The Transient Nature of the DIBs

Ashley Villar

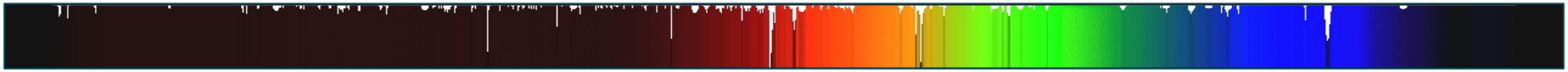
Thanks to...

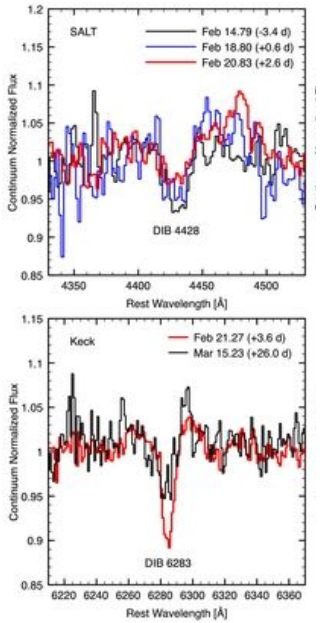
Karin, Aneta, Vinay & Meredith - for teaching

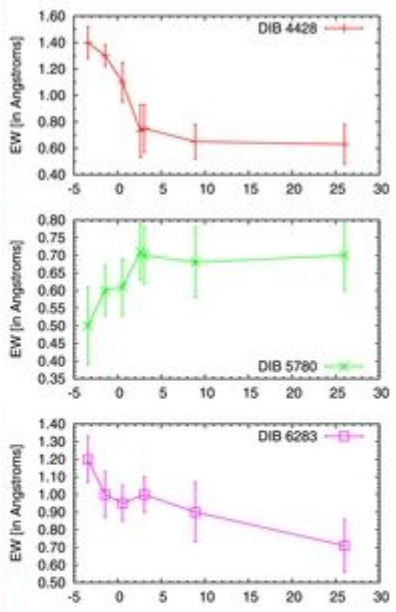
Dan Milisavljevic - for authoring

Ryan & Jane - for answering questions

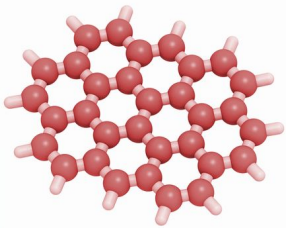
Are the Carriers of Diffuse Interstellar Bands (DIBs) large, organic molecules?

