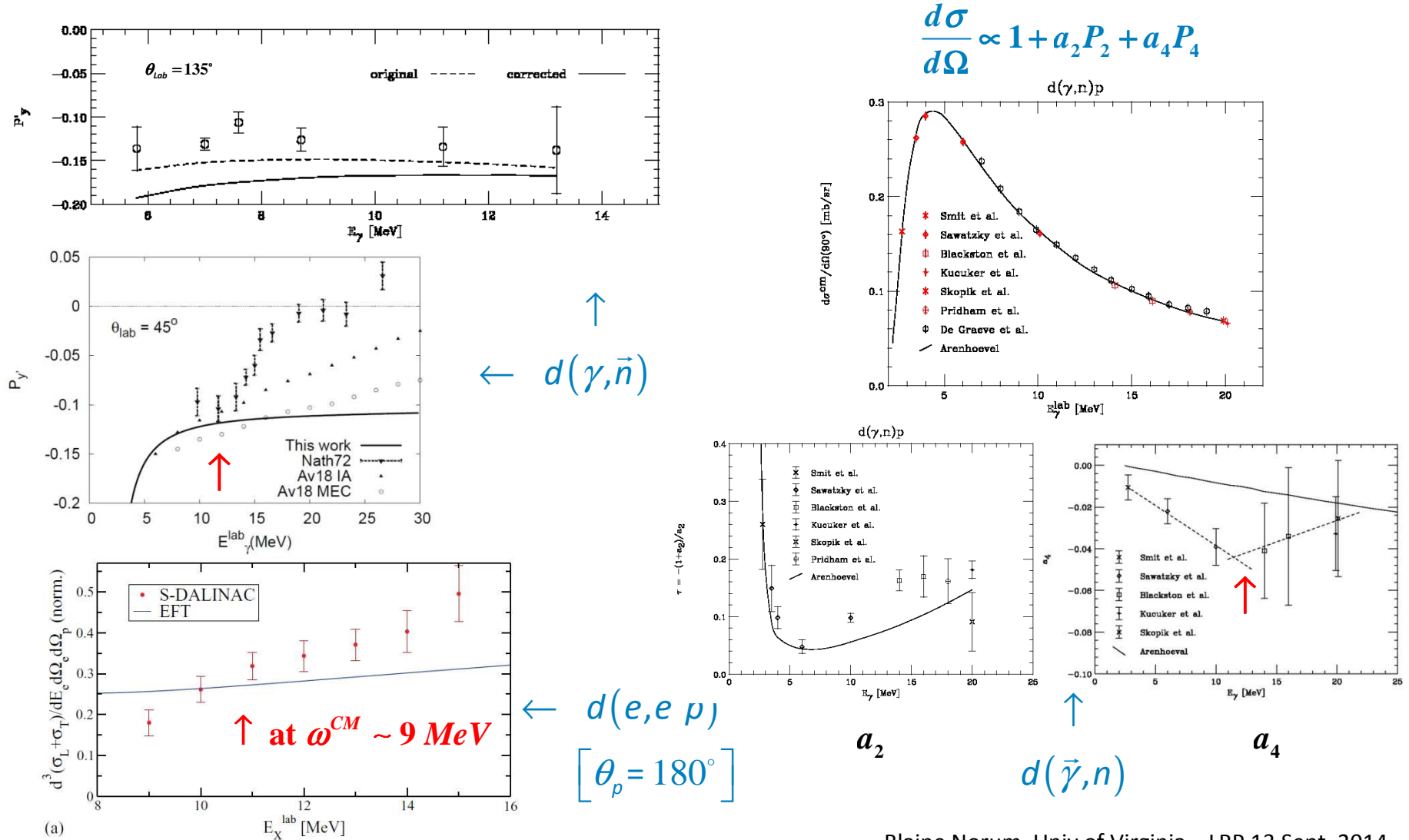# Problems with the Two-Nucleon System?

