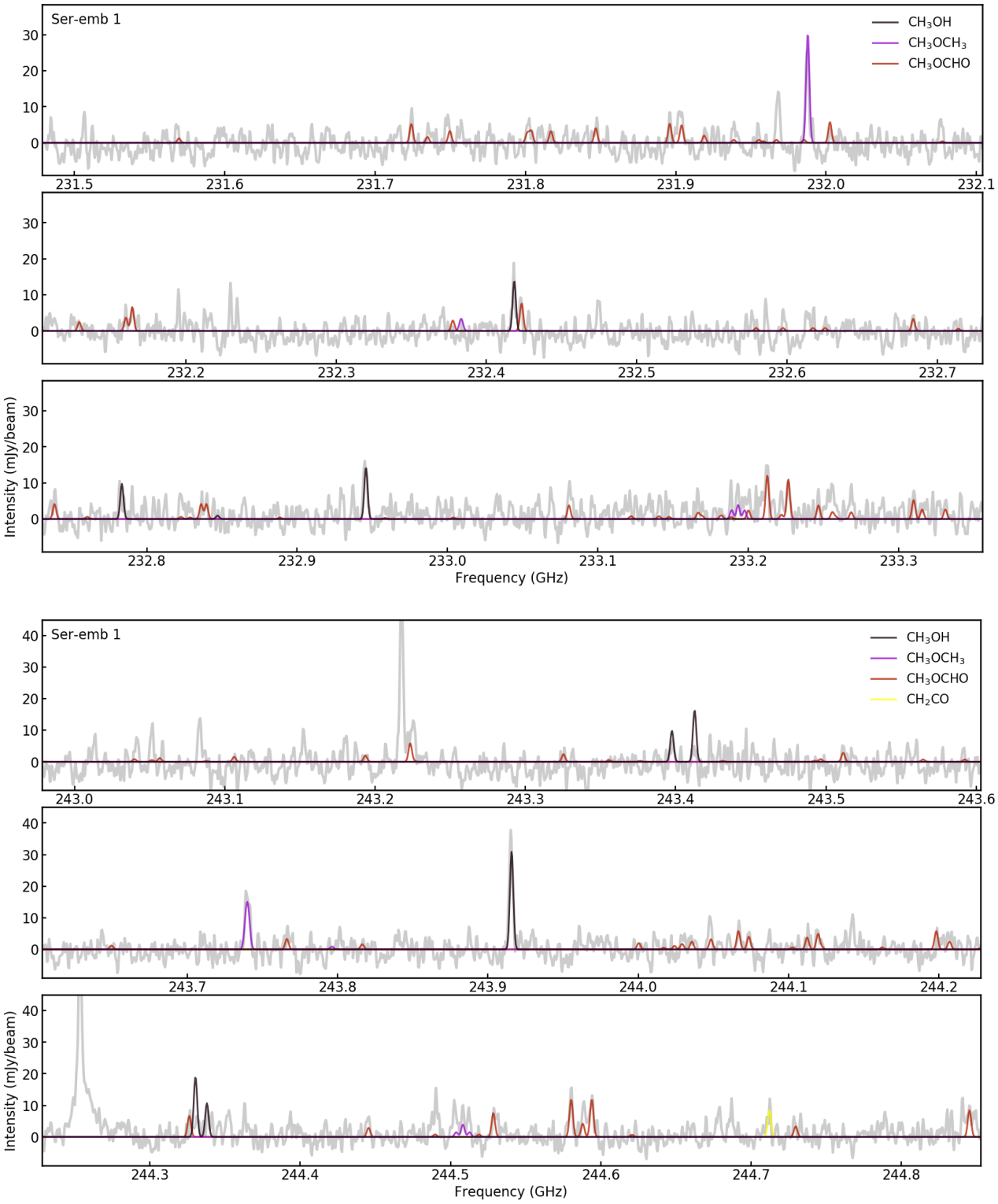

Figure 5: Full spectrum extracted from the continuum peak pixel in Ser-emb 1 (grey line), along with synthetic spectra of the detected COMs (colored lines). Spectra are calculated assuming the CH_3OH rotational temperature.