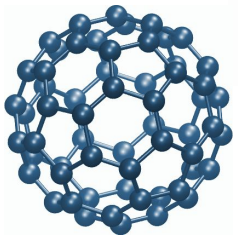




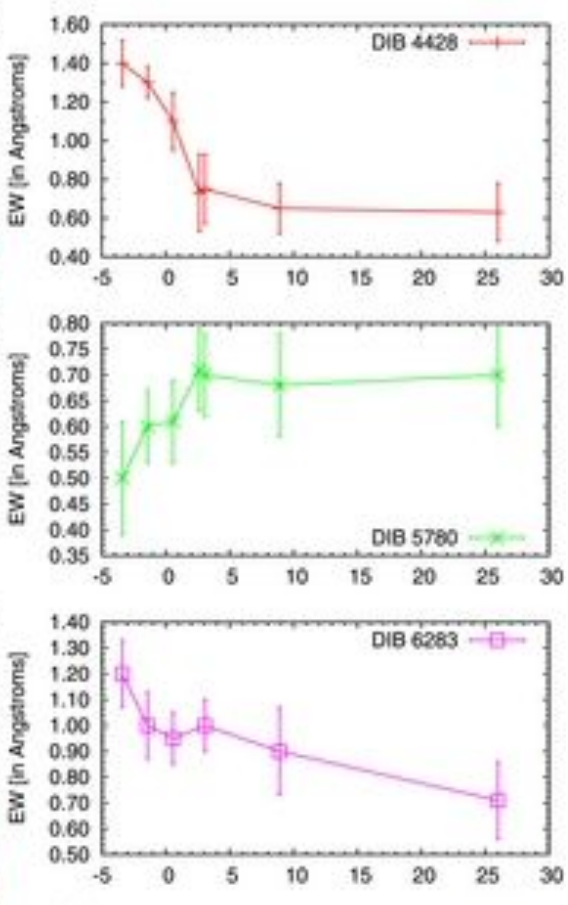


polycyclic aromatic hydrocarbons





fullerenes



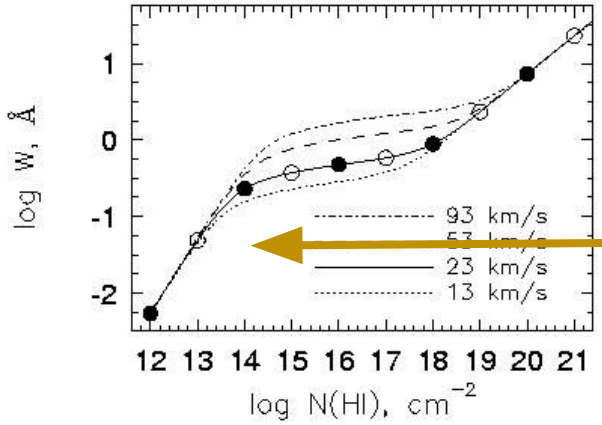
Kendall's τ:

