The chemical structure of the young pre-stellar core L1521E

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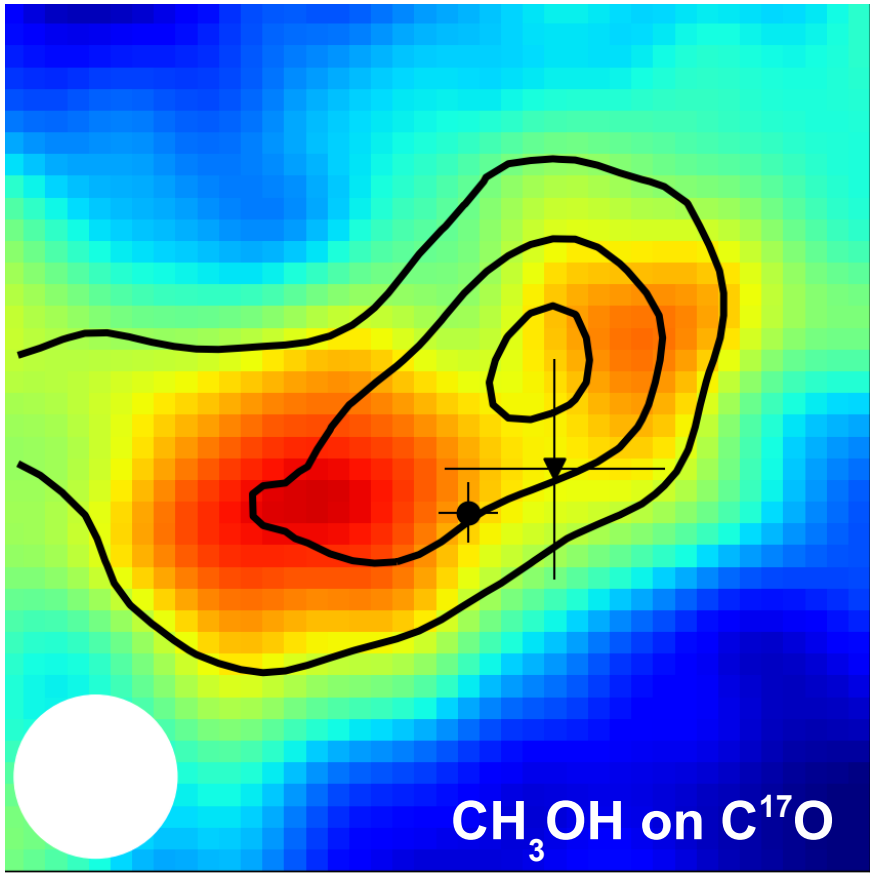

Outline

-Introduction

-Observations on L1521E

-Results / Spatial structure

-Results / CO depletion toward L1521E

-Results / Comparison to L1544

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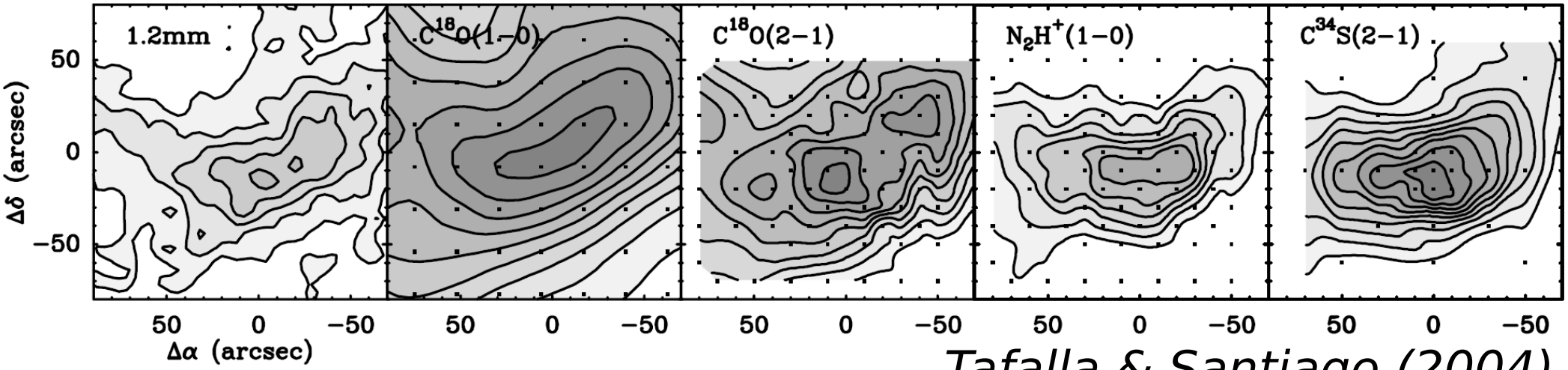
Introduction



Tafalla & Santiago (2004)

-Taurus region, *d*=140 pc

-Hirota et al. (2002): L1521E is a very young core

-Tafalla & Santiago (2004): L1521E shows no CO and CS depletion

-**Goal**: *probe CO depletion, chemical structure, and compare to the more evolved, well-studied L1544 core*

Introduction

	L1521E	L1544
$n(H_2)$ (cm^{-3})	**$(1.3–5.6)\times10^5$** Hirota et al. (2002)	**$(1.4\pm 0.2)\times10^6$** Crapsi et al. (2005)
***N*(H_2) (cm^{-2})**	**2.8×10^{22}** Spezzano et al. (2016)	**$(9.4\pm1.6)\times10^{22}$** Crapsi et al. (2005)
Time-scale (yr)	**$\leq1.5\times10^5$** Tafalla & Santiago (2004)	**few $\times$ 10^5** Kong et al. (2015)

Observations

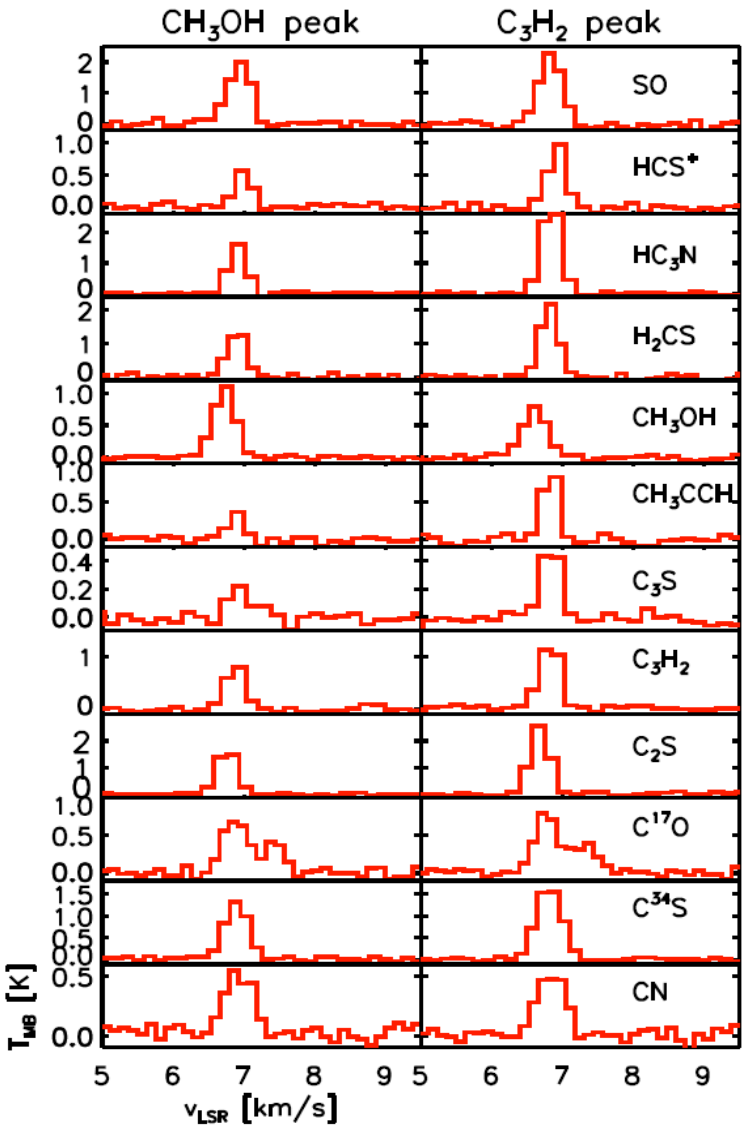
-IRAM-30m, ~2.5×2.5 arcminute maps

-80.9 GHz – 113.2 GHz

-Beam-size: 30 arcsec

-*N*(H_2) map from *Herschel*/ SPIRE continuum

-1.2 mm continuum from Tafalla & Santiago (2004)