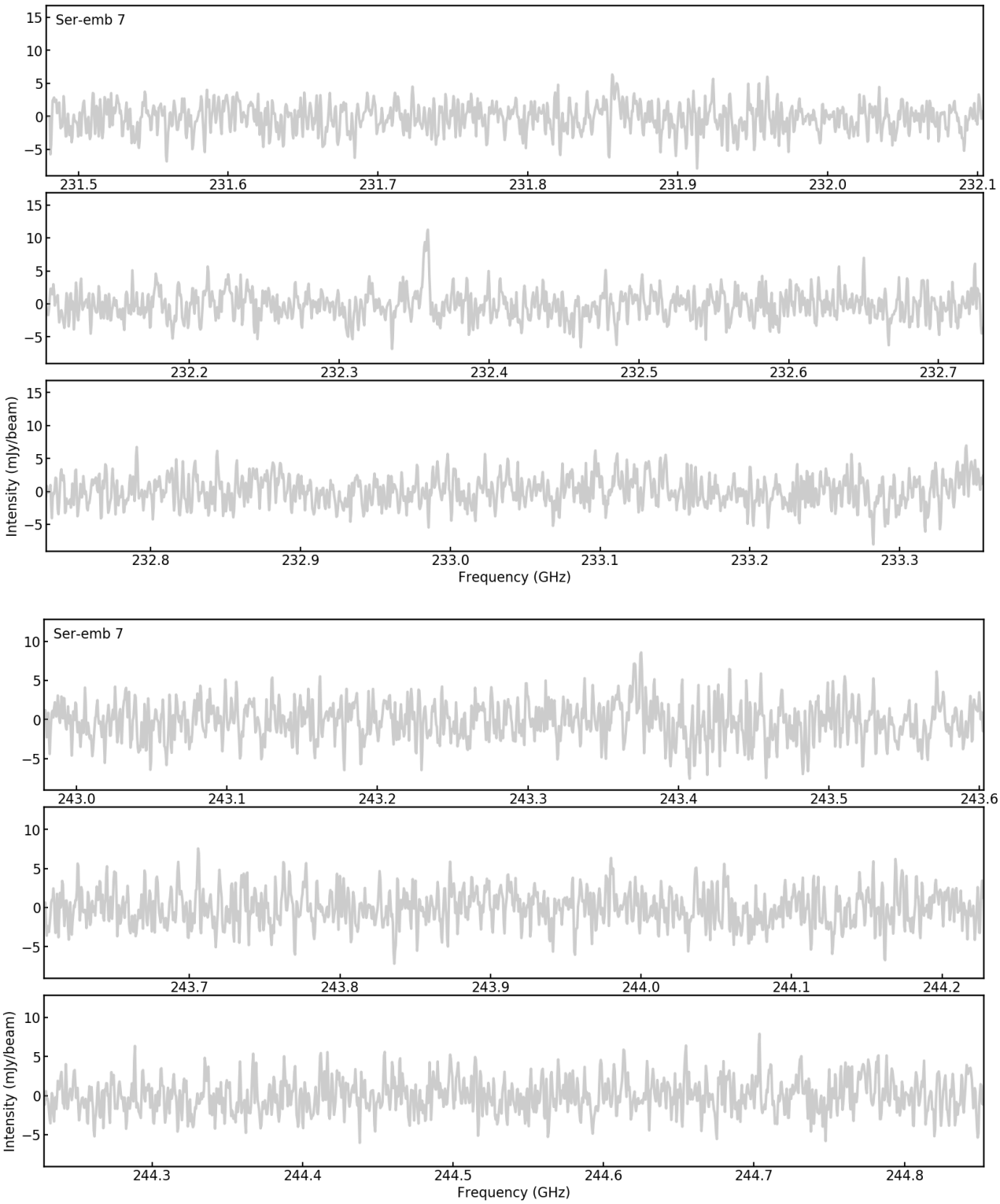

Figure 6: Full spectrum extracted from the continuum peak pixel in Ser-emb 7 (grey line).