4428 - 5780: -0.80 (p = 0.05)

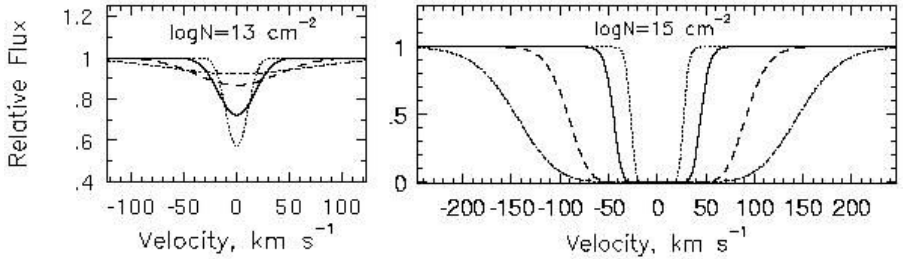
4428 - 6283: 0.74 (p = 0.07)

6283 - 5780: -0.53 (p = 0.20)

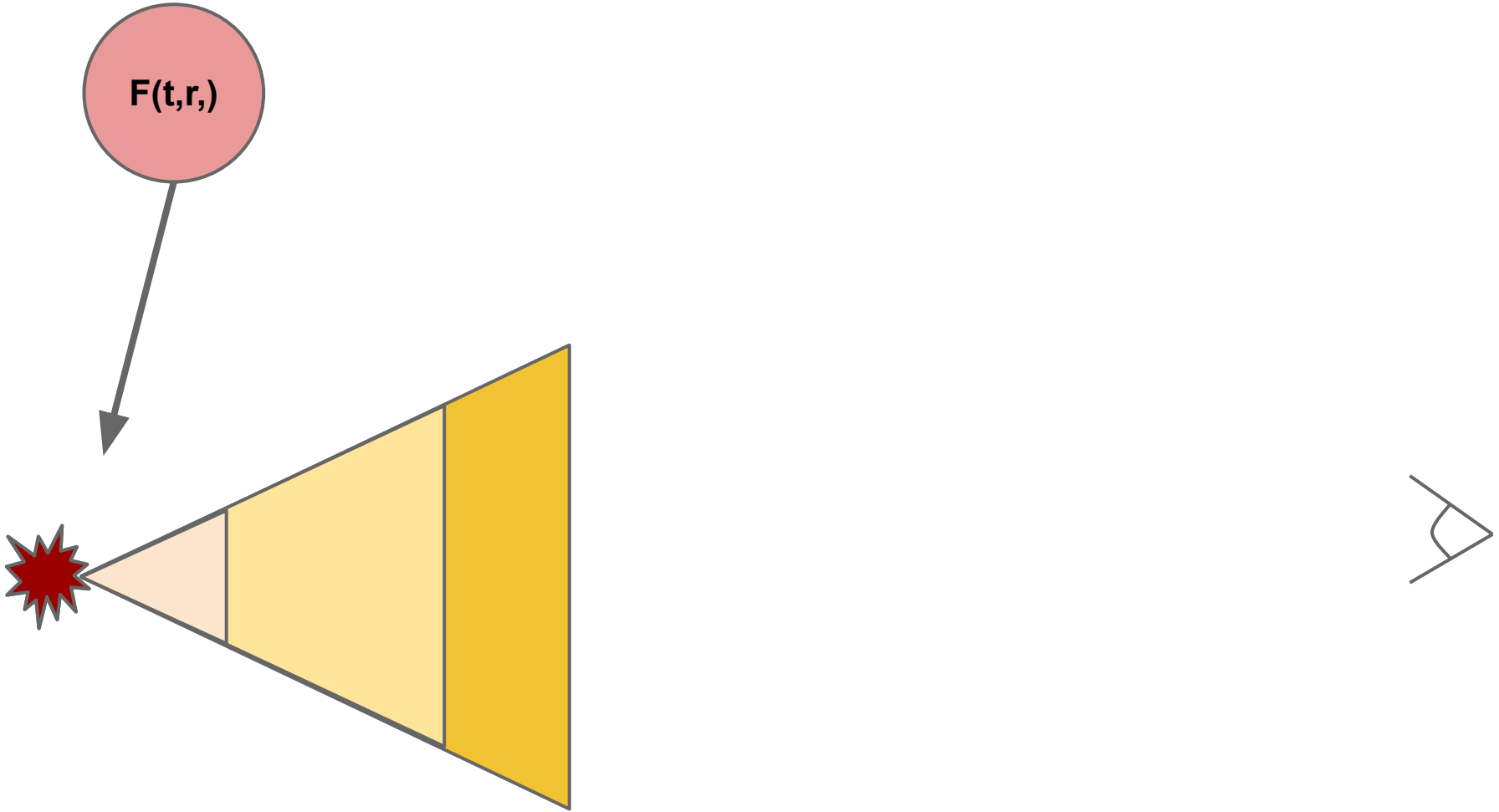
Equivalent Widths and the Curve of Growth

