Gruppo Roma1 (2012)

F. Meddi	P. A. 30%	
G.M. Urciuoli	I Ric. 70%	
F. De Persio	Laur.	
A. Ruggieri	Tec. Inf.	2 mesi
S. Sestito	Tec. Elett.	4 mesi
M. Zullo	Rep. Dis.	10 mesi
G. Chiodi	Off. Elett.	4 mesi
F. Cidronelli	Off. Elett.	5 mesi
Officina meccanica	supporto.	

Lead (^{208}Pb) Radius Experiment : PREX

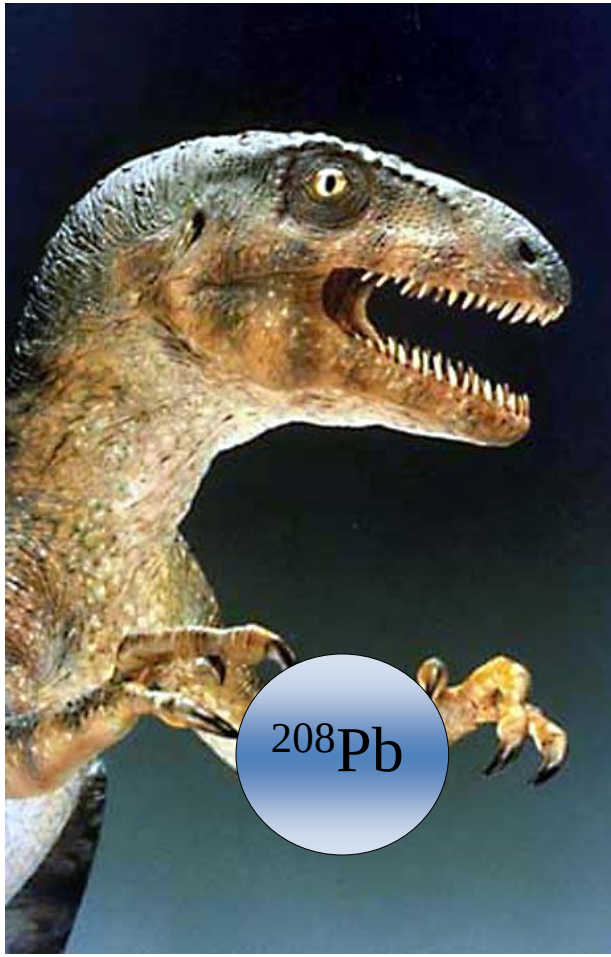
Elastic Scattering Parity Violating Asymmetry

E = 1 GeV, $\theta = 5^0$ electrons on lead

Spokespersons

- Krishna Kumar
- Robert Michaels
- Kent Pascke
- Paul Souder
- Guido Urciuoli

Hall A Collaboration Experiment



Electron - Nucleus Potential

$$\hat{V}(r) = V(r) + \gamma_5 A(r)$$

electromagnetic

$$V(r) = \int d^3r' \; Z \; \rho(r') / |\vec{r} - \vec{r}'|$$

$$\frac{d\sigma}{d\Omega} = \frac{d\sigma}{d\Omega}_{Mott} |F_P(Q^2)|^2$$

Proton form factor

$$F_P(Q^2) = \frac{1}{4\pi} \int d^3r \; j_0(qr) \; \rho_P(r)$$

axial

$$A(r) = \frac{G_F}{2\sqrt{2}} \left[(1 - 4\sin^2\theta_W) Z \, \rho_P(r) - N \, \rho_N(r) \right]$$

$\Rightarrow$ $A(r)$ is small, best observed by parity violation

$\Rightarrow$ $1 - 4\sin^2\theta_W << 1$ neutron weak charge >> proton weak charge