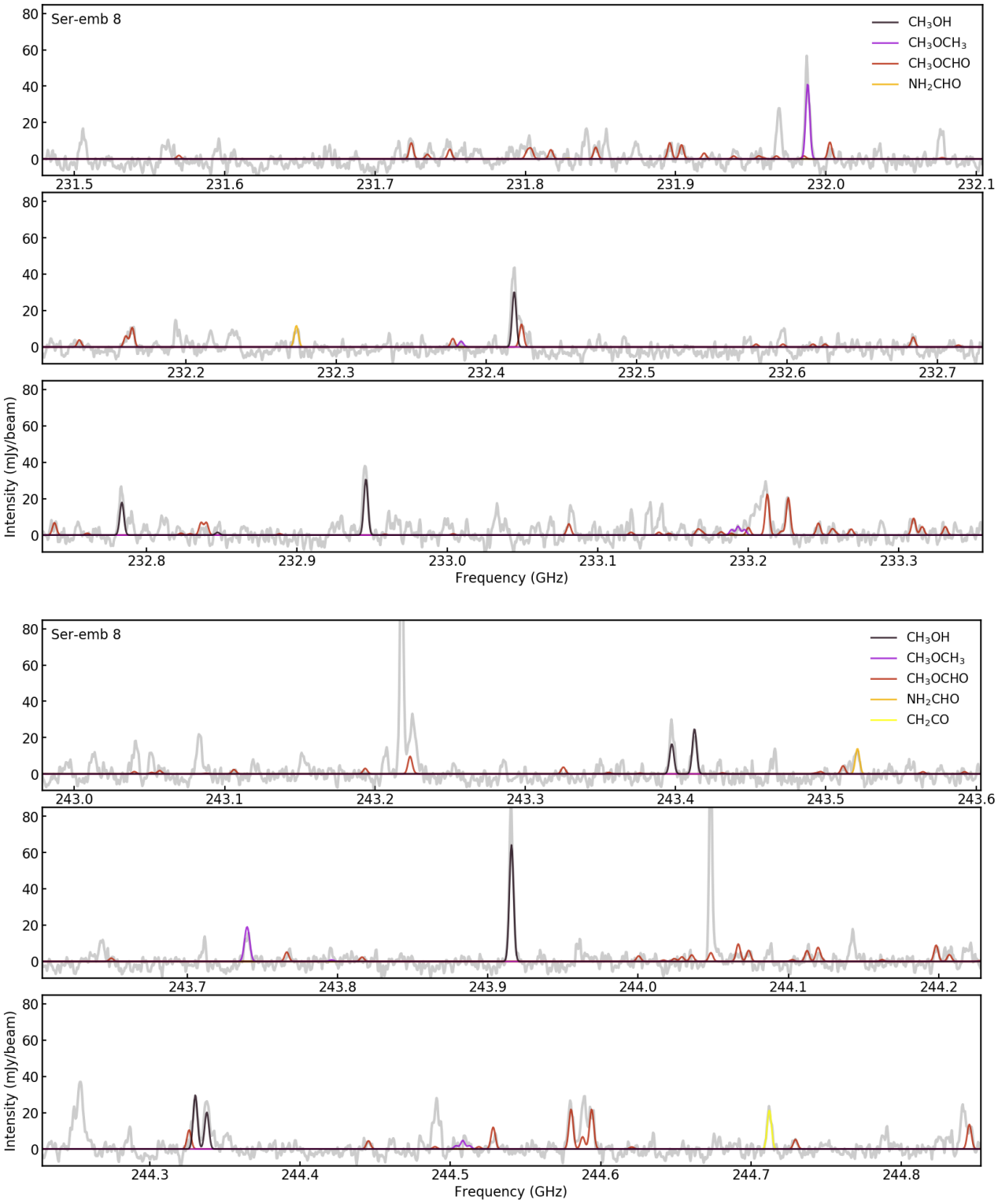

Figure 7: Full spectrum extracted from the continuum peak pixel in Ser-emb 8 (grey line), along with synthetic spectra of the detected COMs (colored lines). Spectra are calculated assuming the CH_3OH rotational temperature.

