Nucleon emission with polarized and unpolarized photons: A proposal for ALBA

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Contents

- **The model**

  OBC+MEC+SRC simultaneously
- **(γ,N), ($\vec{\gamma}$,N)**
- **(γ,NN), ($\vec{\gamma}$,NN)**
- **Conclusions**

sensitivity to $f(r)$

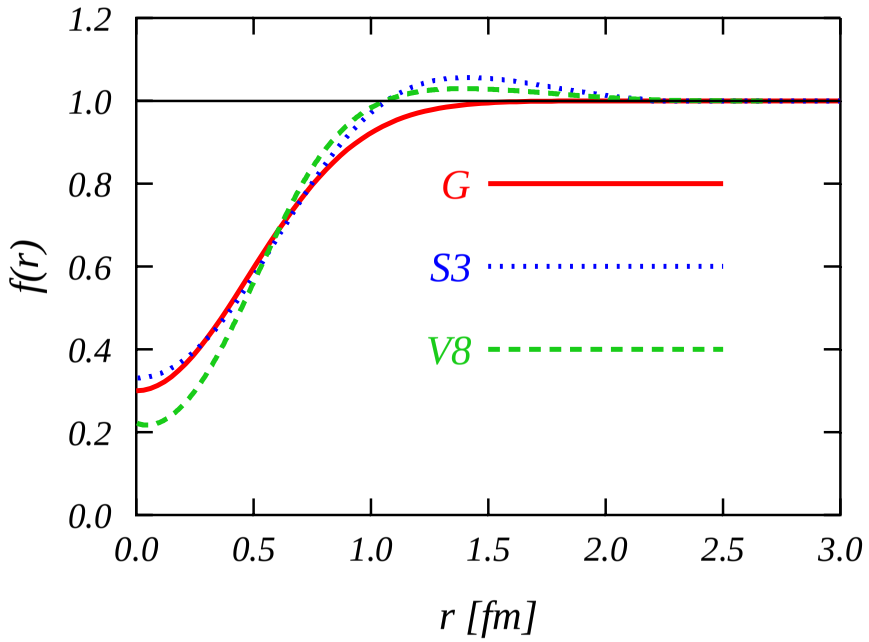
- Afnan & Tang

