Update 11/22/19

John P.

Argon issue

- I think I solved it
- The problem is that the Mathematica package interprets all the matrix elements it reads in as applying to ground state to ground state transitions.
- Calvin's Argon matrix included elements for 3 excited states in addition to the ground.
- After removing the extra states and adding in the oxygen core, I got something reasonable.

Argon issue continued

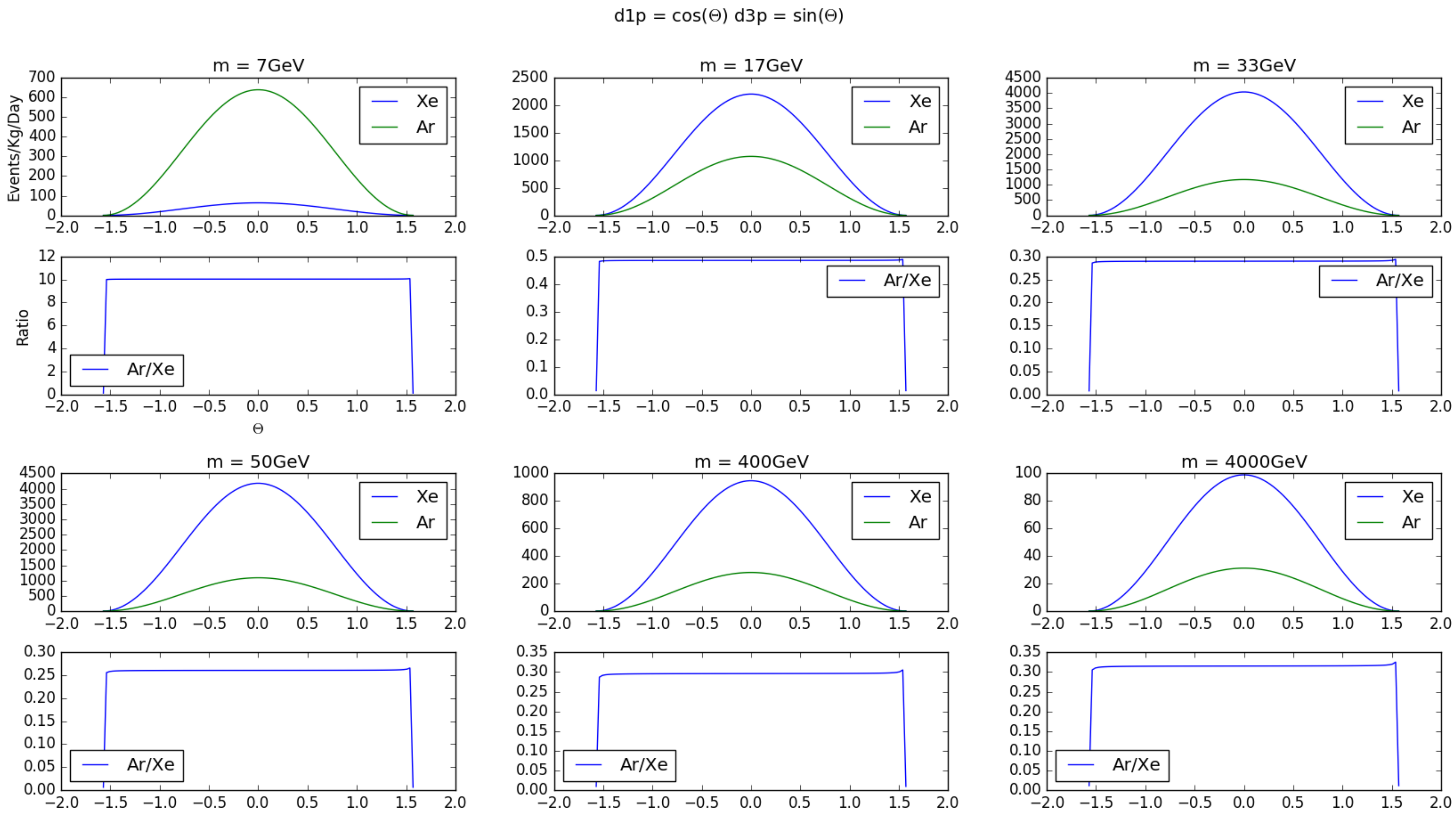
- It turns out that the transition probability for operator 1 at zero momentum transfer should tell you about the number of protons or neutrons:

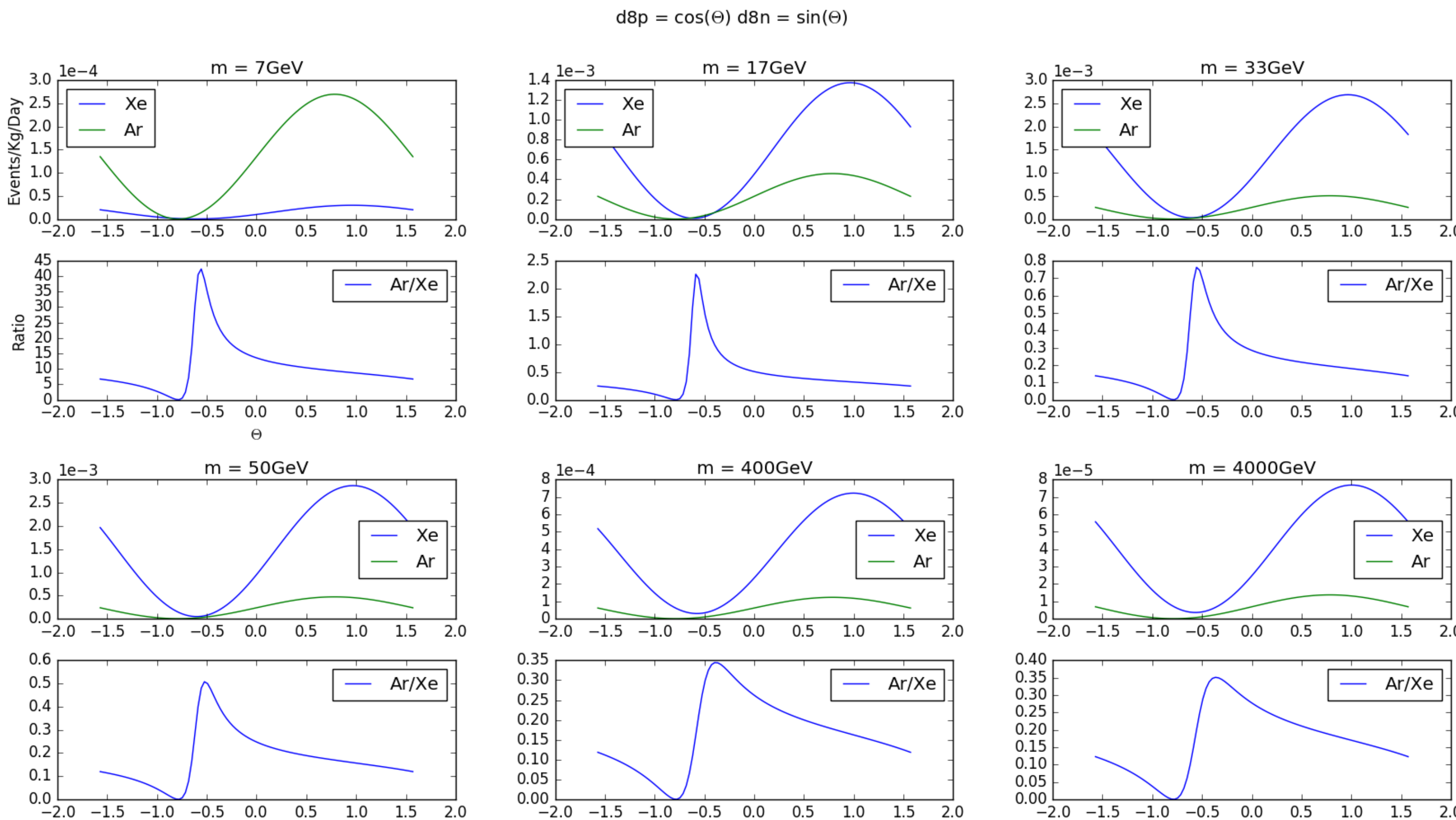
$$\frac{1}{2j_\chi+1}\frac{1}{2j_N+1}\sum_{spins}|\mathcal{M}^2| \to c_1^{p\,2}Z^2$$

$$\frac{1}{2j_\chi+1}\frac{1}{2j_N+1}\sum_{spins}|\mathcal{M}^2| \to c_1^{n\,2}(Z-A)^2$$

- Using this, I found that the edited density matrix (added O16 core, ground state only) gave the correct numbers of protons and neutrons.
- Before getting rid of the extra states, the Mathematica package thought that Ar36 had 94 protons and 190 neutrons.