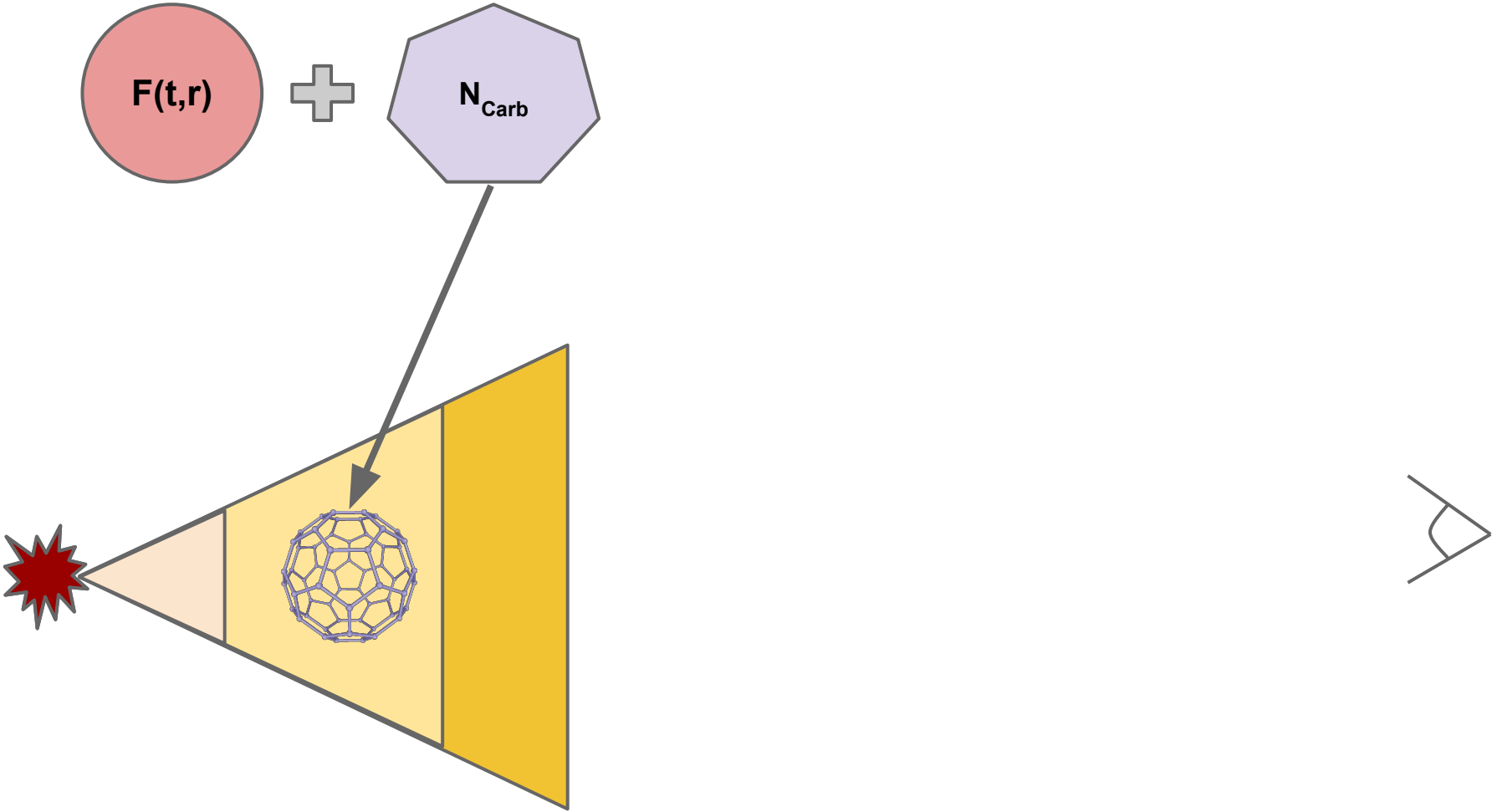


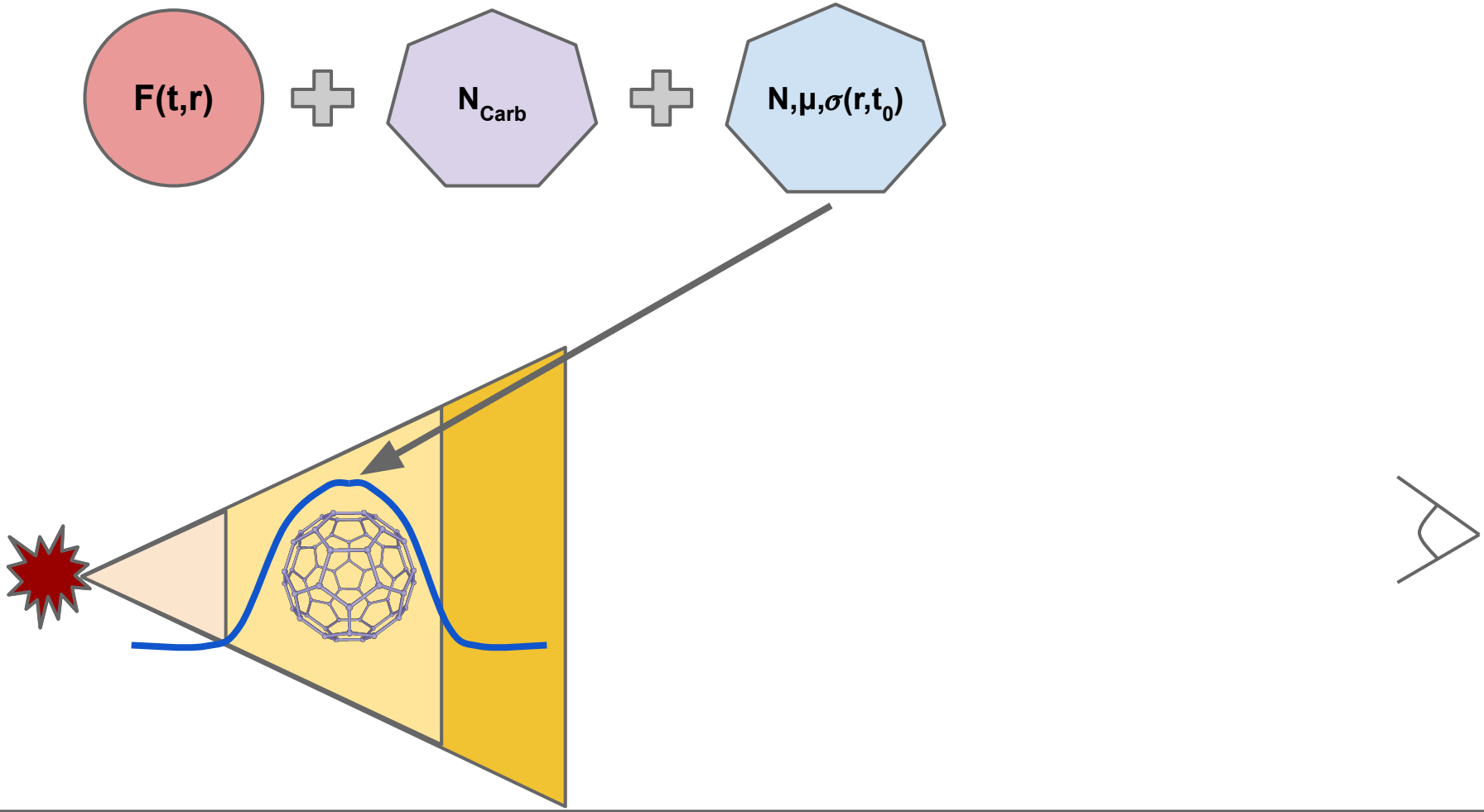
$$N \propto (EW)\, \lambda^{-2} f^{-1}$$