  $\rightarrow$ G: Gaussian

  $f(r) = 1 - a\exp(-br^2)$

  $a = 0.7; b = 2.2$ fm^{-2}

  $\rightarrow$ $S3$: Euler



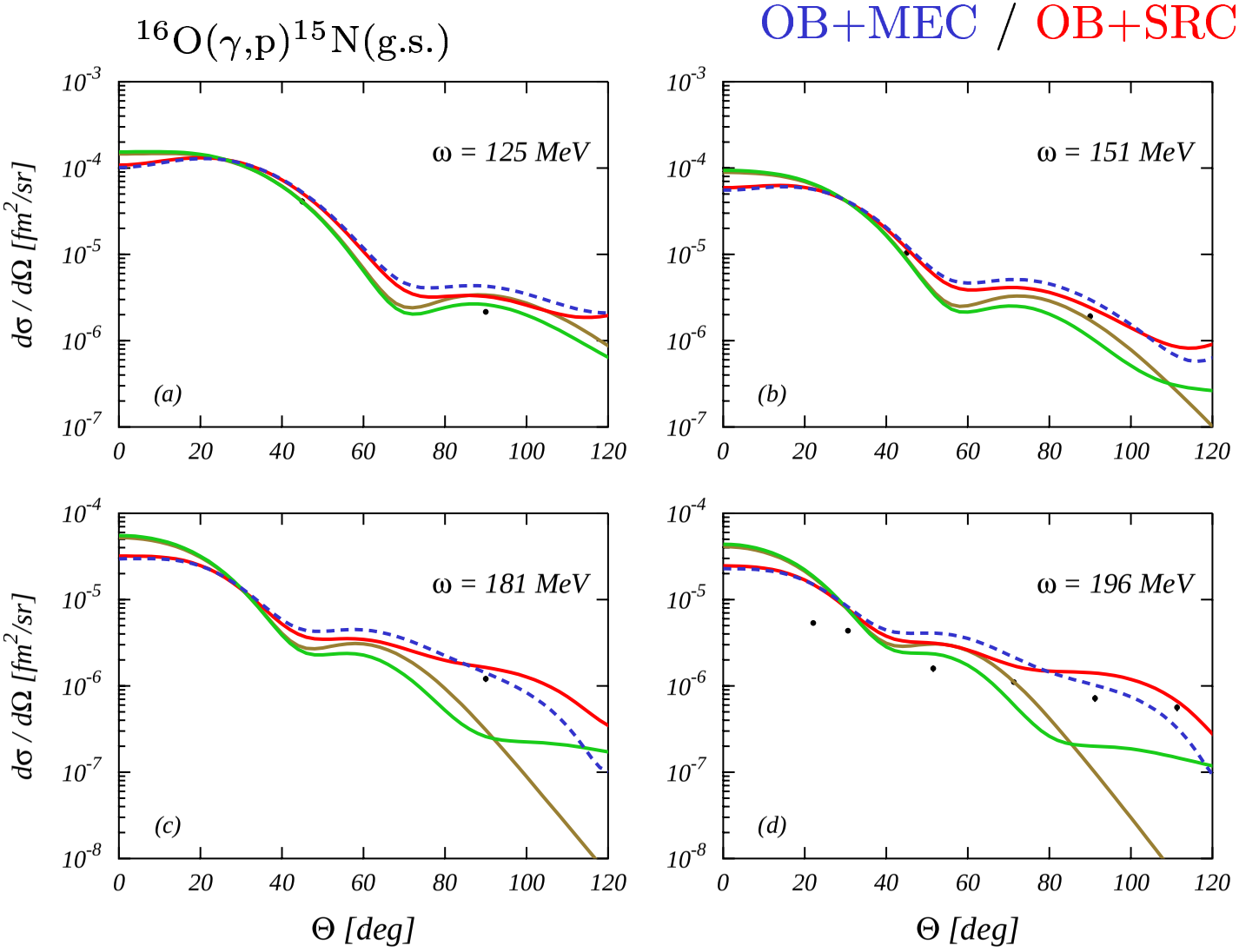
- Argone $V8'$ + Urbana IX

  $\rightarrow$ $V8$: scalar part

One-nucleon emission (γ,N)

OB / OB+SRC($S3$)

OB+MEC / OB+SRC+MEC

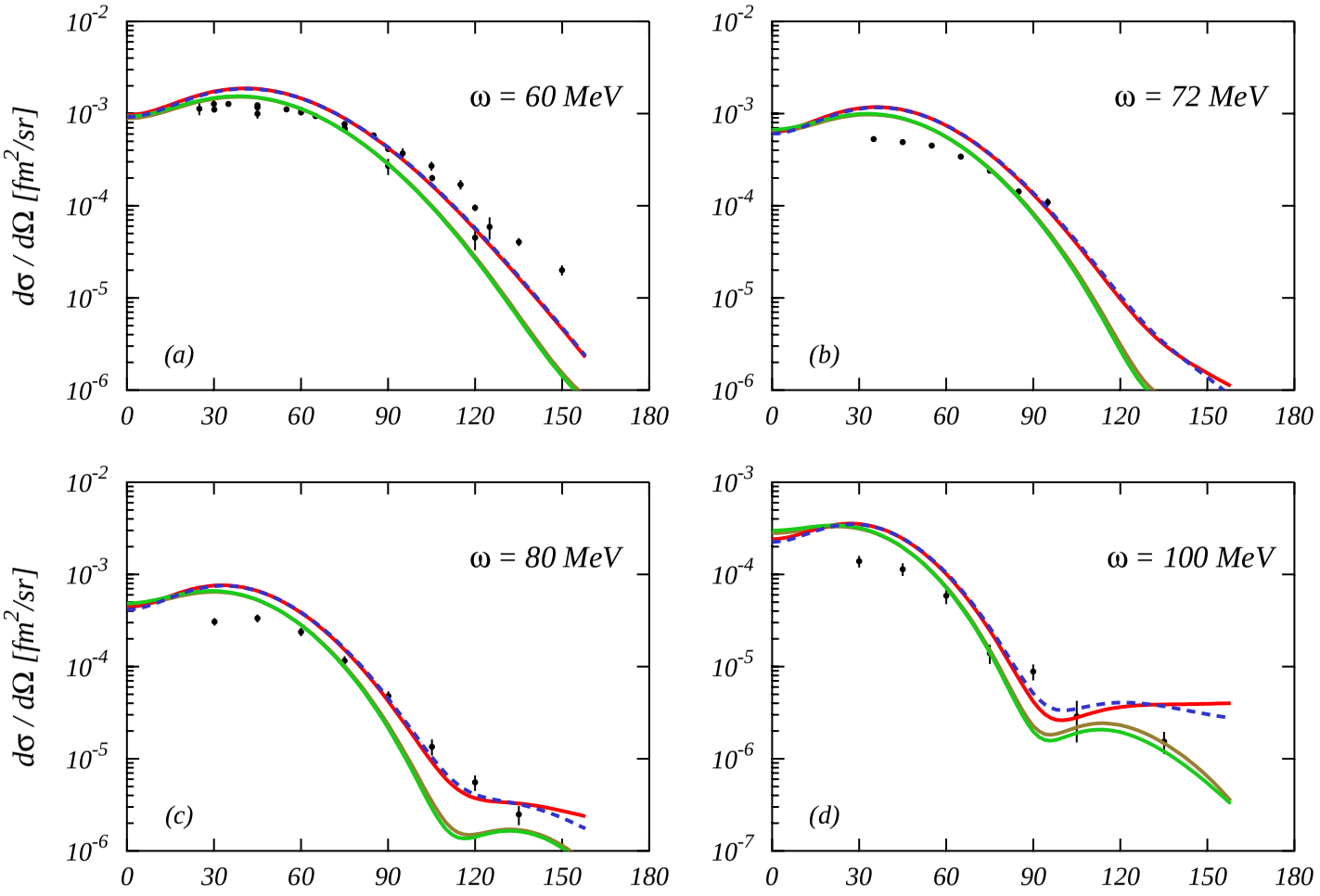


One-nucleon emission (γ,N)