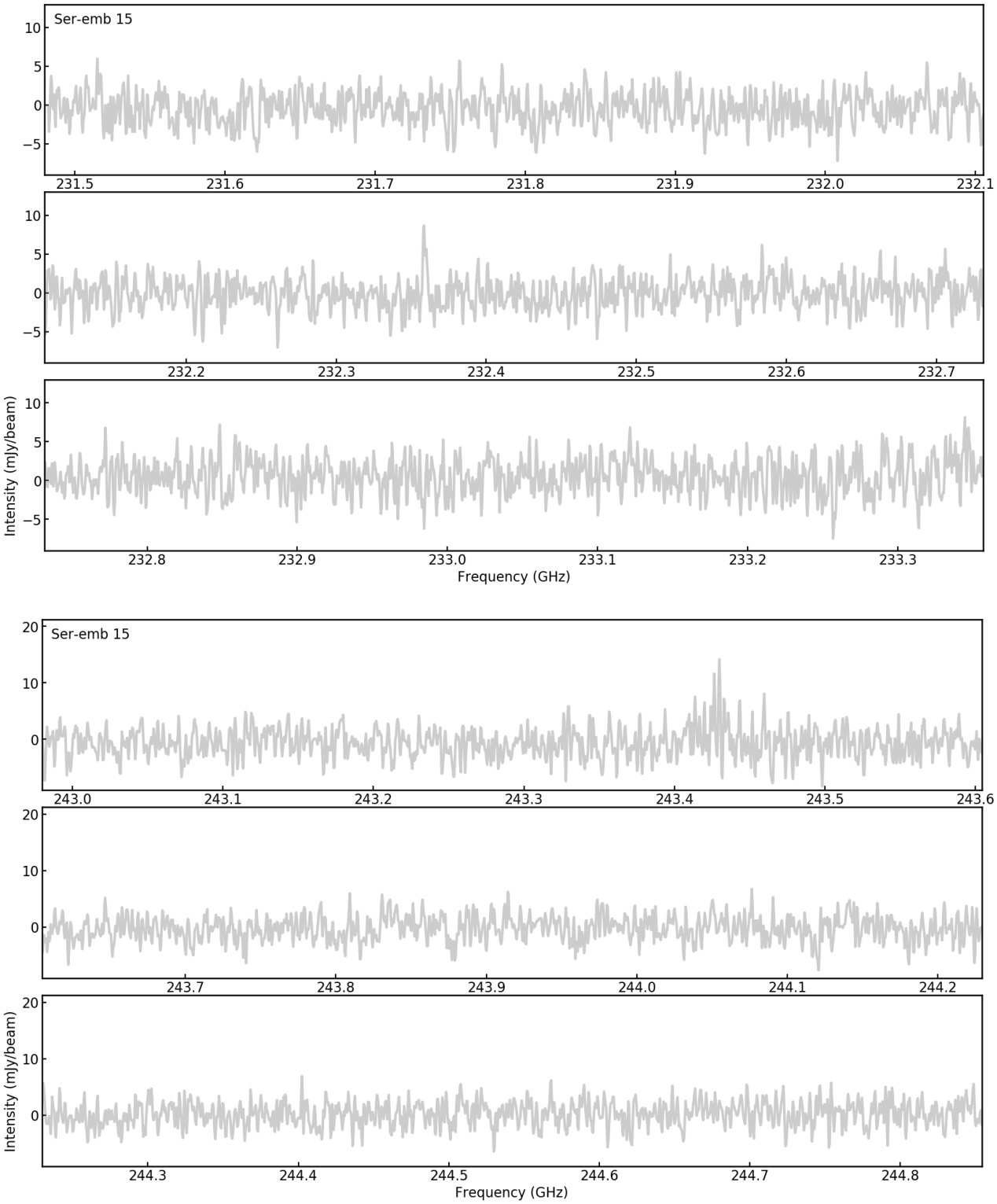

Figure 8: Full spectrum extracted from the continuum peak pixel in Ser-emb 15 (grey line).

Population diagram diagram fitting

For the MCMC population diagram fits to CH_3OH, we use a flat prior $10^5 < N_T < 10^{20}$ cm^{-2} and $100 < T_r < 400$ K. 200 walkers are propagated for 1000 steps, and the samples are well converged. Walker chains and corner plots for each source are shown in Figures 9–11 for the maximum beam dilution case.