Neutron form factor

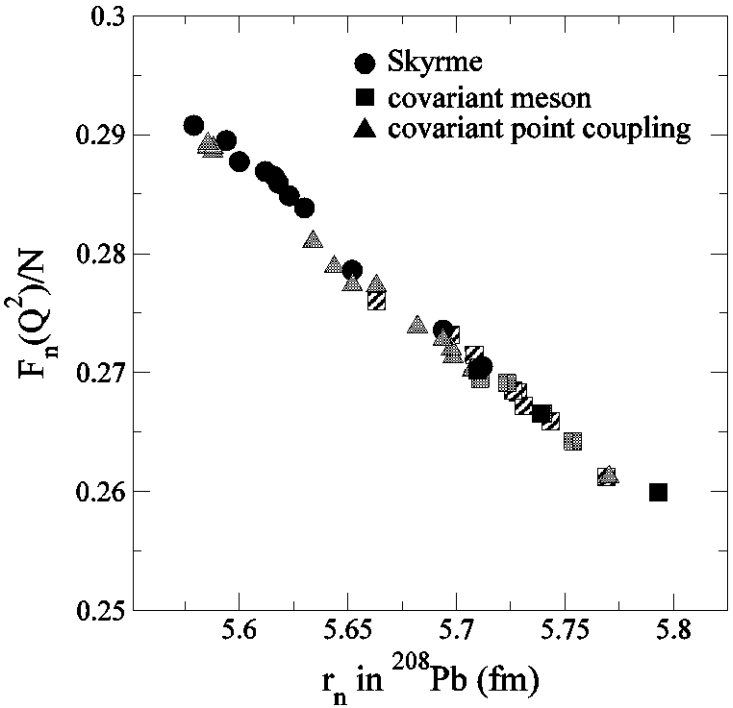
$$F_N(Q^2) = \frac{1}{4\pi} \int d^3r \; j_0(qr) \; \rho_N(r)$$

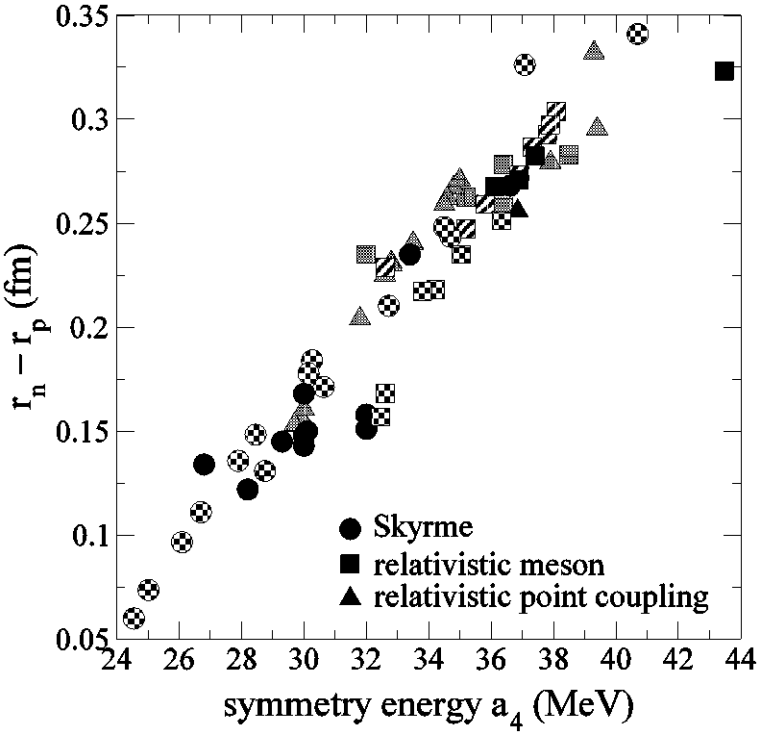
Parity Violating Asymmetry

$$A = \frac{\left(\frac{d\sigma}{d\Omega}\right)_R - \left(\frac{d\sigma}{d\Omega}\right)_L}{\left(\frac{d\sigma}{d\Omega}\right)_R + \left(\frac{d\sigma}{d\Omega}\right)_L} = \frac{G_F Q^2}{2\pi\alpha\sqrt{2}} \left[\underbrace{1 - 4\sin^2\theta_W}_{\approx 0} - \frac{F_N(Q^2)}{F_P(Q^2)} \right]$$

Measurement at one Q^2 is sufficient to measure R_N

Pins down the symmetry energy (1 parameter)





(R.J. Furnstahl)

