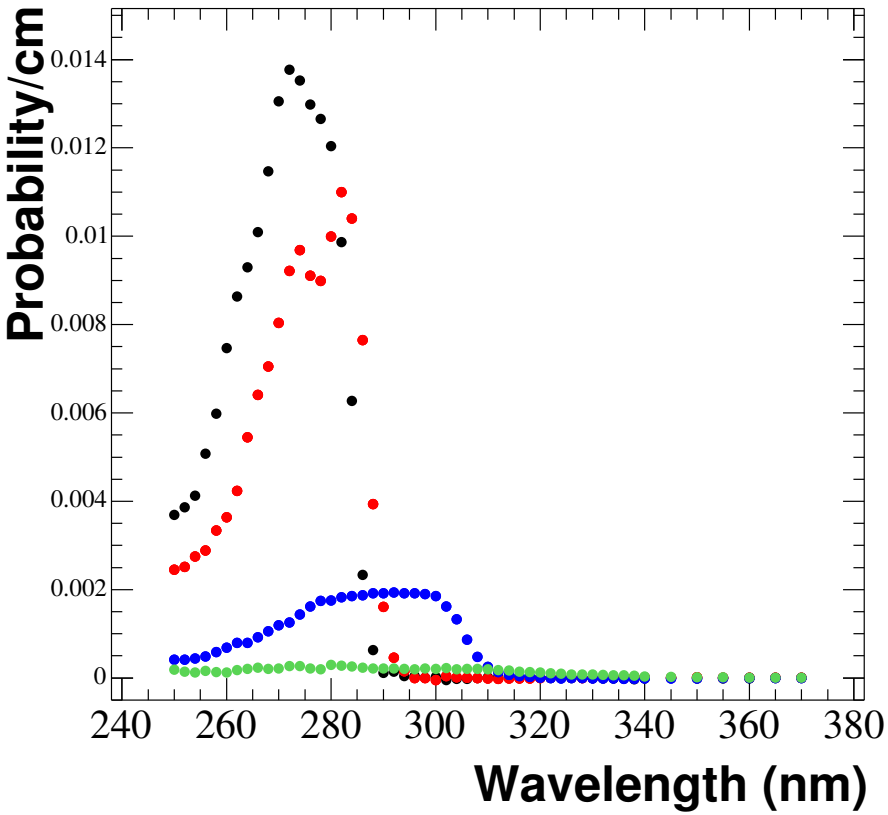
Fluorescence:

Normalization and other Cross Checks

Overall Rate of Fluorescence (SVD):



My current intepretation:

- Translate P into L:
  $L(\text{cm}) = -(\log(1-P))^{-1}$
- For $P \ll 1$:
  $L(\text{cm}) = 1/P$

According to this:

- Typical L are $\mathcal{O}(1\text{m})$
- Typical absorption L are 2-10 cm
- Fluorescence is a small effect

I think this is probably wrong: what to do when pathlengths $\sim$ 1 cm?
To convert $P \rightarrow L$, we need to account for absorption:

$$P \rightarrow P/(1 - e^{-1\text{cm}/L_a})$$

What about scattering? Perhaps there is no analytic solution.

Scattering Normalization of Fluorescence:

If we assume

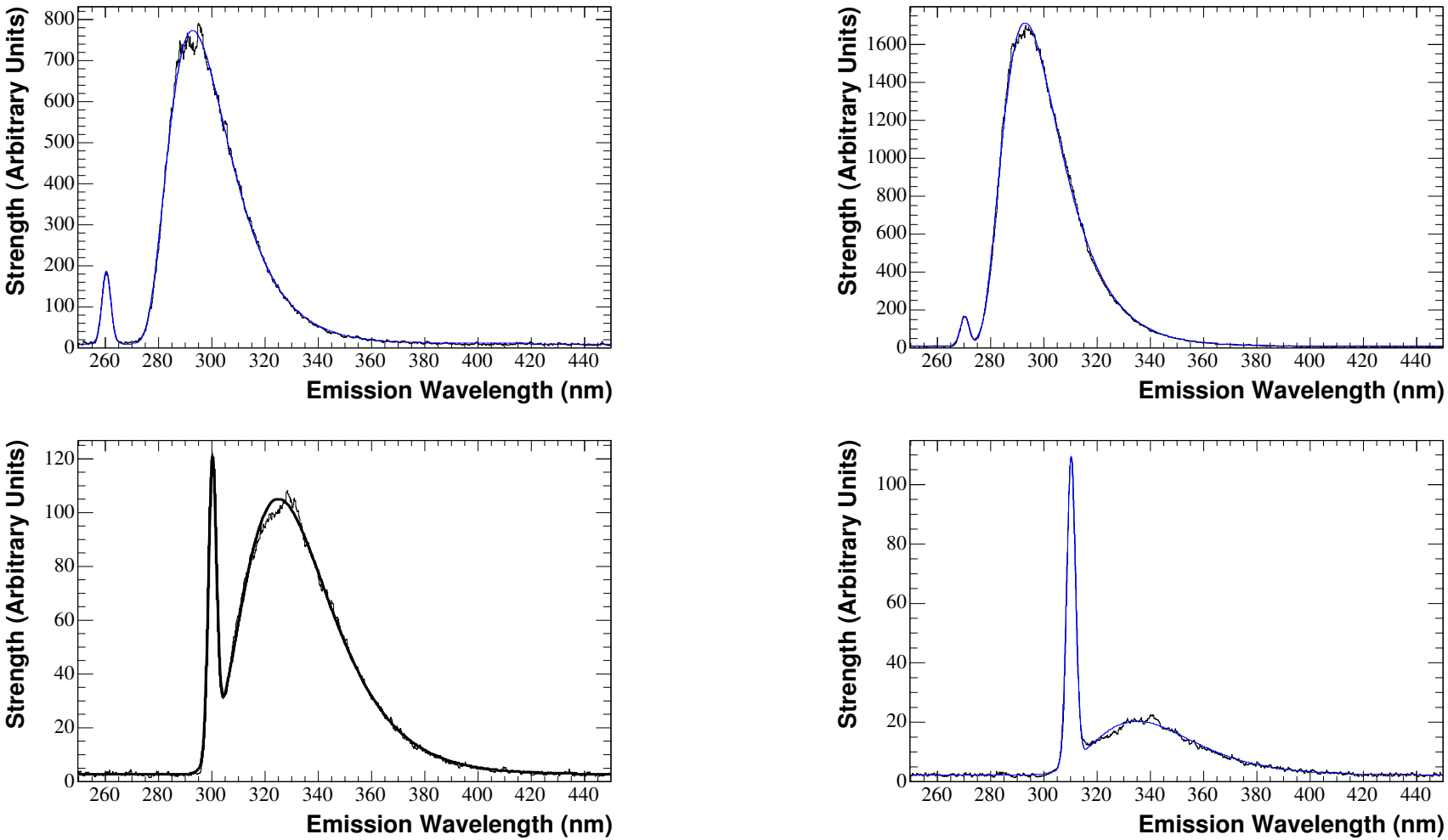
- Scattering length at a given wavelength
- Wavelength dependenceo of scattering length

we can normalize the total fluorescence using the scattering peak Assume:

- λ^4 dependence (good to 10%)
- $L_S(400\text{nm}) = 30$ m
  28 m (central flask), 32 m (442 nm gonimeter), ~ 30 from bare fiber
- Expected L_S: 5.4 m at 260 nm, 10.8 m at 310 nm

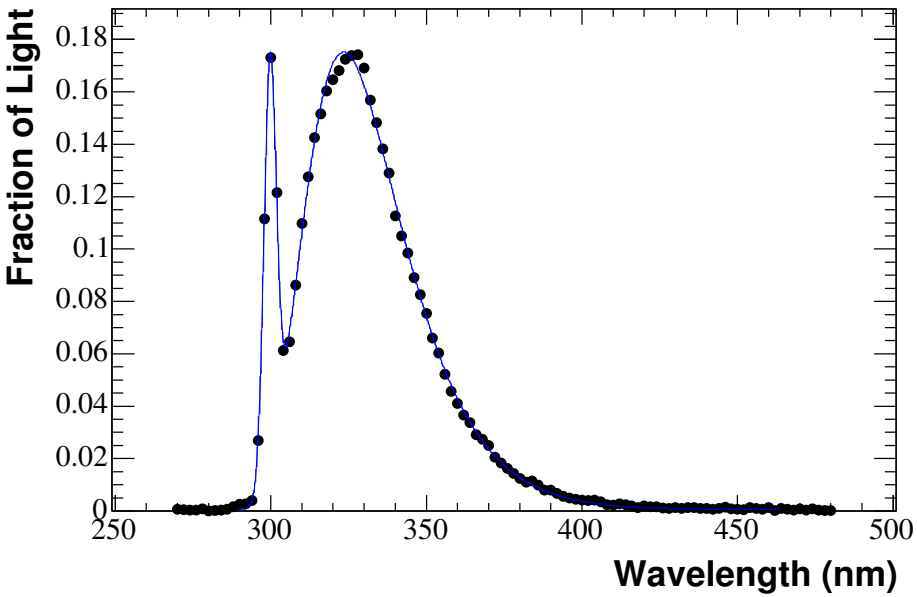
Fit scattering component and fluorescence components to determine light yield.