OB / OB+SRC($S3$)

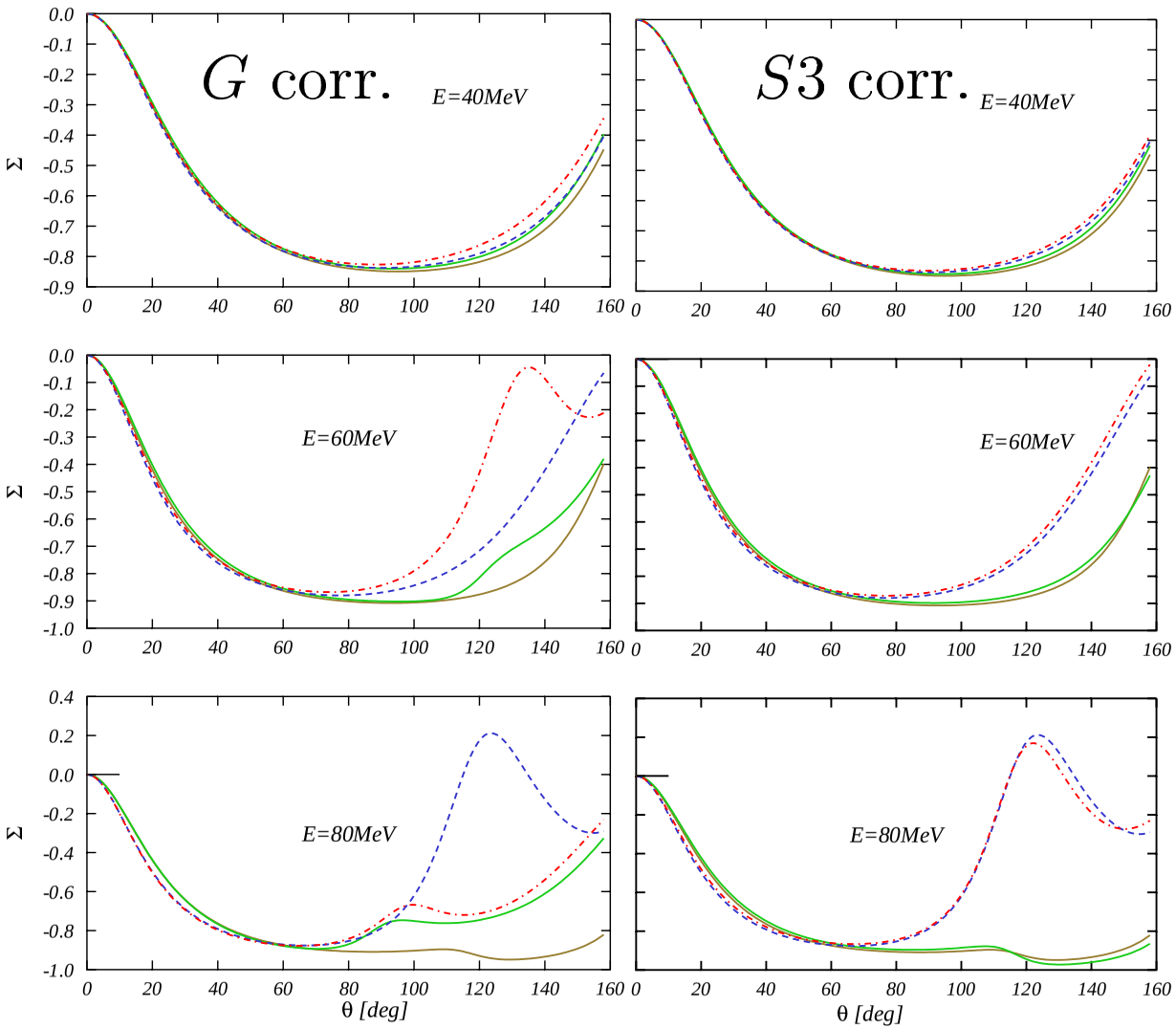
OB+MEC / OB+SRC+MEC

$^{16}O(\gamma,p)^{15}N(g.s.)$



One-nucleon emission $(\vec{\gamma},\mathrm{N})$

$^{16}\mathrm{O}(\vec{\gamma},\mathrm{p})^{15}\mathrm{N}(\mathrm{g.s.})$



asymmetry

$$\Sigma = \frac{w_{\mathrm{TT}}}{w_{\mathrm{T}}}$$

OB

OB + SRC

OB + MEC

OB + SRC + MEC

Conclusions

- one-nucleon emission (γ,p) and ($\vec{\gamma}$,p)
  - SRC: small corrections, within theoretical uncertainties
  - (γ,p): sensitivity to SRC,
    but SRC effects are smaller than MEC contributions
  - ($\vec{\gamma}$,p): sensitive to MEC
    but very scarce experiments
  - large contribution of the uncorrelated OB responses
    $\longrightarrow$ two-proton emission to study SRC