New heat maps:




d8p = cos(Θ) d8n = sin(Θ)
m = 7GeV
m = 17GeV
m = 33GeV
m = 50GeV
m = 400GeV
m = 4000GeV
Events/Kg/Day
Ratio
Θ
Xe
Ar
Ar/Xe
1e−4
1e−3
1e−5

PandaX-II basis change

- Did a basis change on the operator 1 limits from the PandaX-II paper. Didn’t do the others since their operators are linear combos of ours, and as result can’t be compared easily.
- The limits from this basis change are definitely inaccurate.

PandaX-II Basis Change

Used one approach where:

$$limit(d_1^p) = \frac{1}{2}(limit(d_1^0) + limit(d_1^1))$$

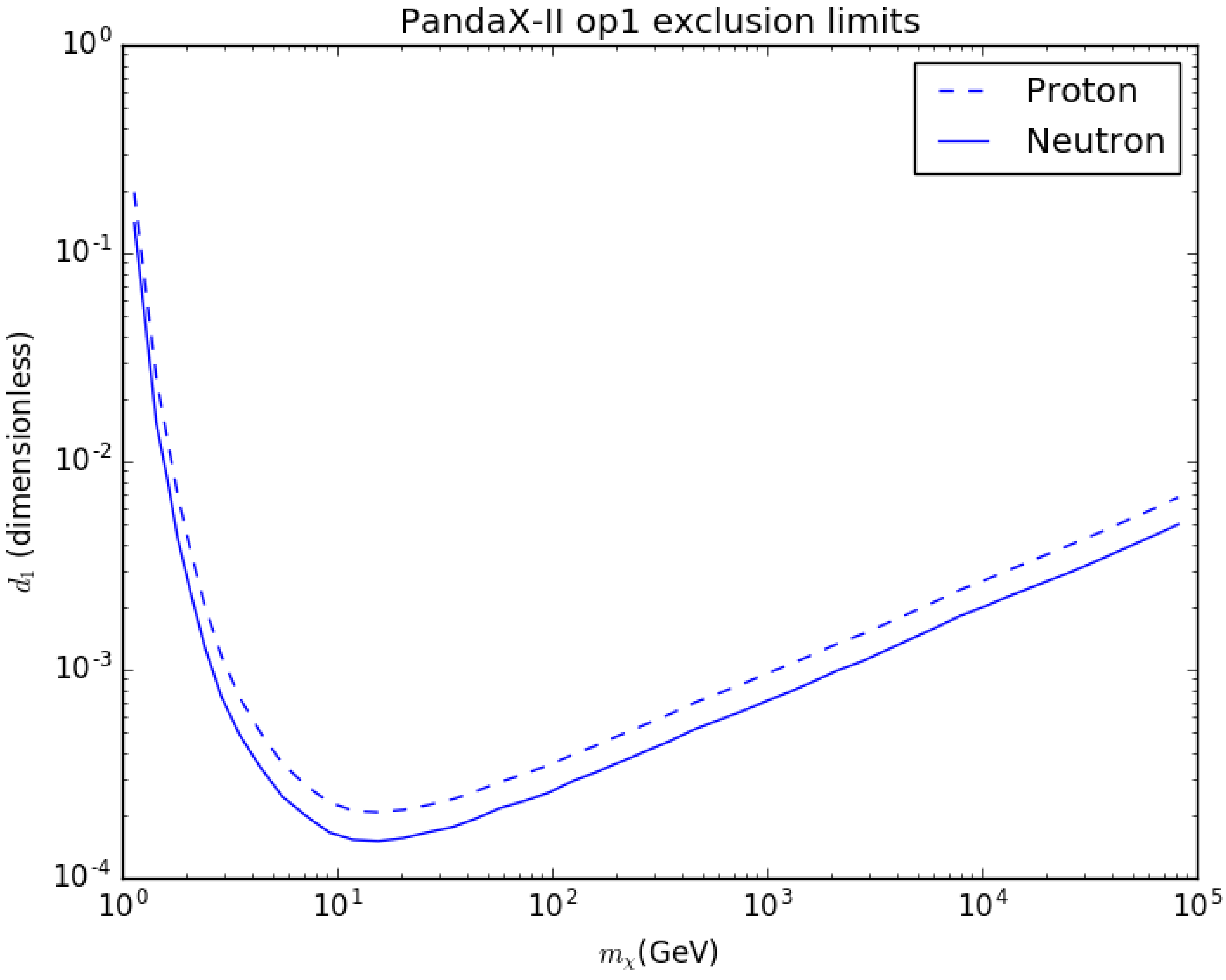
$$limit(d_1^n) = \frac{1}{2}|limit(d_1^0) - limit(d_1^1)|$$