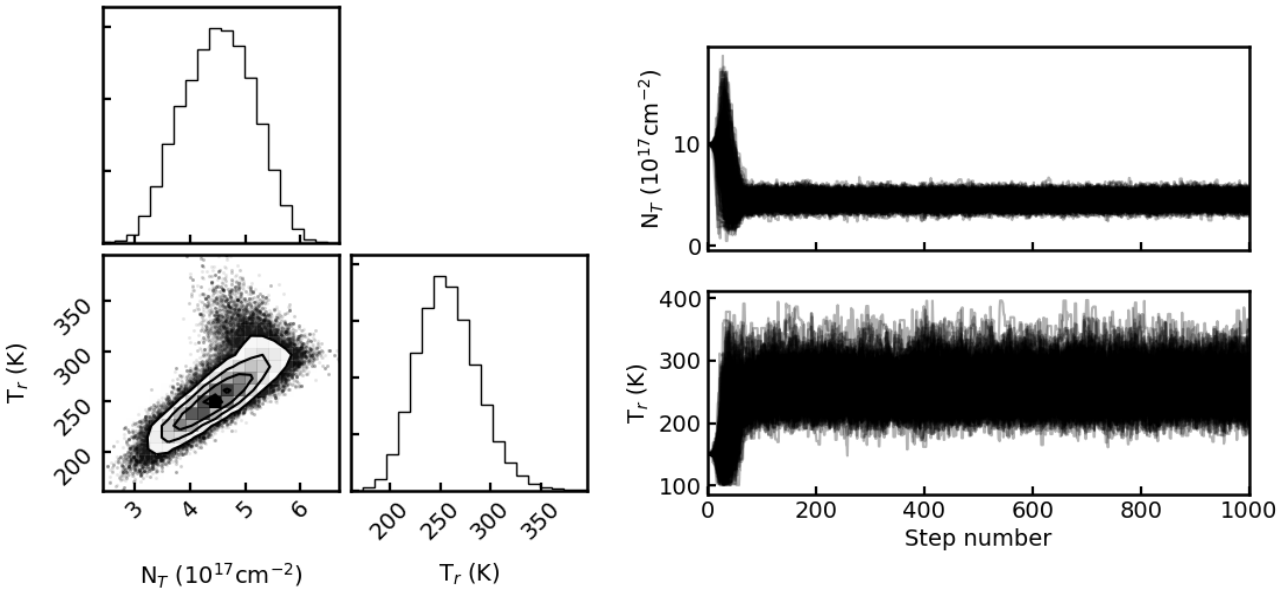

Figure 9: Ser-emb 1 rotational diagram MCMC fit results. The corner plot is shown on the left and the walker chain on the right.