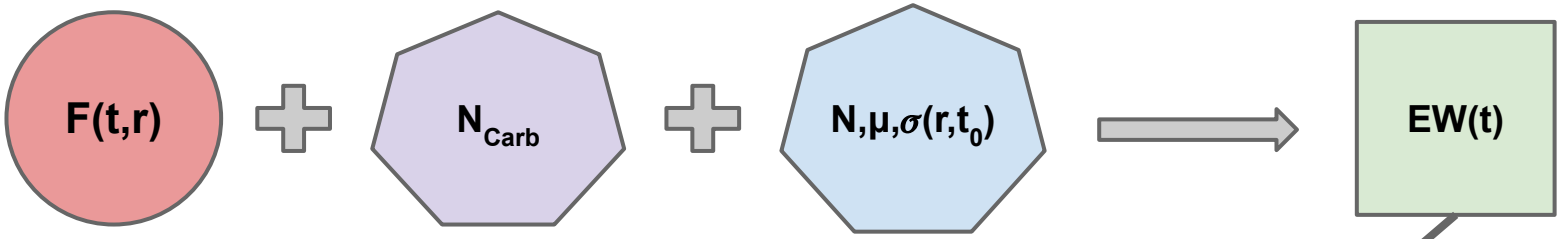


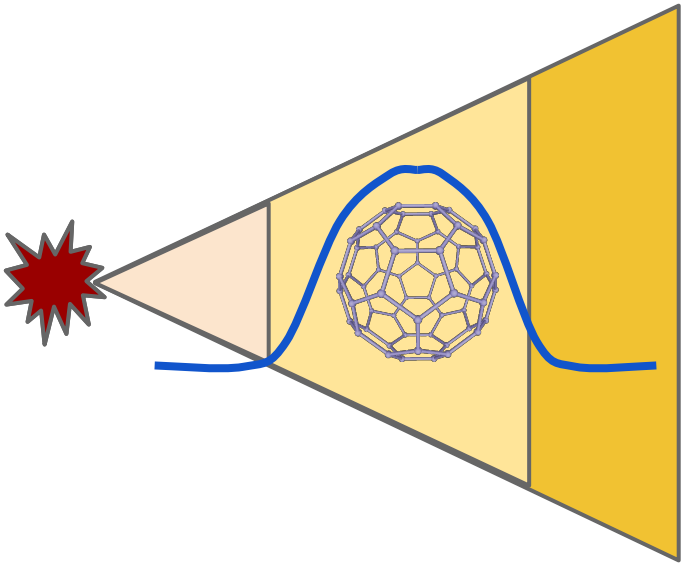
We can use the EWs to understand the carrier population

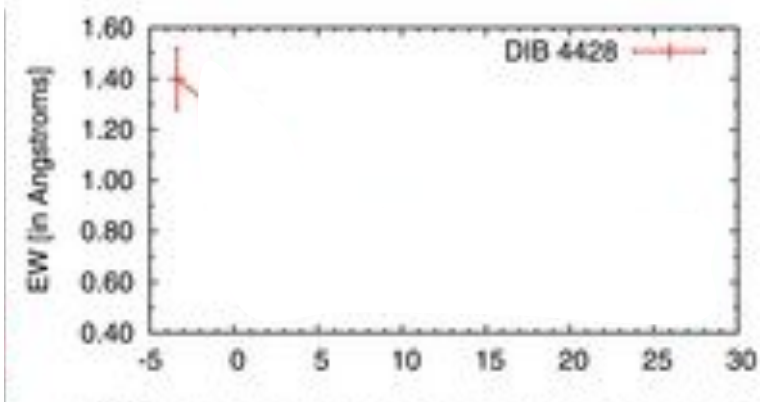

F(t,r,)