Conclusions

- two-nucleon emission
  - OB uncorrelated terms do not contribute
  - MEC compete with SRC

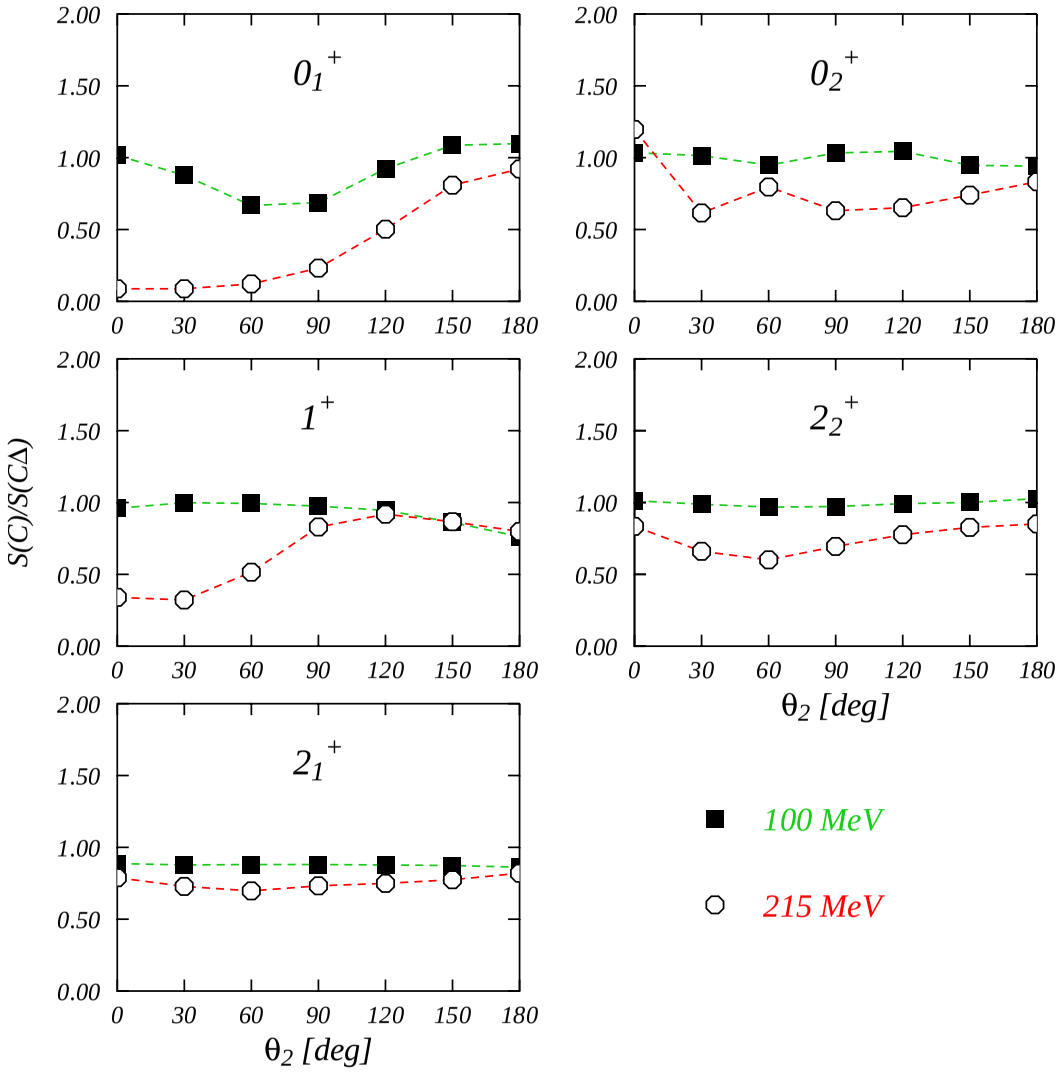
  but if

- two-proton emission
  - only Δ current only
  - good place for SRC

(γ,pp)

$^{16}O\,(\gamma\,,\,pp)^{14}C$

$$S^{(\mathrm{C})} = \int \mathrm{d}\theta_1 \sin\theta_1 \frac{\mathrm{d}^5\sigma^{(\mathrm{C})}(\theta_1)}{\mathrm{d}\Omega_1 \mathrm{d}\epsilon_2 \mathrm{d}\Omega_2}$$