And another suggested to Aaron M by the PandaX people:

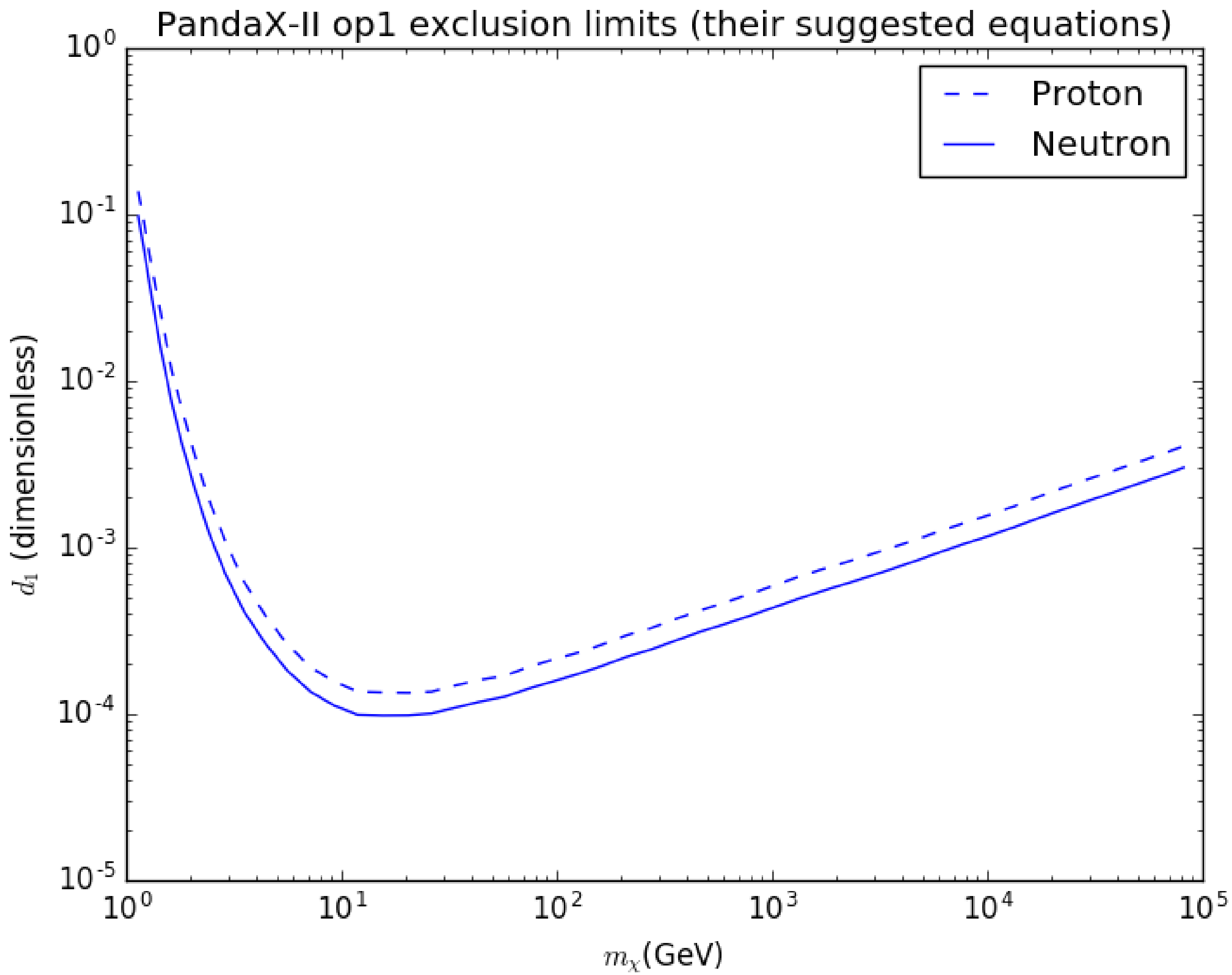
$$d_1^p = \frac{2}{\frac{1}{limit(d_1^0)} - \frac{1}{limit(d_1^1)}} \quad d_1^n = \frac{2}{\frac{1}{limit(d_1^0)} + \frac{1}{limit(d_1^1)}}$$

My Approach:

The proton curve being above the neutron curve is suspicious → → → →



PandaX-II suggestion:



Currently Working on:

- Learning stats and understanding Shaun’s code.