

FLOWERS AND WEEDS

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A close-up photograph of a field of tulips. The majority of the flowers are white with yellow centers, but there are several pink and purple tulips scattered throughout. The flowers are in various stages of bloom, and the background is a soft-focus green field.

*... Flowers are
Wonderful*

*But they
can easily
be
swamped
by
different
types of
weeds!*



Her Highness.

weeds

Putting the herb in suburb.

NEW SEASON BEGINS
TONIGHT 10PM



What is a Flower?

Flower:

A molecule of interest for observation with Herschel HIFI, for which the relevant spectroscopy is well understood: levels identified and known to better than 1 MHz

Does not say anything about knowledge of chemistry, collision rates, or spectroscopy in other wavelength ranges

CF⁺ ($v = 0$) Flower or Not?

Frequency (MHz)	uncert (MHz)	E _l (cm ⁻¹)	J _u	Obs ¹
102587.4838	0.0142	0.0000	1	x
205170.4490	0.03	3.4220	2	x
307744.3680	0.03	10.2657	3	x
410304.7810	0.03	20.5309	4	x
512847.0838	0.0799	34.2172	5	
615366.8172	0.1704	51.3240	6	
717859.4514	0.3038	71.8504	7	
820320.4707	0.4866	95.7956	8	
922745.3595	0.7258	123.1586	9	
1127468.6863	1.401	153.9380	10	
1229758.0954	1.85	225.7410	11	
1536283.1440	3.733	359.0306	14	
1638328.7261	4.561	410.2755	15	
1740302.0721	5.502	464.9242	16	
1842198.6719	6.562	522.9745	17	

Molecular Ion CF^+

Floral attributes:

Transitions and levels understood

Transition frequency uncertainty less than 1 MHz up to 1000 GHz in $v = 0$; similar uncertainties for $v = 1$ ($E \sim 1800 \text{ cm}^{-1}$)

Unfloral attributes:

Transition frequency uncertainties rise to > 5 MHz for higher transitions in HIFI Band 6

A True Flower: O₂ ($v = 0$)

Freq (MHz)	uncert (MHz)	Eu (cm ⁻¹)	N u	J u	N l	J l
487249.3755	0.0205	2.0843	3	3	1	2
715393.0720	0.0337	18.3372	5	4	3	3
773839.6910	0.0640	16.3876	5	4	3	4
834145.7191	0.0338	16.3876	5	5	3	4
1061124.0518	0.0416	44.2117	7	6	5	5
1120715.0358	0.0414	42.2240	7	6	5	6
1179879.2388	0.0416	42.2240	7	7	5	6
1466807.1330	0.0600	79.5646	9	8	7	8
1525131.0204	0.0422	79.5646	9	9	7	8
1751254.8766	0.0365	130.4375	11	10	9	9
1812405.5390	0.1120	128.3978	11	10	9	10
1870017.9181	0.0366	128.3978	11	11	9	10

O₂ – A True Flower?

Floral: $v = 0$ levels understood
and frequencies known to
better than 0.1 MHz



Unfloral: $v = 1$ frequencies ($E \sim 1600 \text{ cm}^{-1}$)
are much less well known with
uncertainties up to 9 MHz

Conclusion: Very low O₂ abundance
makes $v > 0$ levels unlikely
to be significant



Conclusion

Florality is a question of degree but we have to come to conclusions about possible laboratory needs based on likelihood of transitions of a given species being observable

Lower frequency lines observed with HIFI may help in identification and improve precision with which frequencies of higher frequency lines are known