$$\frac{S^{(\mathrm{SRC})}}{S^{(\mathrm{SRC}+\Delta)}}$$

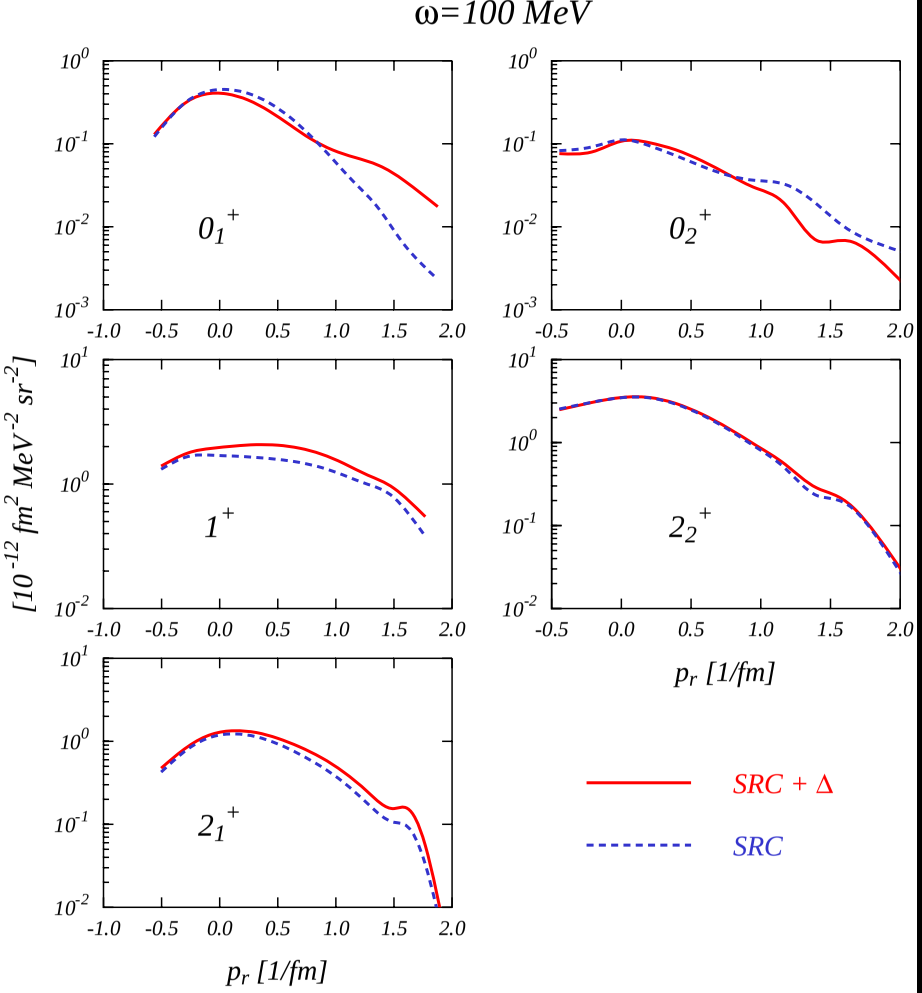
$(\epsilon_2 = 40\mathrm{MeV}; G\ \mathrm{corr.})$

$(1p_{1/2})^{-2}\ :\ 0_1^+$
$(1p_{3/2})^{-2}\ :\ 0_2^+$
$(1p_{1/2})^{-1}(1p_{3/2})^{-1}\ :\ 1^+$
$(1p_{1/2})^{-1}(1p_{3/2})^{-1}\ :\ 2_1^+$
$(1p_{3/2})^{-2}\ :\ 2_2^+$

(γ,pp)

- superparallel kinematics
  small Δ effect at $\omega = 100$MeV
  except for 0_1^+ at high $|\mathbf{p}_r|$

superparallel back-to-back



$(\theta_1 = 0^o; \theta_2 = 180^o; G$ corr.$)$

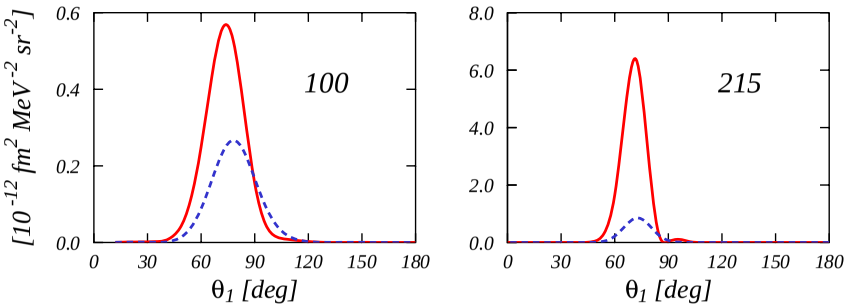
(γ,pp)

- superparallel kinematics
  small Δ effect at $\omega = 100$MeV
  except for 0_1^+ at high $|\mathbf{p}_r|$

- other kinematics: symmetric
  Δ effects dominate
  at both $\omega = 100$ and 215MeV