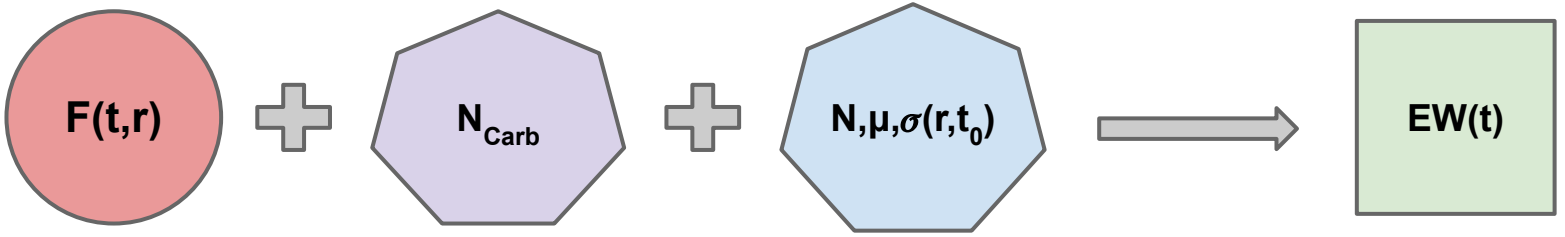

F(t,r)
N Carb

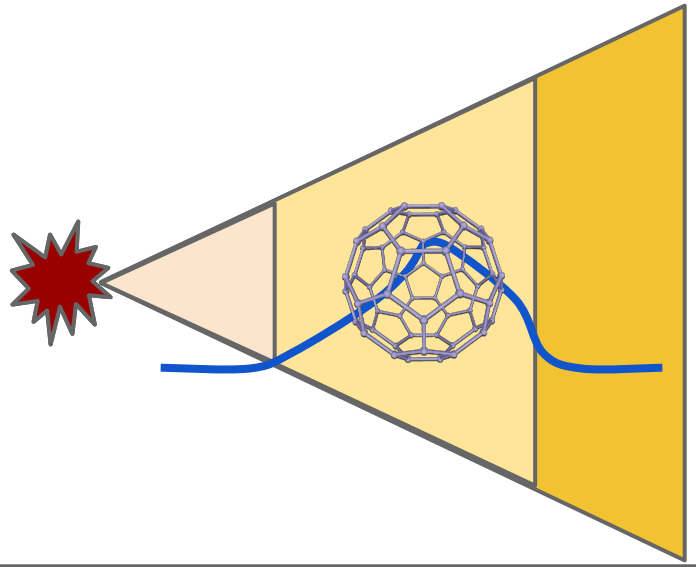

F(t,r)
N_Carb
N,μ,σ(r,t_0)

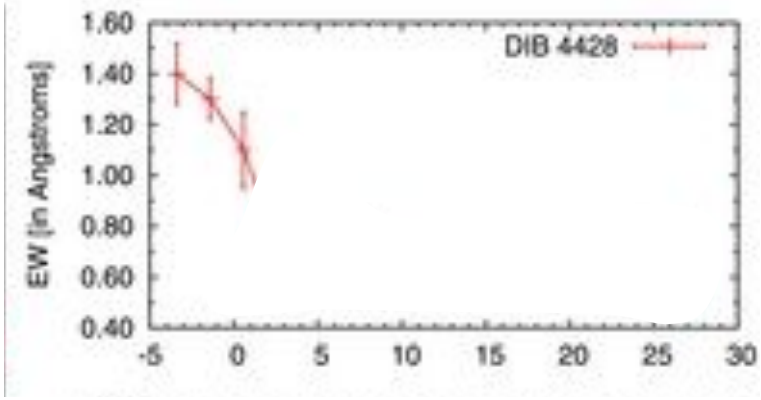

F(t,r)
N_Carb
N,μ,σ(r,t_0)
EW(t)




DIB 4428
EW [in Angstroms]
1.60
1.40
1.20
1.00
0.80
0.60
0.40
-5
0
5
10
15
20
25
30


F(t,r)
N_Carb
N,μ,σ(r,t_0)
EW(t)