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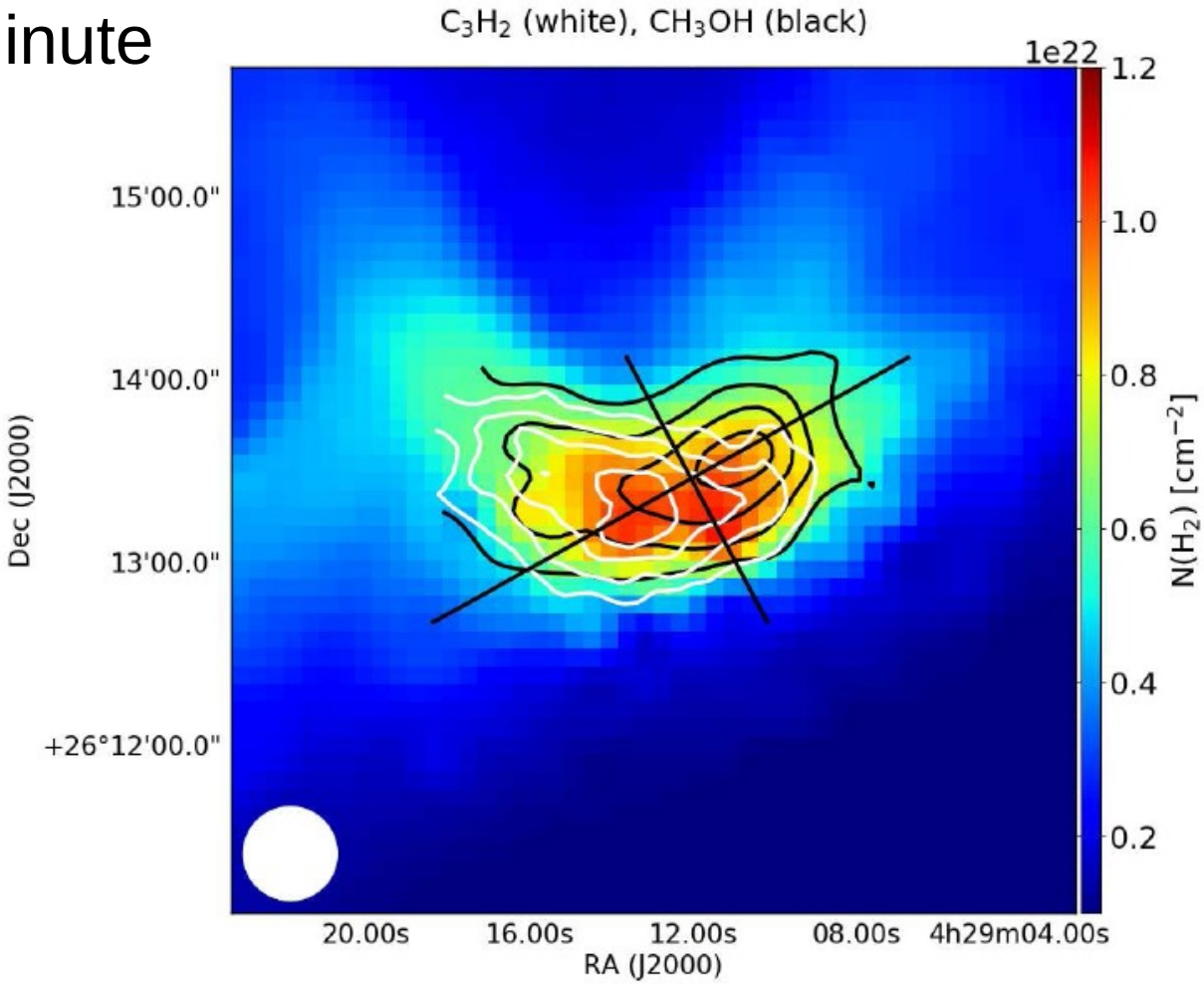
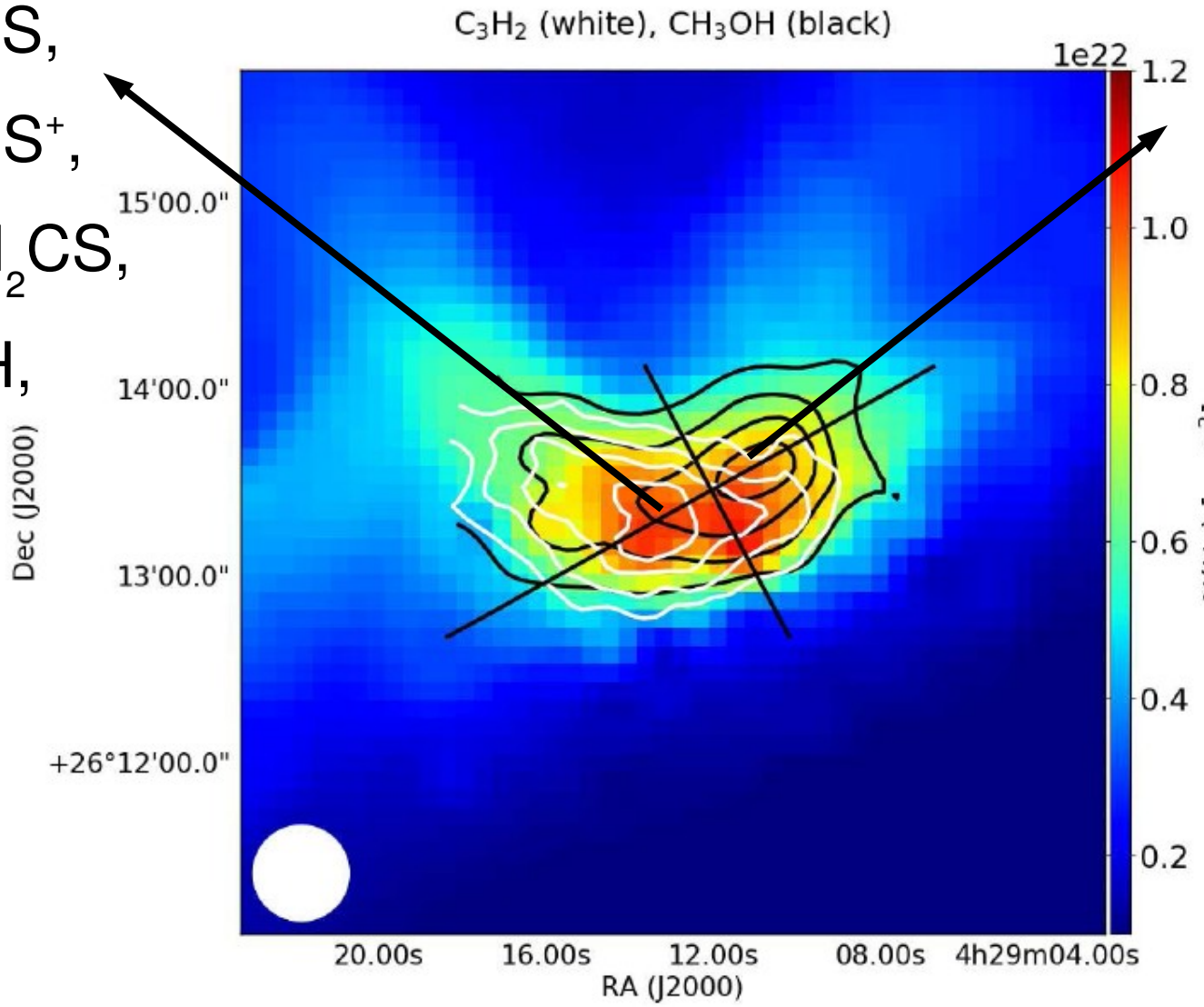