symmetric

$^{16}O\,(\gamma\,,pp)\,^{14}C$

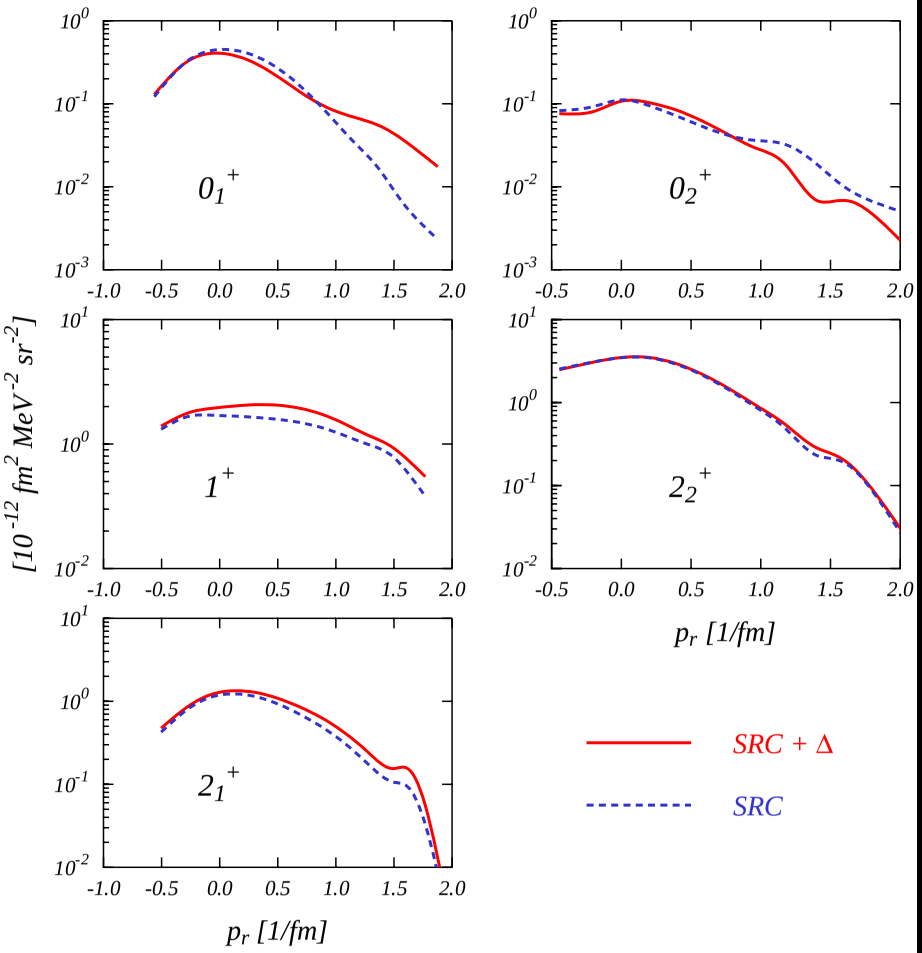


$(\epsilon_1 = \epsilon_2; \theta_2 = \theta_2; G \text{ corr.}; 0_1^+)$

superparallel back-to-back

$^{16}O\,(\gamma\,,pp)\,^{14}C$

ω=100 MeV



$(\theta_1 = 0^o; \theta_2 = 180^o; G \text{ corr.})$

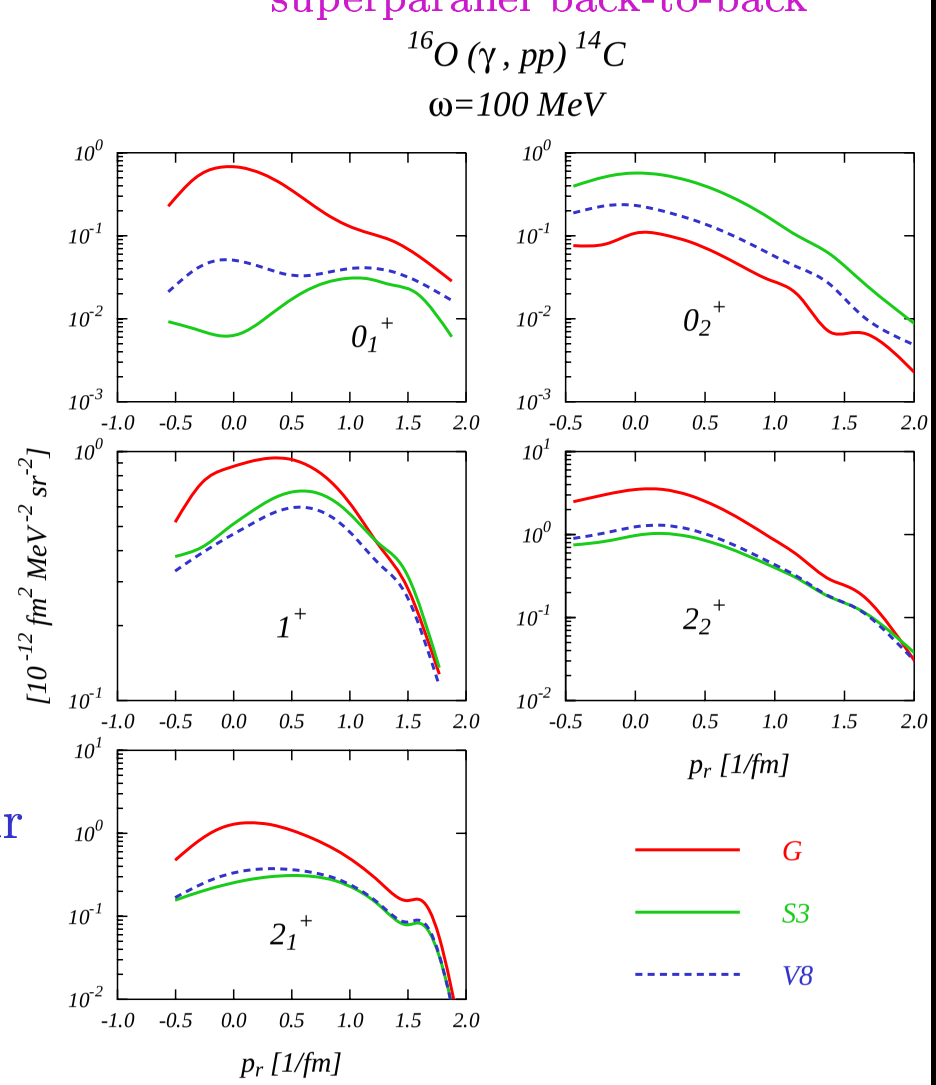
(γ,pp)

