Measurements for HH 7-11: extinguished line plus continuum at four wavelengths. Label wavelengths 1-4: 0.656, 1.26, 1.28, 1.64 microns, and call the measurements (pixel values, fluxes) .

Take as priors: zero-reddening flux ratios 

Assume that

1. the extinction is all foreground, and described by the Draine and Weingartner calculations. The extinction factor is of the form , where
2. the scattered light continuum is characterized by a single blackbody temperature *T,* that we can determine by fitting to non-line emitting regions. It will be a pretty low temperature as there’s no continuum evident in the Hα image.

**TASK 1:** Determine a good value for *T* by fitting to to the fluxes of the continuum filament by HH 8.

Then for each pixel we have four equations in four unknowns: the extinction-corrected fluxes and  of the longer-wavelength [Fe II] and H I lines; the extinction , and the scale factor *C* that multiplies the blackbody function for the continuum:

**TASK 2:** Write code for solving the nonlinear four equation/four unknown system.

**TASK 3:** Use the code to generate images in ; that is, extinction-corrected [Fe II]1.64 and Paβ.

**Bonus TASK (added by Adam on request…):**

Ok I’m going to try to rewrite these equations in different variables…….

Can we successfully reduce this system into 3 equations? Now to try random stuff…times f3 by RH for elimination method?

Subtract?

Solve for f1?

We would like to eliminate C and Av…well, if we use the f2-f4 system maybe we can…let’s see if we do something similar like

Subtract:

And now we can try to solve…that…for stuff…for C:

Now if we look at

Let us think about exponent rules.

Well that looks mighty convenient…essentially f1 is a function of f2,f3,f4 and a bunch of constants…except what is Av? We need to now try to make a new elimination…such as f1,f2 or f1,f4 or f3,f2 or f3,f4. The problem is we need to solve without fH or fFe which means we need to use f1-f3 and f2-f4 actually…

Similarly

Simplified

Well…I guess we can try to combine the Av like this? In theory the right hand side is a constant like

So…

Similarly

Then:

How the hell do we solve this.

Is this the same as we got above? Let’s see…

So f1 equals:

And

So now you just solve the two equations that equal each other for Av…

**So (as an exercise for the reader)**

**Not sure but would it work to split into f2, f3, f4…but it would be fun to group terms?**

…hey why do my denominators keep cancelling…hm…not sure if this is any better, maybe I can group things further

…idk, just take a derivative? Nah. Sigh. I think we have to solve T(Av) or vice versa…like…

Maybe wrong ideas…does this have a definite value like if we had a definite integral taking the difference of two planck functions? I don’t know if that would work down the road…as B2 – B1 = integ[Blam] from lam1 to lam2.

What is fun is that earlier we also found C(f2, f4, Av, T). The original equations included fH(f3, C, Av, T) and fFe(f4, C, Av, T). Altogether with Av(f2, f3, f4, T) means we have four equations with four unknowns. I guess. This is technically 3 equations since Av is a function of f2,f3,f4,T, but…why, just why (for reference, see below).

Using

**Then…as an alt exercise…**

Let us try again Assuming C\_1 is 0…

Next we can go ahead and recall f2-f4 which relates C and Av:

Let us now use this to solve f3 for Av.

Now we may solve this for fH…

Log(RHFH) is like log(AB) = log(A) + log(B)

When we exponentiate this, we get y^(log(A) + log(B))

We know y^(A+B) = y^A \* y^B

Next, we know that y1^x \* y2^x = (y1\*y2)^x probably with some restriction…

This implies y2^log(fH) \* y3^(log(FH) – (y2\*y3)^(logFH)

Same with y3,y4 becoming (y3\*y4)^(log(FH)

Let us next note we can actually do y^(log(x)) = x^(log(y))

This means altogether that:

Note since

Then

Now we must solve this as fH(T)…it would help greatly to rewrite this

(where fH can be considered as x)…this can be furthered turned into variables but I imagine it’ll be inconvenient

Following this, we would get fH(T), which can be used to solve for Av(fH, T) then C(Av, fH, T) and finally can be plugged into either f2 or f4 to get fFe.

As a sanity check, bounds on the Fe+/H relative abundance can be derived from , independent of models. For example, in the low-density limit,



Where χ , α is the effective recombination coefficient, γ is the collisional excitation coefficient, and A is the spontaneous radiation rate (aka the Einstein A coefficient)

So therefore, the γ is for Fe, the α is for H, and the Einstein coefficients…are also for H??