Spatial distribution of the species

C_3H_2, C_2S, C_3S, HCS^+, HC_3N, H_2CS, CH_3CCH, $C^{34}S$, SO, $C^{17}O$



CH_3OH, CN, SO, $C^{17}O$

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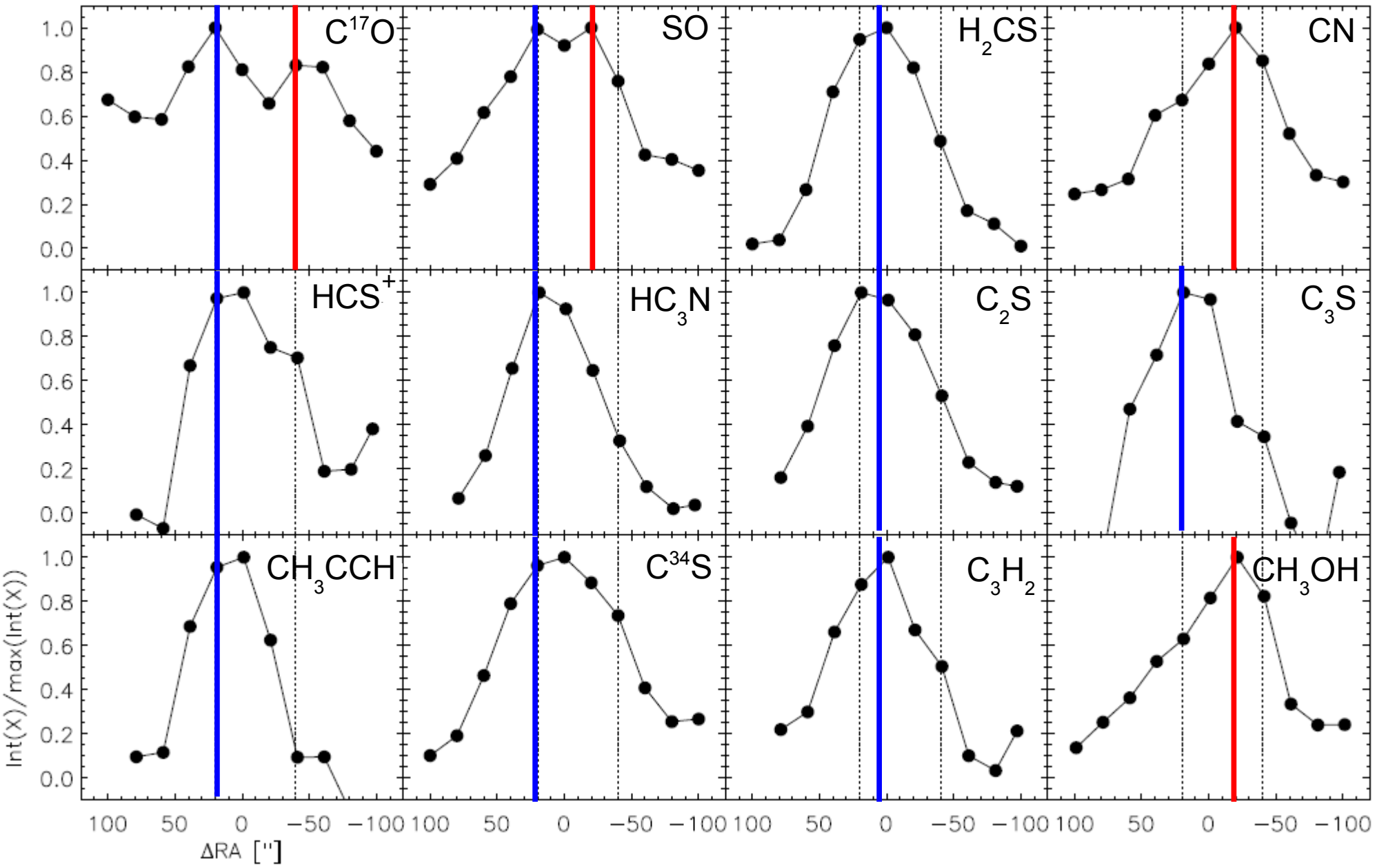

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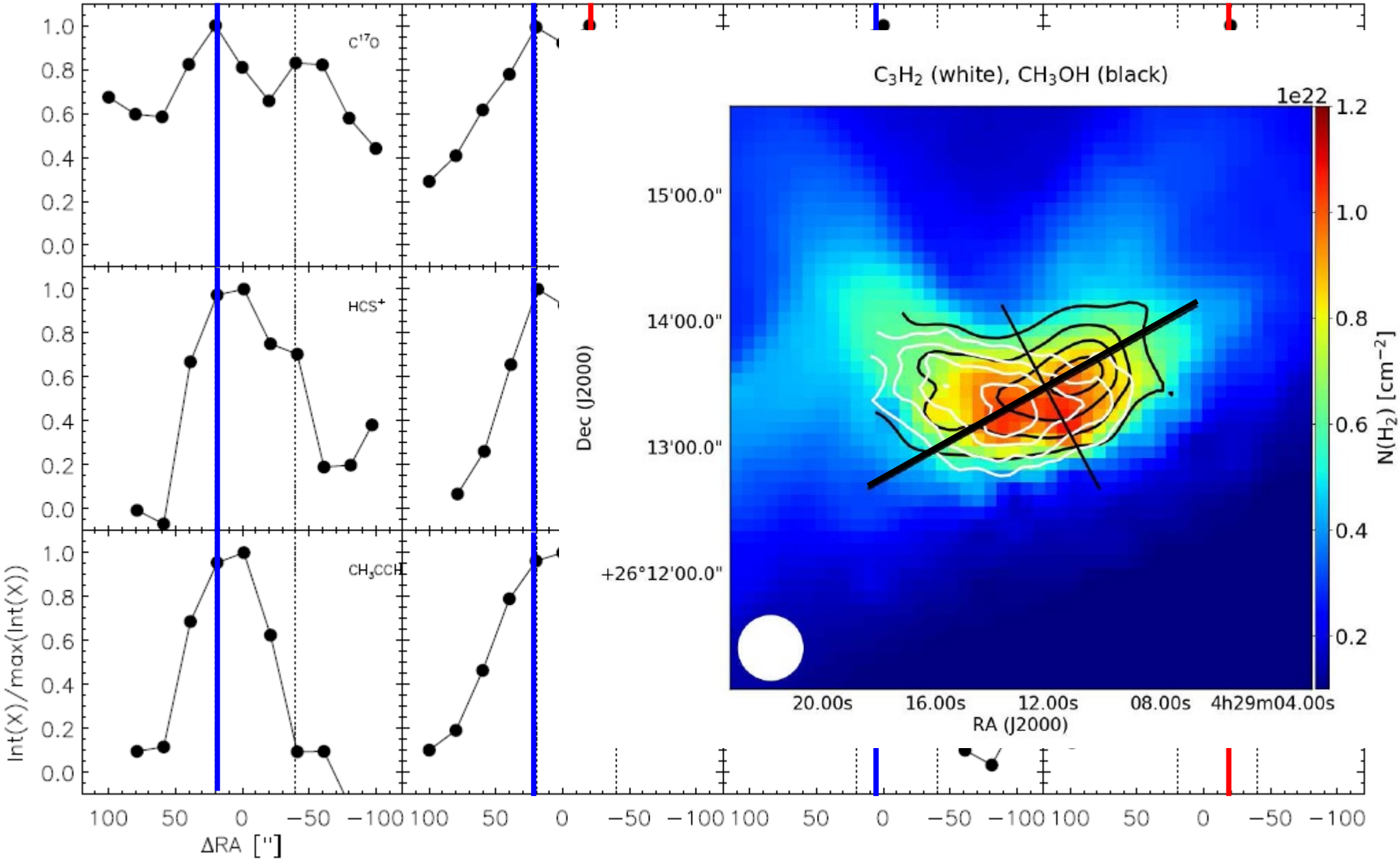