DIB 4428
EW [in Angstroms]
1.60
1.40
1.20
1.00
0.80
0.60
0.40
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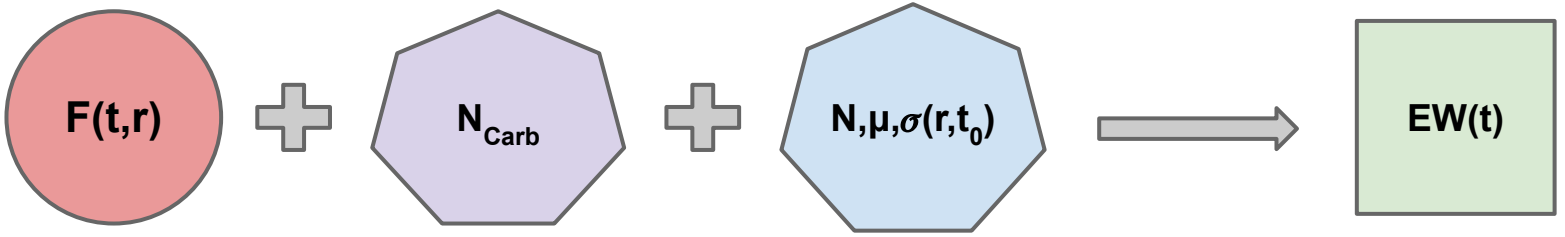
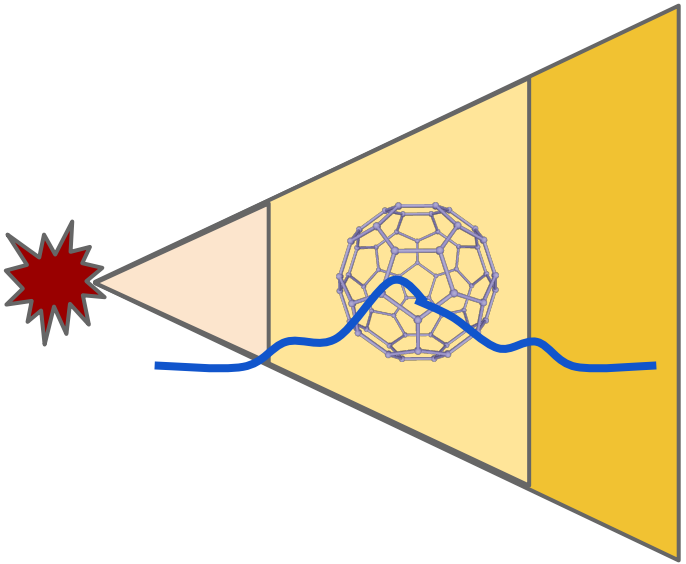
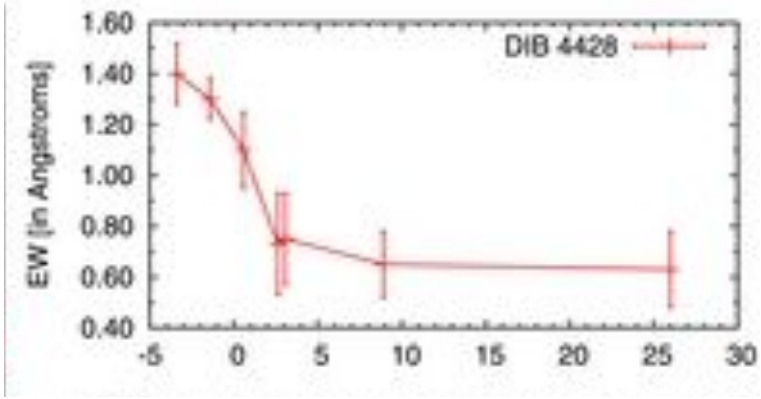
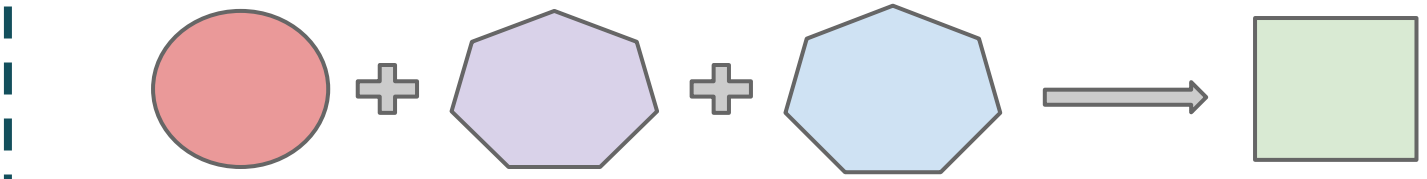
20
25
30

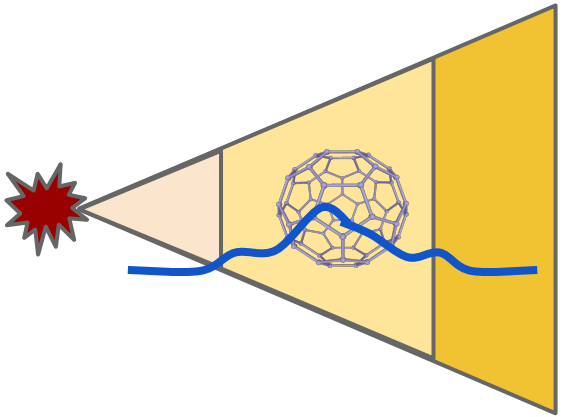

F(t,r)
N_Carb
N,μ,σ(r,t_0)
EW(t)