To quote Chadwick and Goldhaber (1934), *"... its [the deuteron's] properties are as important in nuclear theory as the hydrogen atom is in atomic theory."*
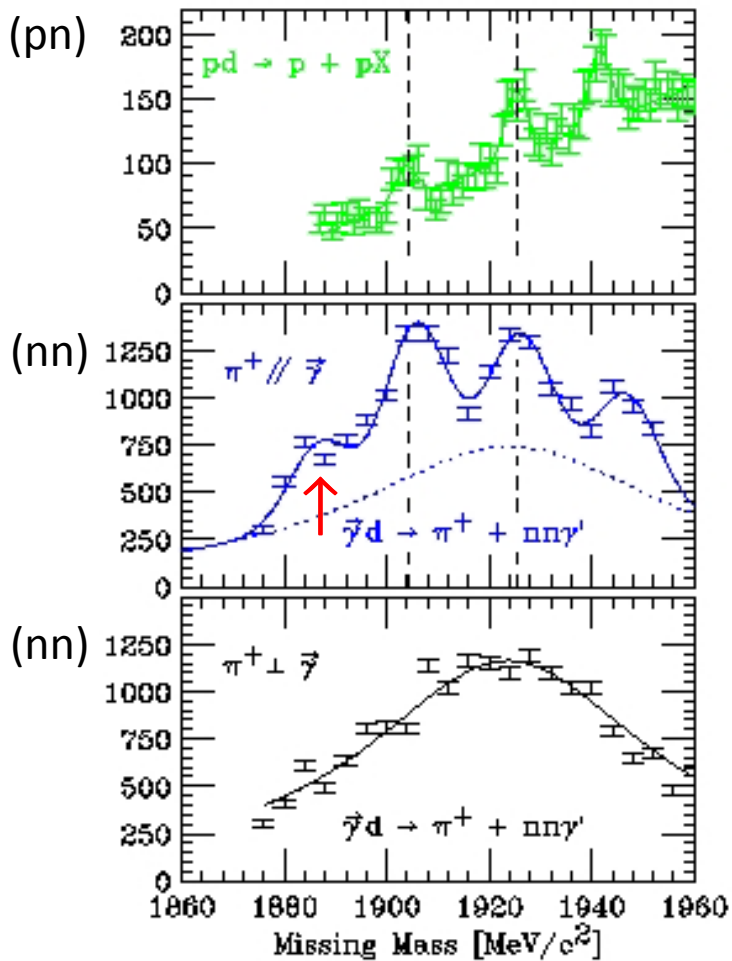
$$\frac{d\sigma}{d\Omega} \propto 1 + a_2 P_2 + a_4 P_4$$



$\leftarrow d(\gamma,\vec{n})$

$\leftarrow d(e,e\,p)$

$\uparrow$ at $\omega^{CM} \sim 9\ MeV$

$\left[\theta_p = 180°\right]$

$a_2 \qquad a_4$

$d(\vec{\gamma},n)$

**Serious problem exists:**
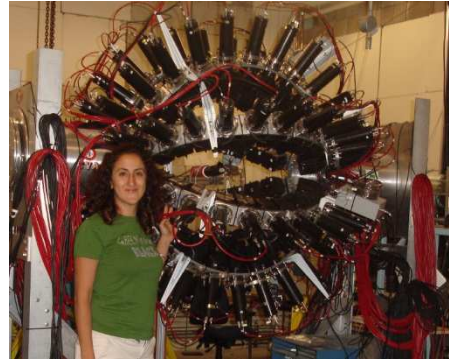
- Absolutely warrants examination!
- Explanation? (6q)?

Current activities at HI$\vec{\gamma}$S: $d(\vec{\gamma},n)$, $\vec{d}(\vec{\gamma},n)$, $d(\vec{\gamma},\vec{n})$

Planned activities at HI$\vec{\gamma}$S: $d(\vec{\gamma},\gamma')pn$, $^{3,4}He(\vec{\gamma},n)$, $^{3,4}He(\vec{\gamma},\vec{n})$

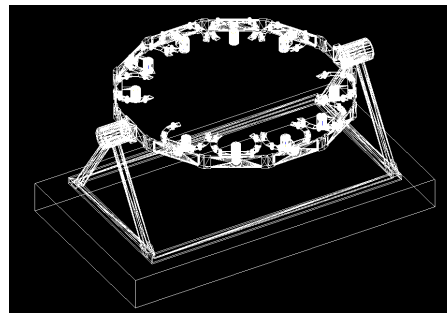Conditionally approved at MAMI: $d(\vec{\gamma},\pi^+\gamma')$, $d(\vec{\gamma},\pi^0\gamma')$, $d(e,e'\pi^+\gamma')$



(pn)

(nn)

(nn)

$\uparrow$ **at** $\omega^{CM} \sim 9\ MeV$



Blowfish – 88 cell neutron detector array



Ten (later 20?) cell neutron polarimeter array



HIFROST – polarized hydrogen/deuterium target

**Takeaways:**

- Much work to be done
- Much greater focus required at HI$\vec{\gamma}$S and elsewhere
- If we can't understand the deuteron … ???

Blaine Norum, Univ of Virginia – LRP 13 Sept. 2014