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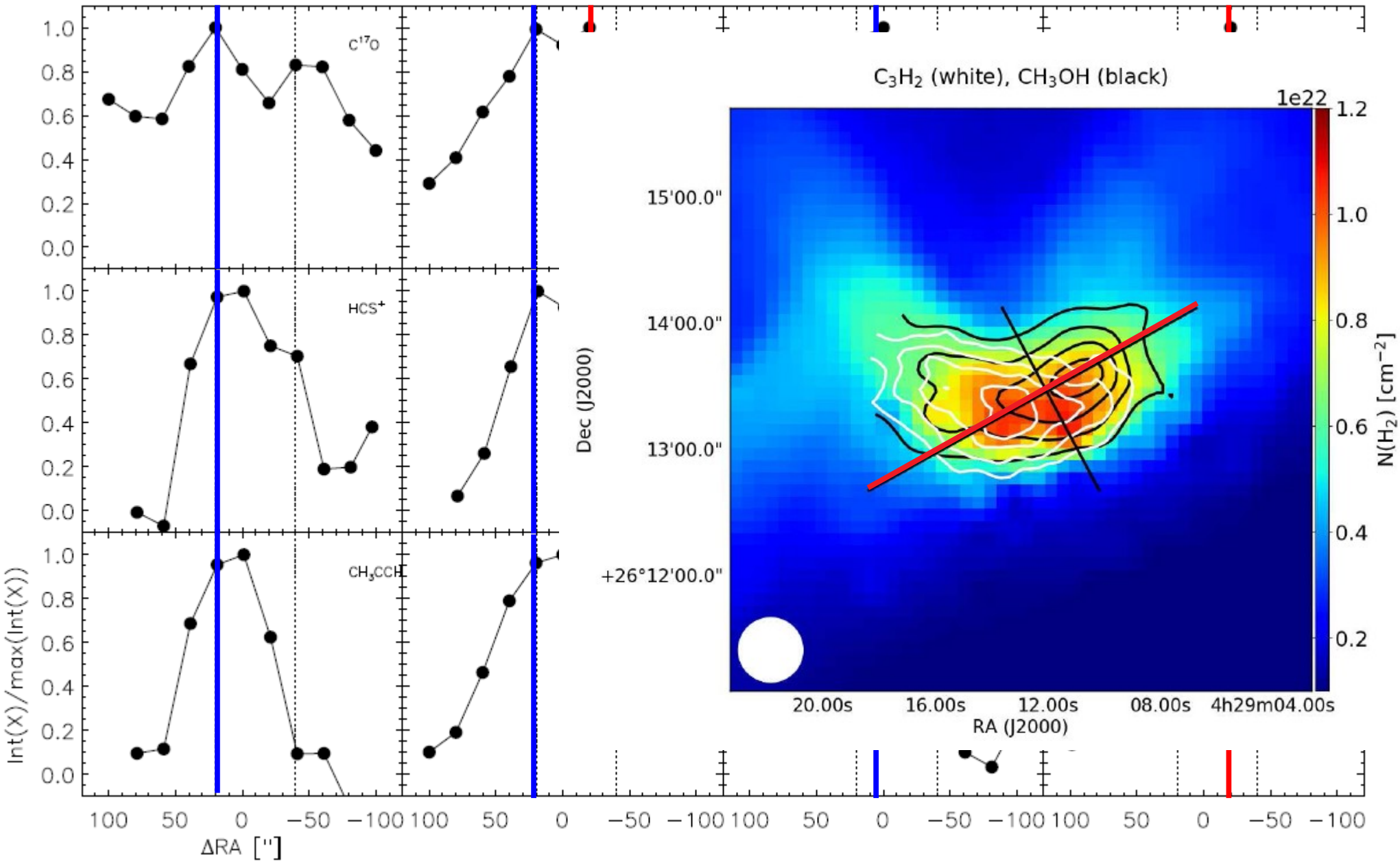