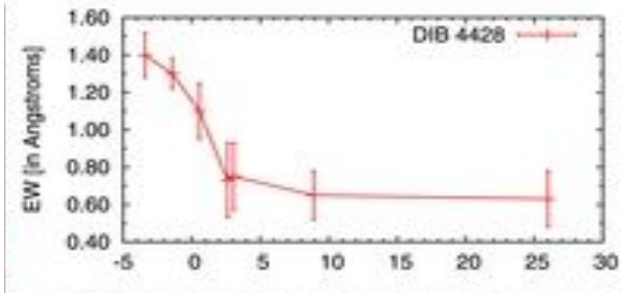


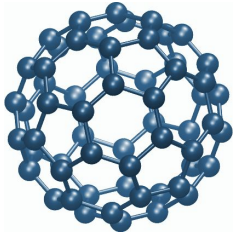

DIB 4428
EW [in Angstroms]
1.60
1.40
1.20
1.00
0.80
0.60
0.40
-5
0
5
10
15
20
25
30

Python-based MCMC code: emcee

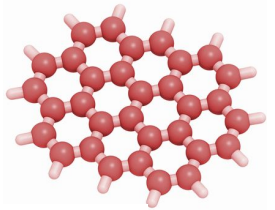


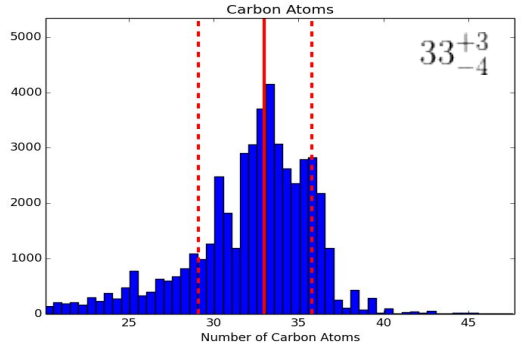




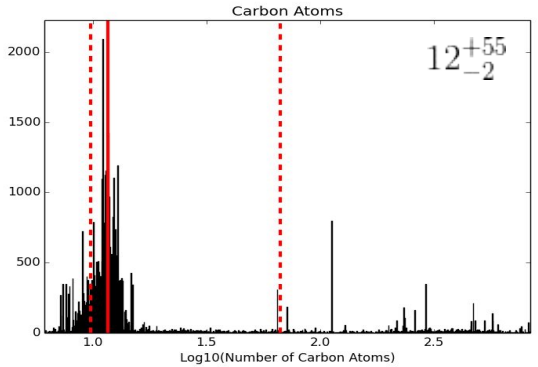


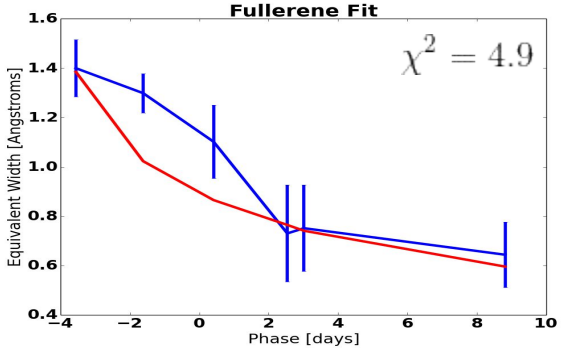
Results

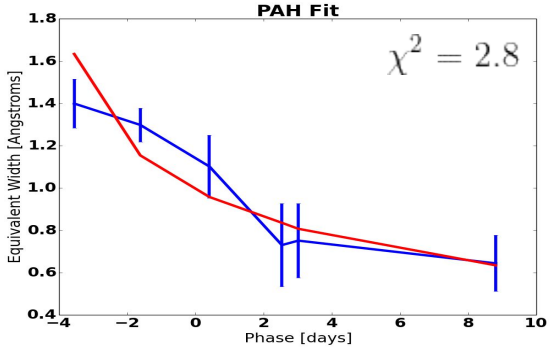




F = 0.70
(p = 0.56)







Conclusions

- I created a SN/DIBs model to simulate the EWs over time
- Both fullerenes and PAHs are plausible candidates for DIBs carriers
- Further studies of DIBs in SNe could constrain the nature of the DIBs carriers