Molecular emission around low-mass protostars in the Serpens Main with IRAM 30m

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Questions

- Where are molecules dissociated in molecular outflows?
- What are the typical UV fields in Class 0/I protostars?
- What is the influence of UV radiation on the surroundings of low-mass protostars?

CN/HCN: UV field tracer

HCN —UV→ CN + H

Observations

- Spectra are obtained using IRAM 30m single dish antenna
- Targeted lines: HCN, CN, CS and their isotopologues

Serpens Main

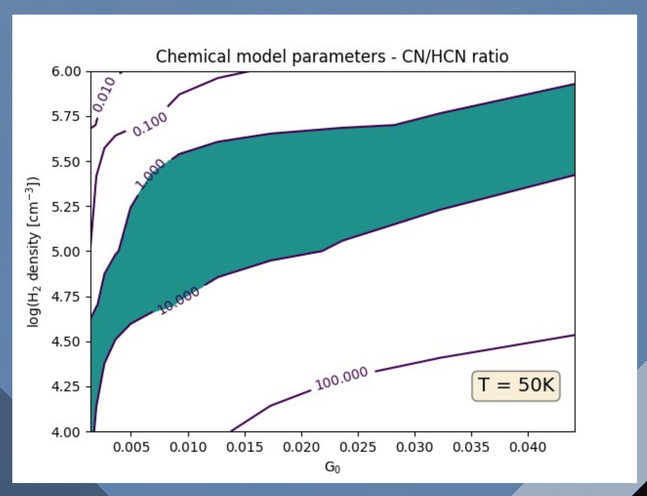
Molecule	Freq. [GHz]	Beam size [arcsec]
HCN 1-0	88.63	28
CN 1-0	113.49	22
CS 3-2	146.96	16
$C^{34}S$ 3-2	144.62	16
$H^{13}CN$ 2-1	86.34	29
$H^{13}CN$ 1-0	172.68	14

Conclusions

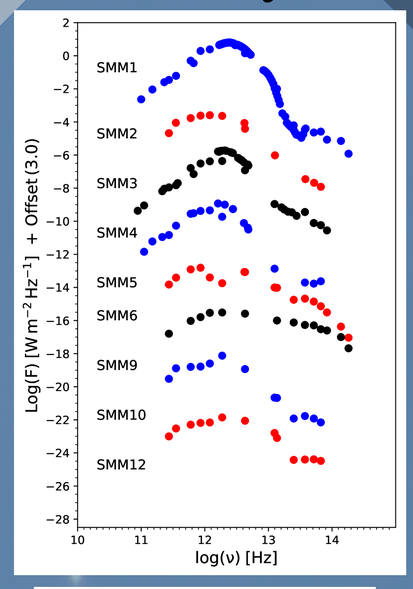
- CN/HCN ratio is higher around more envolved low-mass protostars
- N(CN)/N(HCN) ratio does not depend strongly on excitation conditions
- Nahoon astrochemical model shows that an additional UV radiation of a few percent of the average in the ISM is required
- The UV radiation cannot be neglected in models of star formation

Astrochemical model

- Nahoon code calculates abundances of 474 species
- In low temperature regime abundances of CN/HCN not depend strongly on temperature



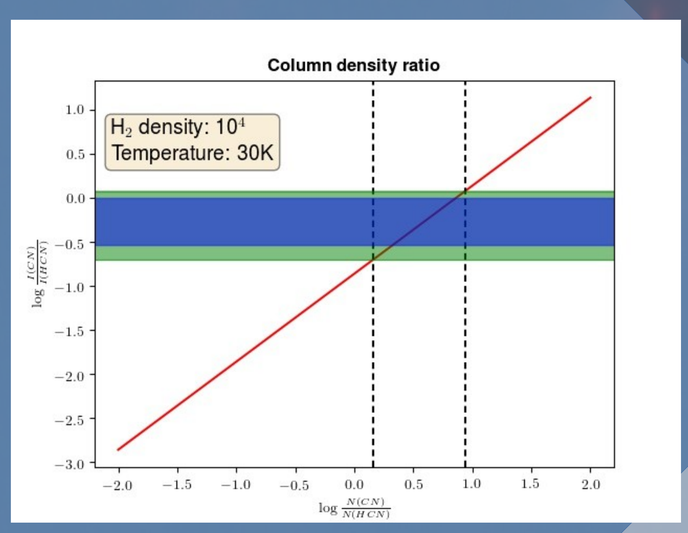
SED analysis



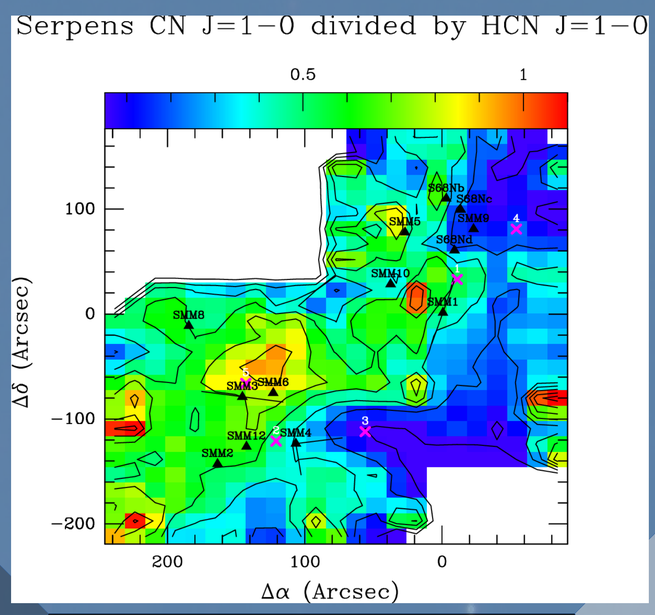
Sbmm source	T_{bol} (K)	L_{bol} ($L_\odot$)	Class
SMM9	46.14	11.69	Early Class 0
SMM1	40.35	108.72	Early Class 0
SMM5	148.24	4.49	Early Class I
SMM10	85.09	5.13	Late Class 0
SMM4	29.54	13.6	Early Class 0
SMM6	526.44	43.39	Late Class I
SMM12	100.87	6.68	Early Class I
SMM3	42.39	27.49	Early Class 0
SMM2	41.6	5.1	Early Class 0
SMM8		0.068[a]	

CN/HCN column density ratio

- RADEX set of models
- Column density ratio covers the range of 1-10 irrespectively of the gas parameters



CN/HCN spatial distribution



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