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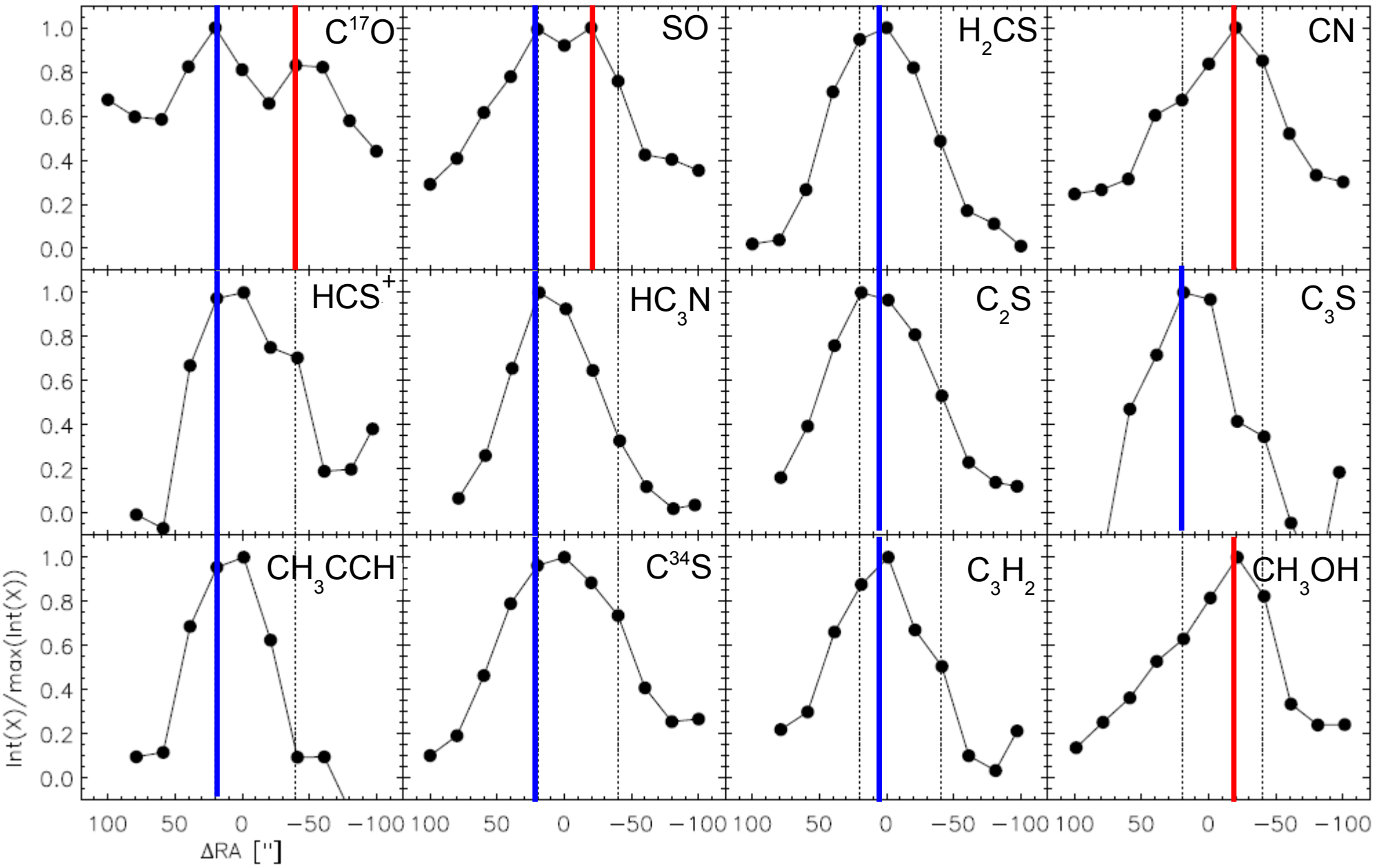
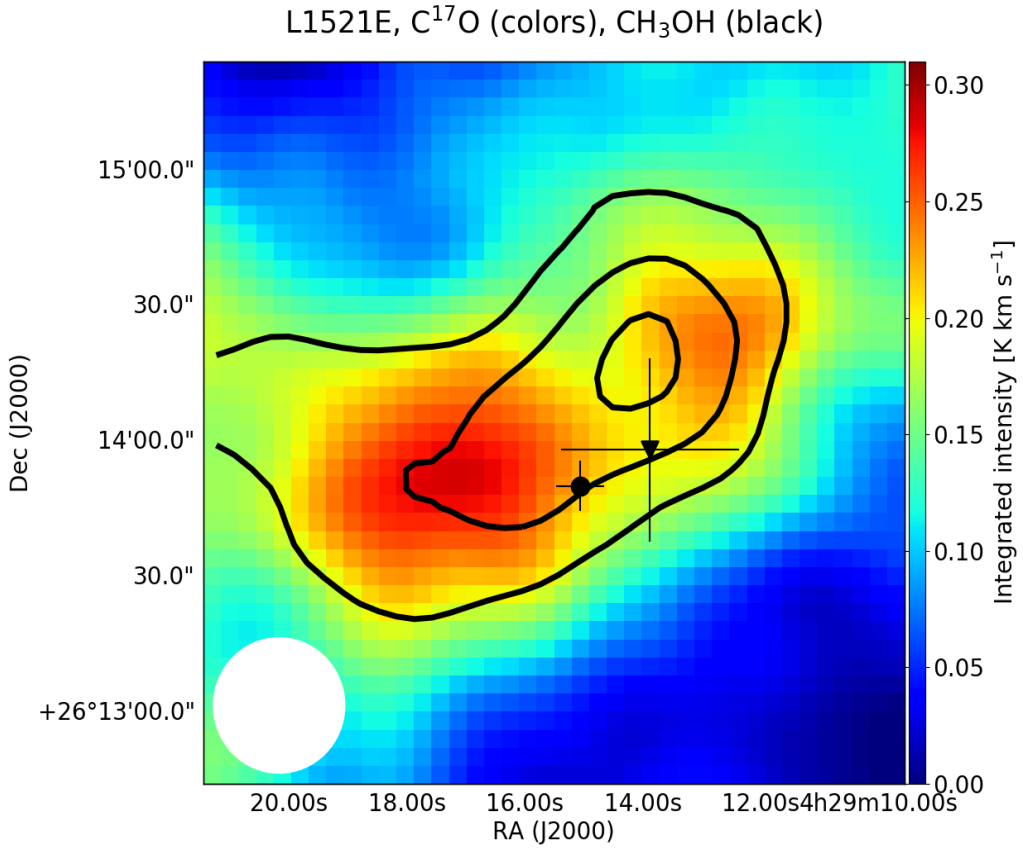


Depletion in L1521E?



-CO is depleted at the dust peak

-Methanol peaks where CO is frozen out – similar to L1544

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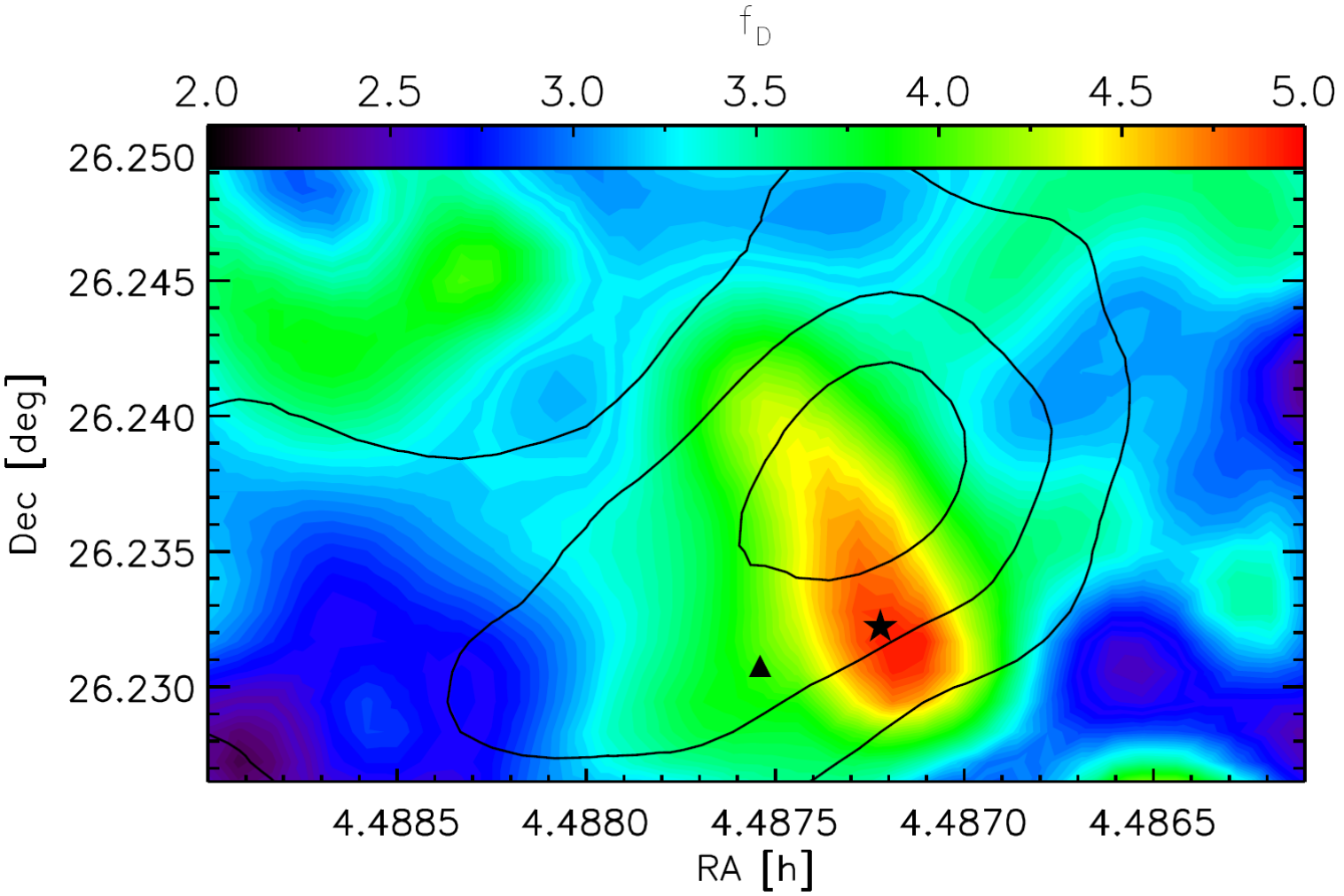