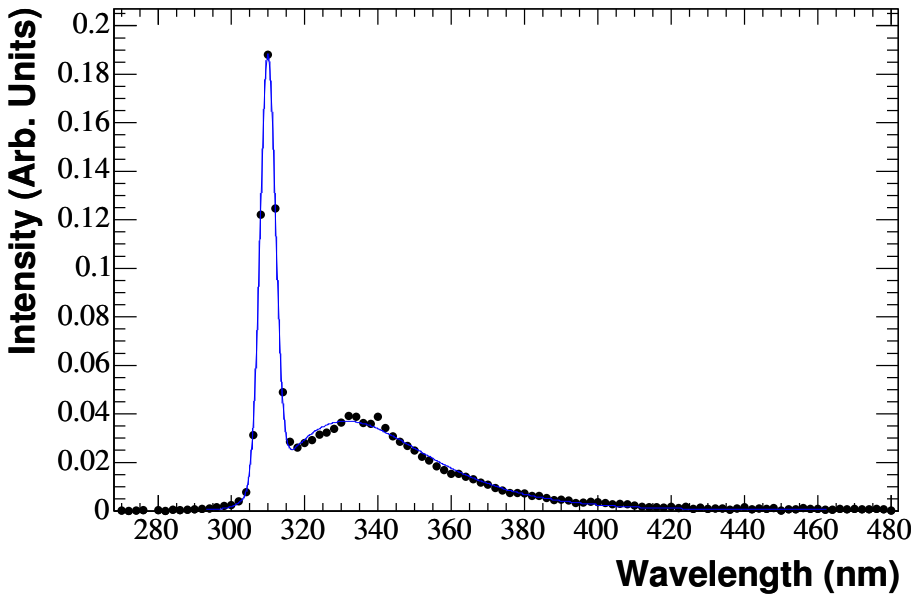
Fermilab Emission data (260, 270, 300, 310 nm):



Fluorescence is clearly dominant at 260/270 nm
Comparable to scattering at 310 nm

JHU Emission data (300, 310 nm):





- Probably not inner filter corrected
- N_2 bubbling: may increase scattering
- Background subtracted
- Clearly separated scattering removed: No scattering for 260, 270 nm

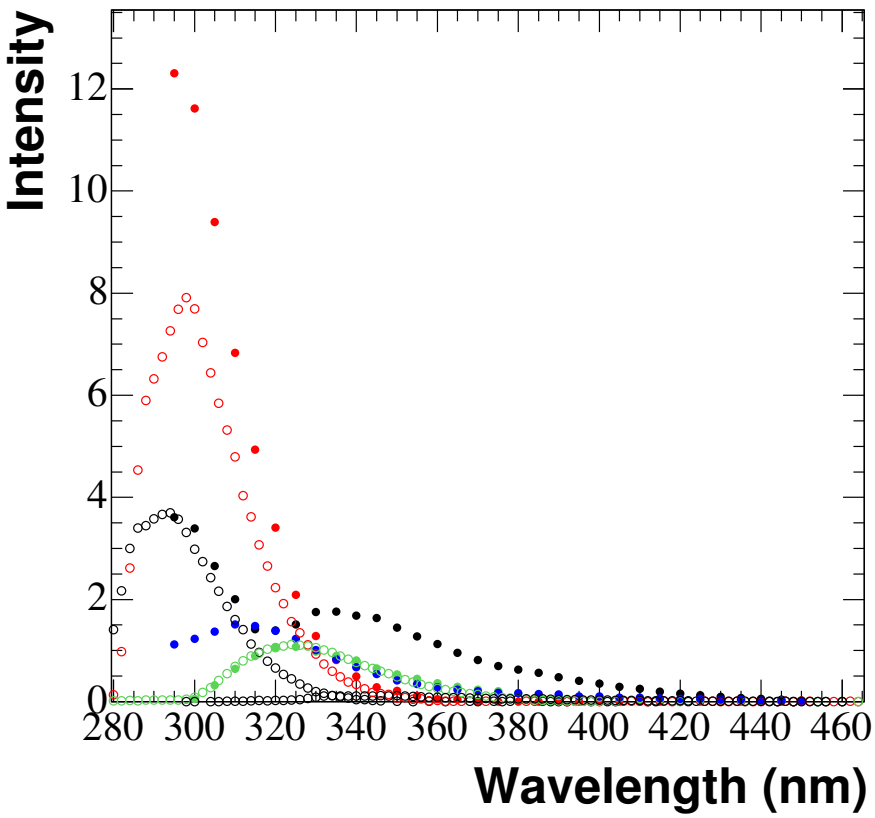
Scattering Normalization of Fluorescence:

Wavelength	Scatter	Fluorescence	F/S	SVD	Ratio
260 (Fermi)	728	23985	32.9	6.3	5.2
270 (Fermi)	684	51370	75.1	13.8	5.4
300 (Fermi)	404	4496	11.1	1.9	5.8
300 (JHU)	0.77	7.41	9.6	1.9	5.1
310 (Fermi)	310	877	2.8	0.49	5.7
310 (JHU)	0.915	1.826	2.0	0.49	4.1

- Scattering rate based on $L_S = 30$ meters at 400 nm, λ^4 extrapolation
- Question: is incident light polarized?
  Unpolarized: correction decreases F/S ratio by ~ 2
  $\perp$ polarized: no correction
  $\|$ polarized: large correction (depolarization factor)

Is there any reason light should be polarized? Can we check?

Cross Check of Time-resolved measurement: 285 nm



Black: SVD1/4(open), 33 ns (solid)

Red: SVD2 (open), 14 ns (solid)

Green: SVD3 (open), 1 ns (solid)

Blue: 6 ns (solid)

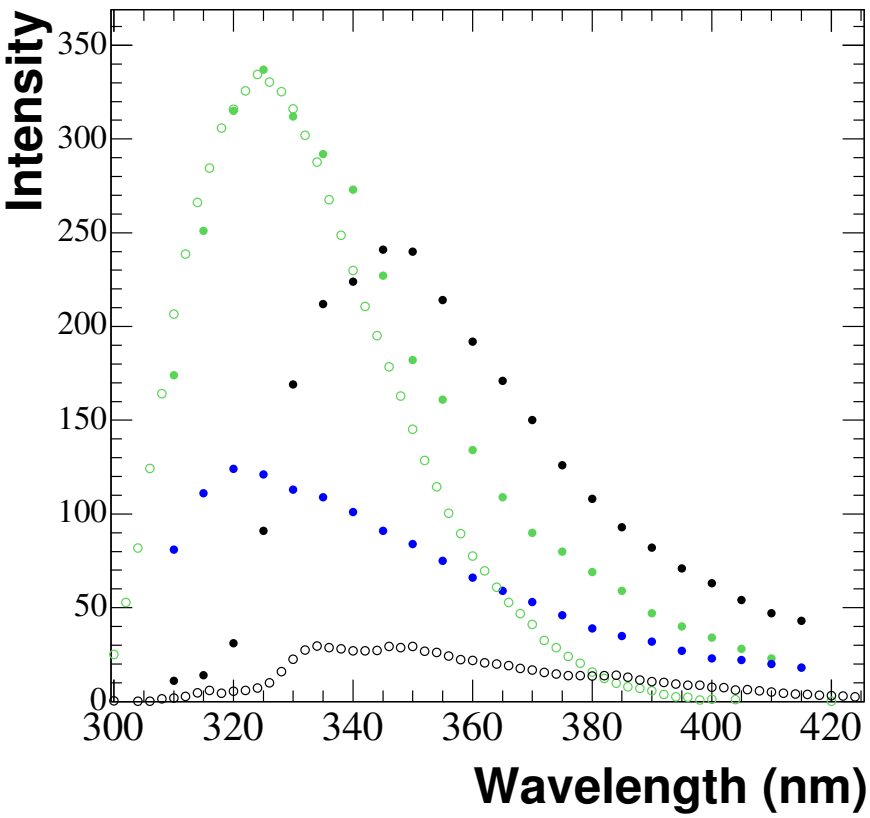
Arbitrarily scaled to make 1 ns agree

Relative contributions don't agree:

- SVD2: steep slope of excitation
- SVD1: matches 1st hump of 33 ns!
- SVD4: grossly underestimates
- 6 ns is rather strong:
  Why didn't SVD pick it up?

SVD	284 nm ($cm^{-1}/10^{-3}$)	286 nm ($cm^{-1}/10^{-3}$)
1	6.28	2.33
2	10.4	7.65
3	1.85	1.87
4	0.260	0.235

Cross Check of Time-resolved measurement: 300 nm



Black: SVD4(open), 33 ns (solid)

Green: SVD3 (open), 1 ns (solid)

Blue: 6 ns (diamonds)

Arbitrarily scaled to make 1 ns agree

Relative contributions don't agree:

- SVD1/2: outside of excitation
- SVD3: tail doesn't agree
- SVD4: grossly underestimates
- 6 ns is rather strong:
  Why didn't SVD pick it up?

SVD	300 nm ($cm^{-1}/10^{-3}$)
1	0.027
2	-0.045
3	1.86
4	0.210