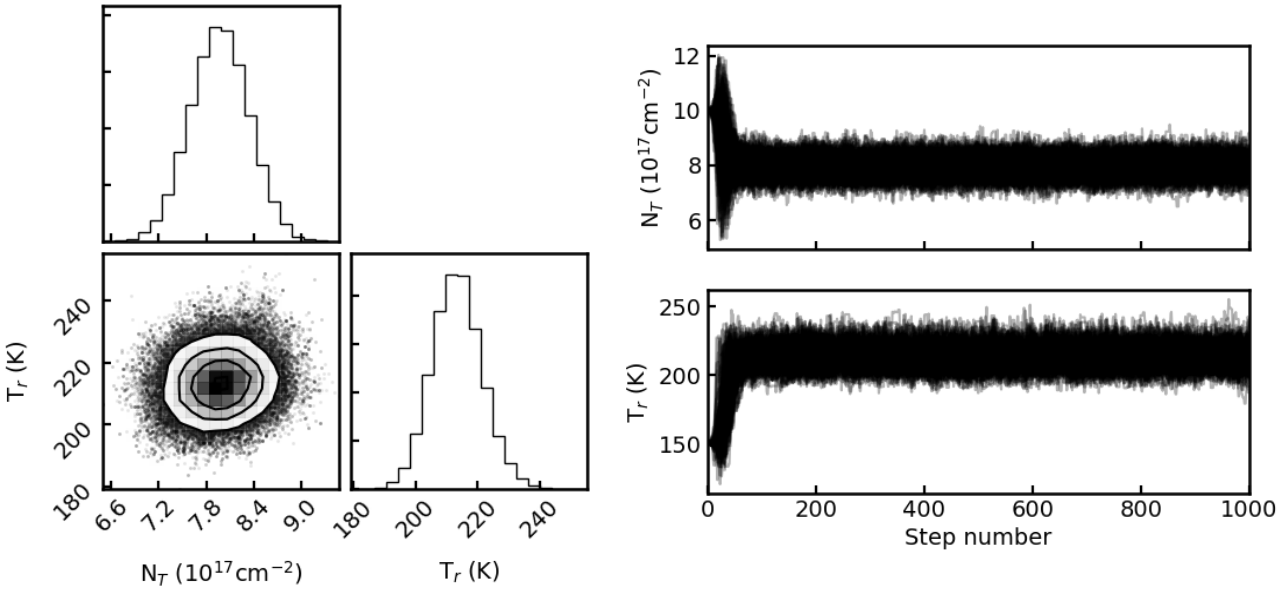

Figure 10: Ser-emb 8 rotational diagram MCMC fit results. The corner plot is shown on the left and the walker chain on the right.

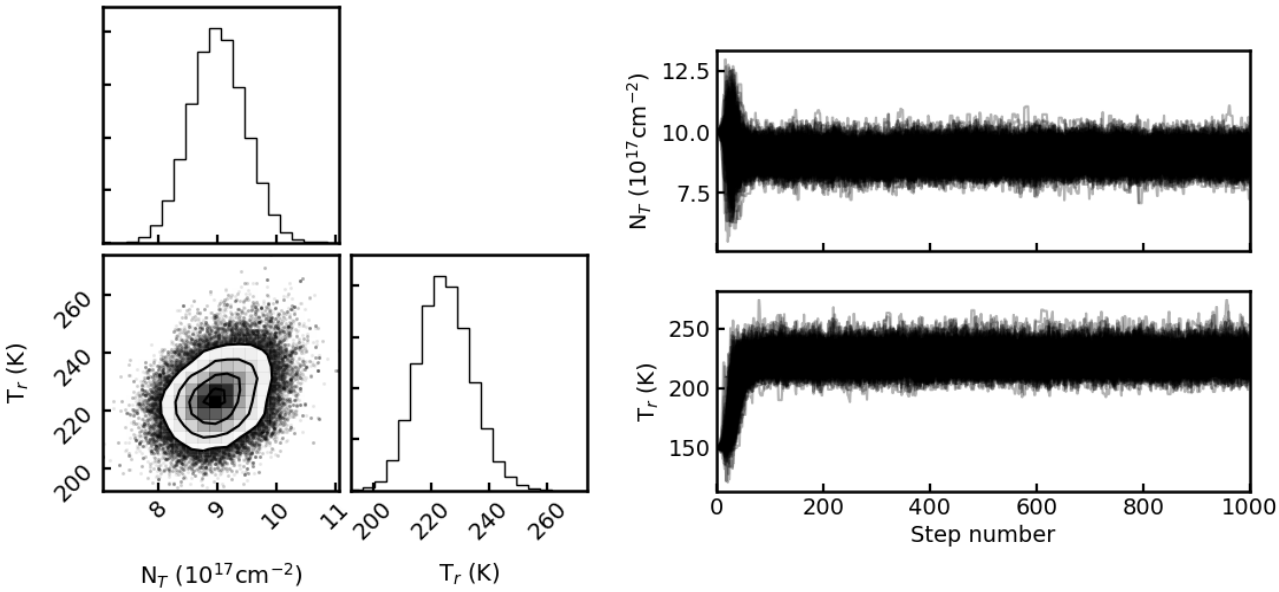

Figure 11: Ser-emb 17 rotational diagram MCMC fit results. The corner plot is shown on the left and the walker chain on the right.