Contours:
CH_3OH

-Depletion factors derived based on the *Herschel* continuum
-Similar values from the 1.2mm continuum data

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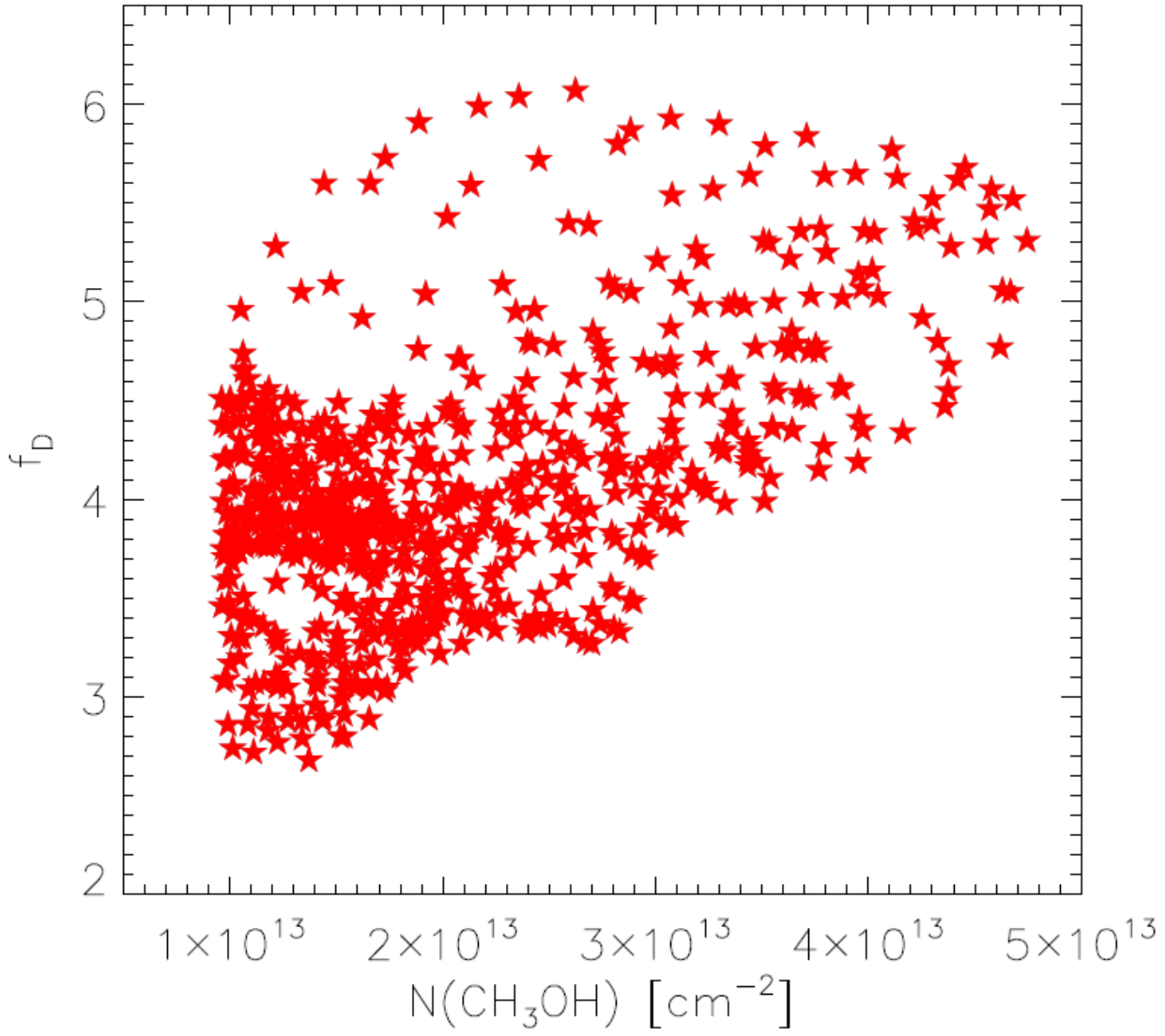
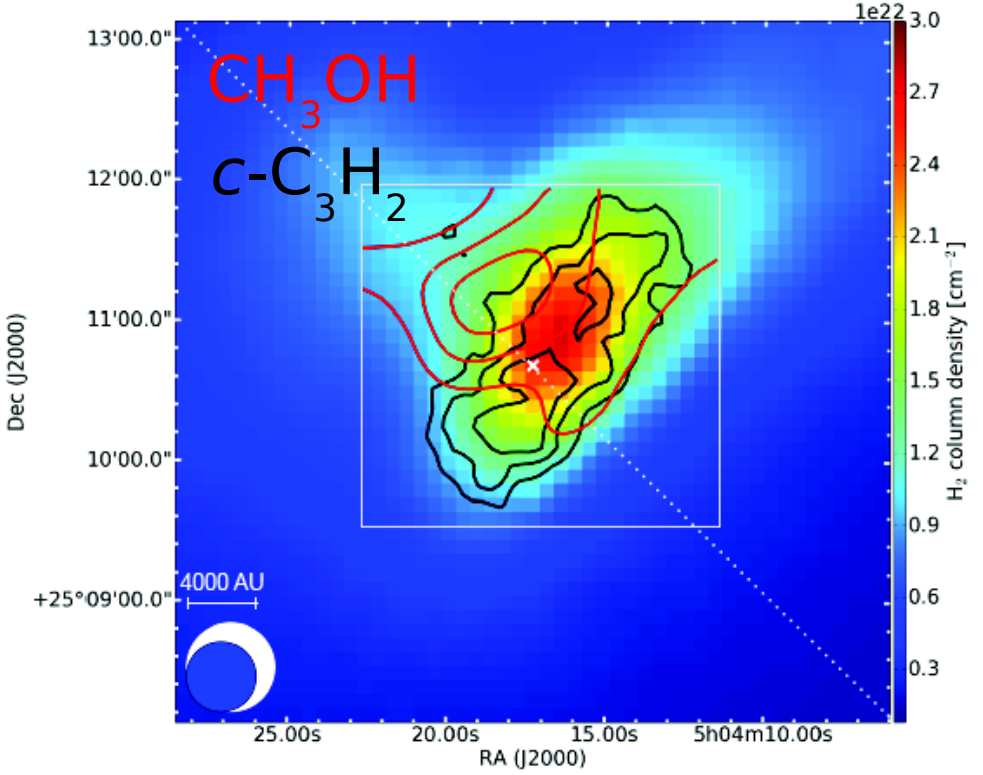