- sensitivity to the SRC

dominance of G correlation

except for 0_2^+
which shows opposite behaviour

superparallel back-to-back

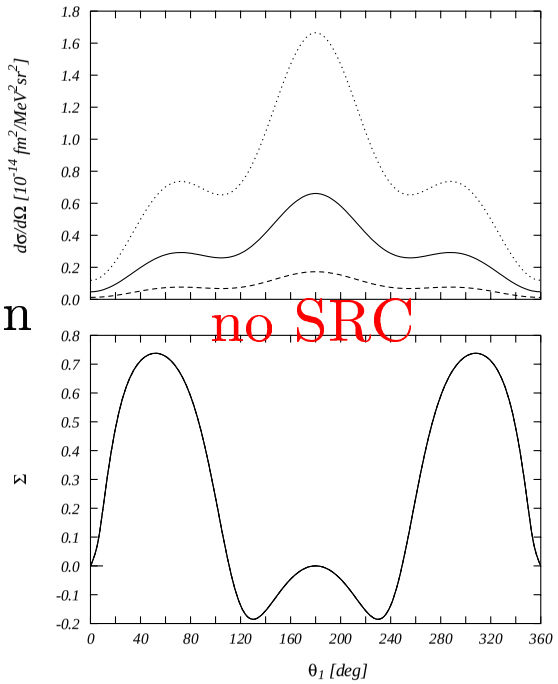


$(\theta_1 = 0^o; \theta_2 = 180^o; G$ corr.$)$

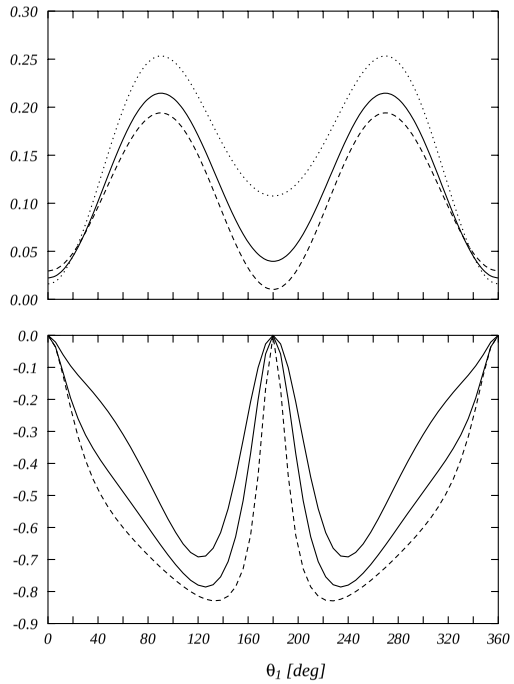
$(\vec{\gamma}$,pp)

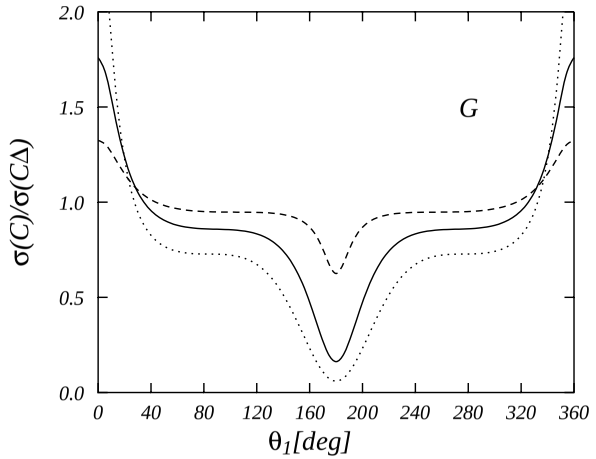
$^{16}\mathrm{O}(\vec{\gamma},\mathrm{pp})^{14}\mathrm{C}$(g.s.); $\omega = 80$ MeV; G corr.