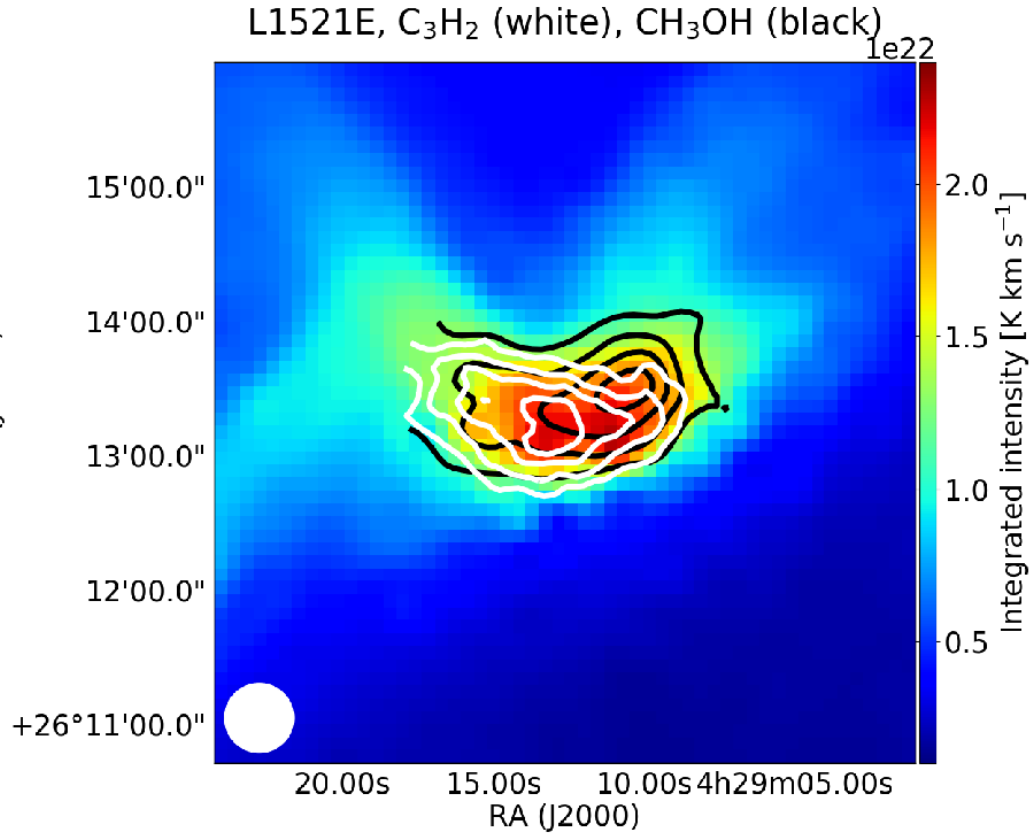
Comparison to L1544

C_3H_2 vs CH_3OH

-C_3H_2 and CH_3OH peak at different positions in both cores

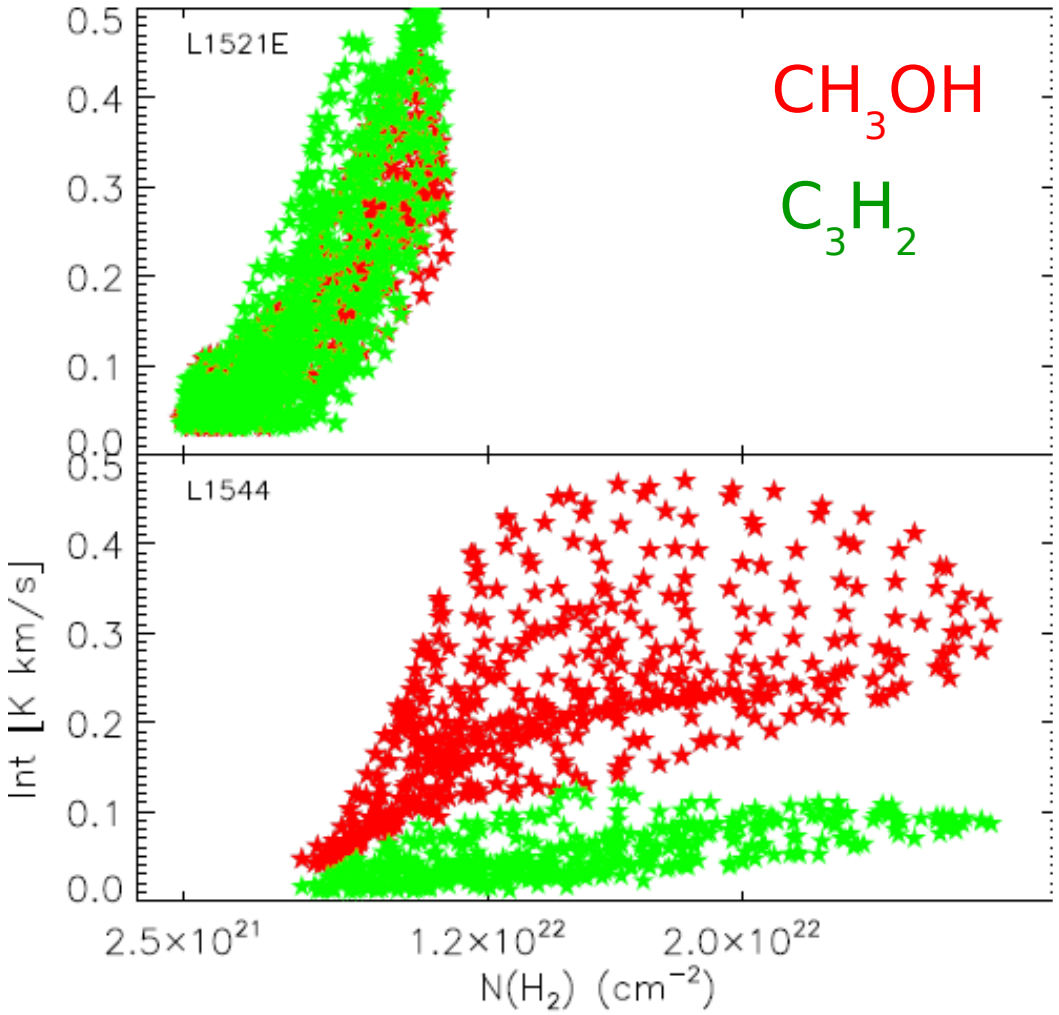


Spezzano et al. (2016)



L1521E (Nagy et al., in prep)

Comparison to L1544



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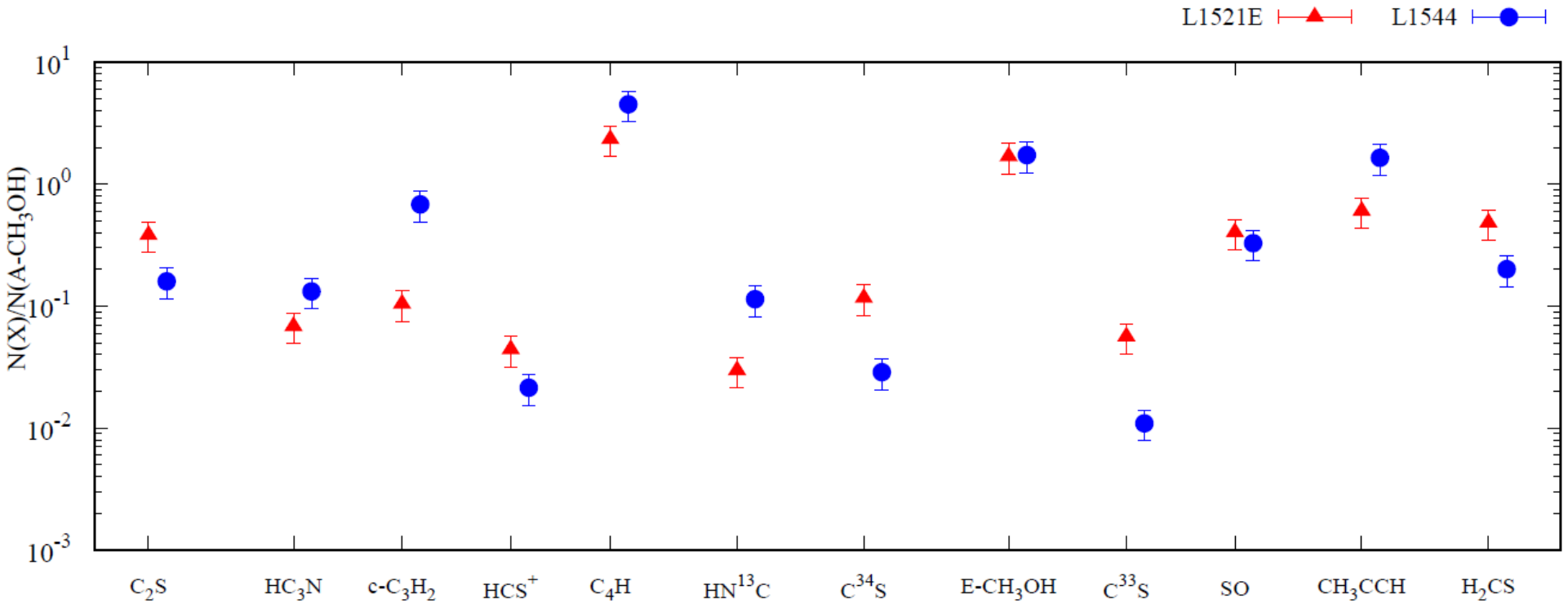
Abundance comparison



-L1544 data: from the ASAI (‘Astrochemical Surveys At IRAM’, Lefloch et al. 2018)

-Sulfur bearing species are more abundant toward L1521E than toward L1544

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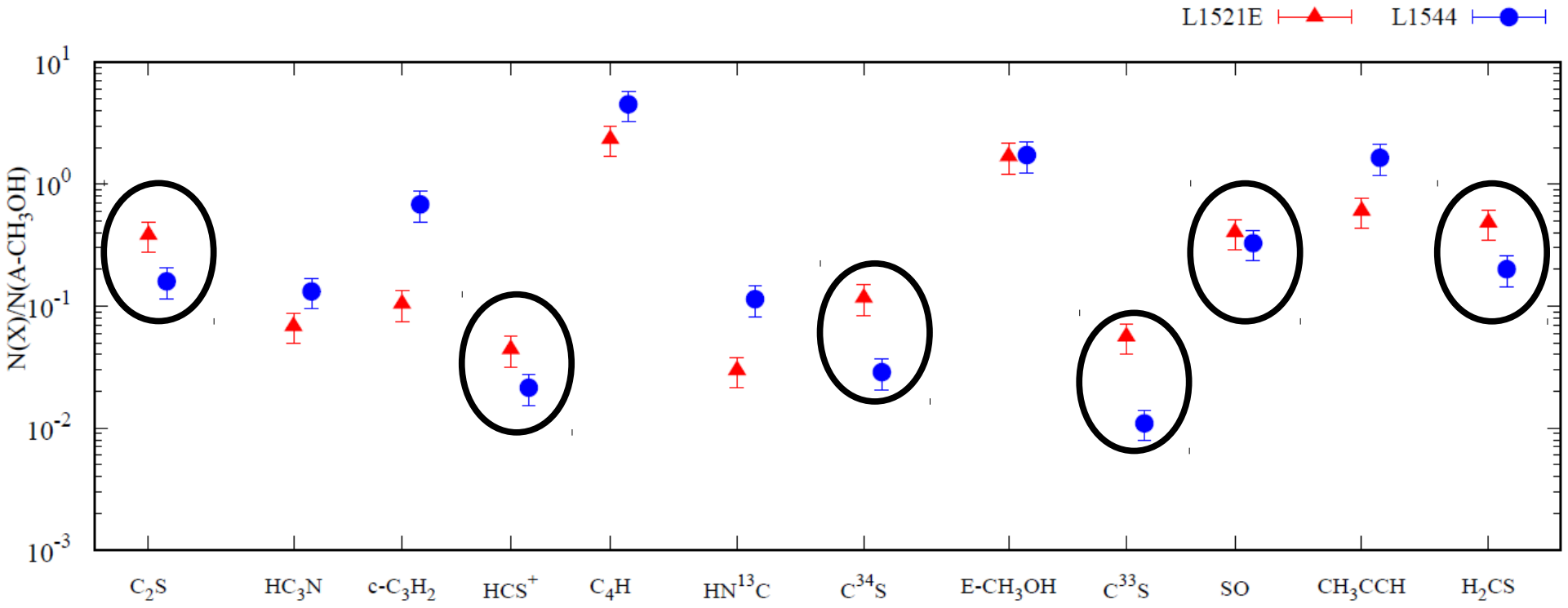

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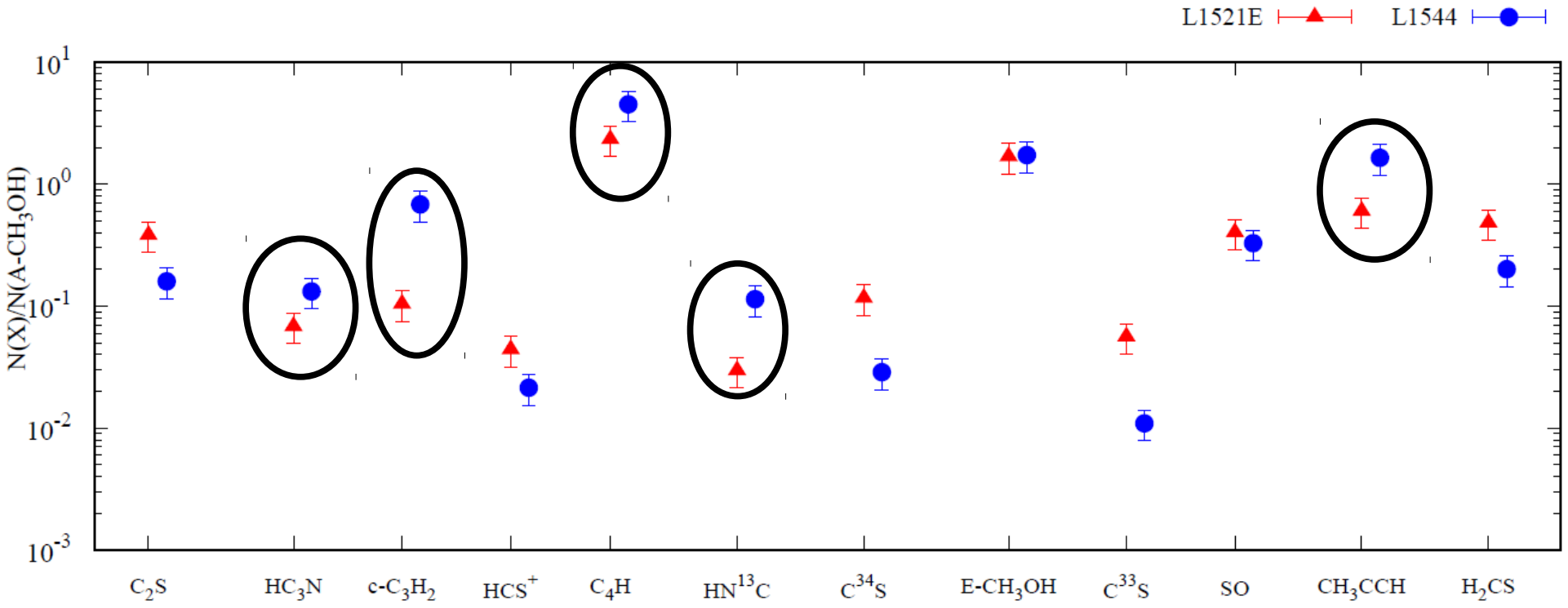

-L1544 data: from the ASAI (‘Astrochemical Surveys At IRAM’, Lefloch et al. 2018)

-Most of the other species are more abundant toward L1544

Summary

-Higher CO depletion for L1521E than expected by earlier studies

-C_3H_2 and CH_3OH peak at different positions in both L1521E and L1544

-Sulfur-bearing species are more abundant toward L1521E than toward L1544

-Carbon-chain molecules are more abundant toward L1544.

-Future: chemical models will be used to understand the chemistry of L1521E better