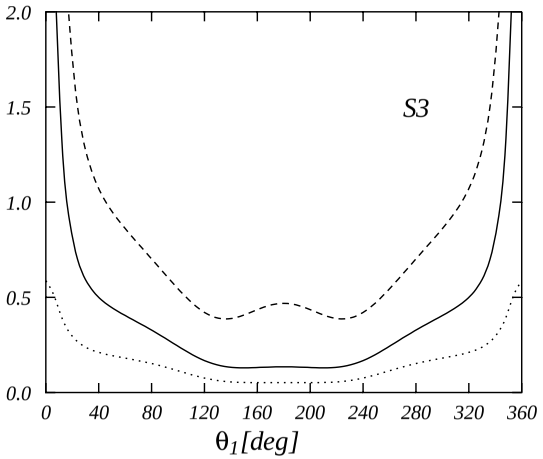
- sensitivity to the Δ current parameterization



no SRC



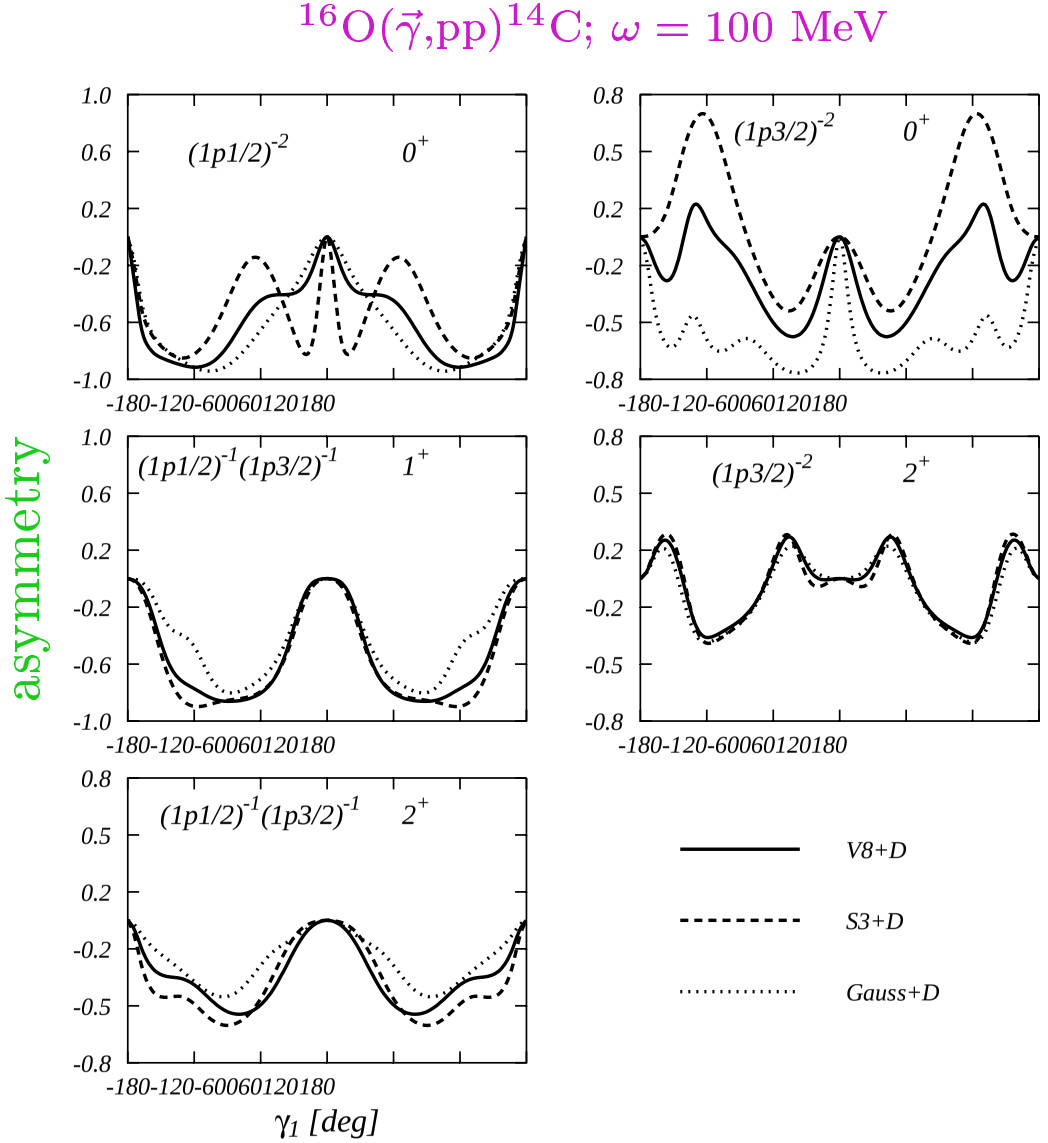




$(\vec{\gamma}$,pp)

- sensitivity to the SRC

  only for 0^+ states



Conclusions

- (γ,pp)
  - Δ current effects smaller than SRC contributions for a variety of kinematics
- ($\vec{\gamma}$,pp)
  - strong sensitivity to both Δ current and SRC

Conclusions

(γ,p), ($\vec{\gamma}$,p), (γ,pp), ($\vec{\gamma}$,pp)

at (relative) low energy

good possibilities for doing nuclear physics at

the gamma-ray beam line ALBA