PREX Result

Systematic Errors

Error Source	Absolute (ppm)	Relative (%)
Polarization (1)	0.0071	1.1
Beam Asymmetries (2)	0.0072	1.1
Detector Linearity	0.0071	1.1
BCM Linearity	0.0010	0.2
Rescattering	0.0001	0
Transverse Polarization	0.0012	0.2
Q^2 (1)	0.0028	0.4
Target Thickness	0.0005	0.1
^{12}C Asymmetry (2)	0.0025	0.4
Inelastic States	0	0
TOTAL	**0.0130**	**2.0**

(1) Normalization Correction applied

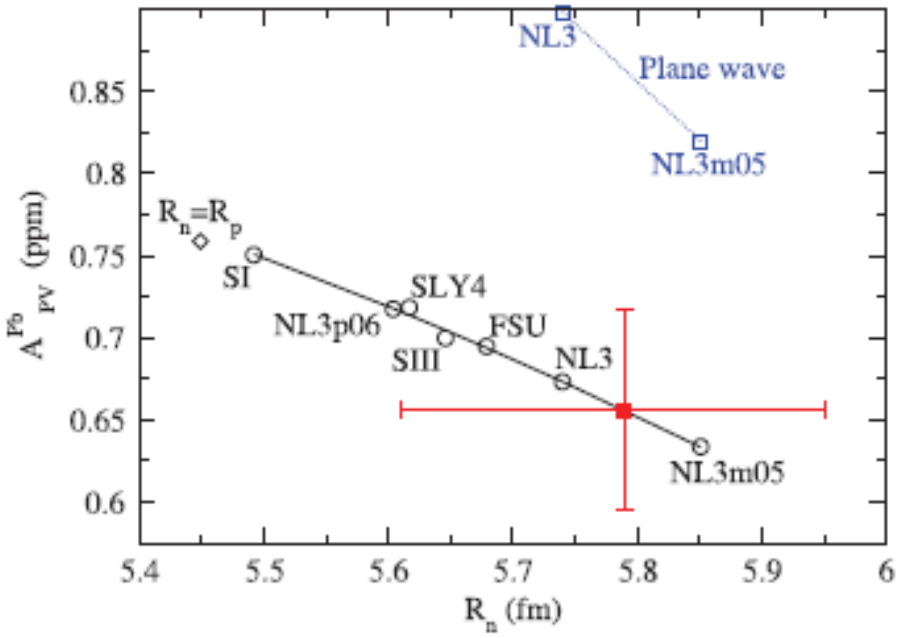
(2) Nonzero correction (the rest assumed zero)

A = 0.656 ± 0.06 (stat) ± 0.014 (syst) ppm

→ Statistics limited (9%)

→ Systematic error goal achieved ! (2%)

A neutron skin established at ~93 % CL



$$R_n \approx 6.156 + 1.675\langle A\rangle - 3.420\langle A\rangle^2 \text{ fm (with } \langle A\rangle \text{ in ppm)}$$

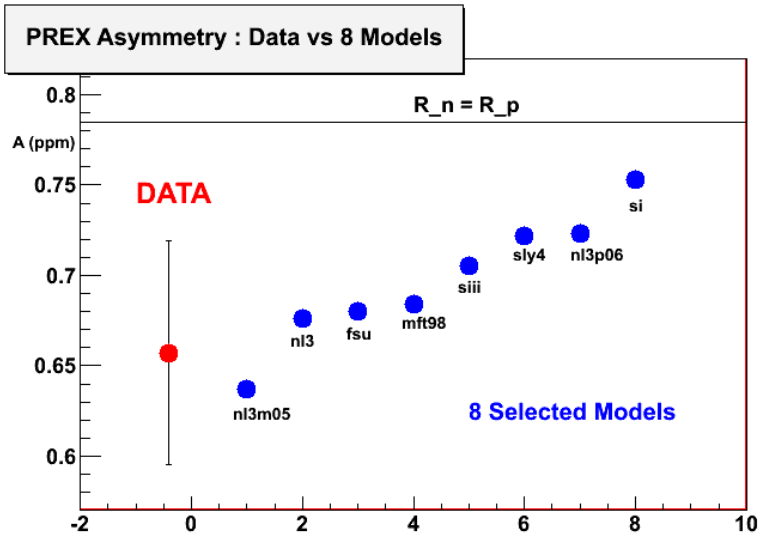
Neutron Radius = R_N = 5.78 + 0.15 - 0.17 fm

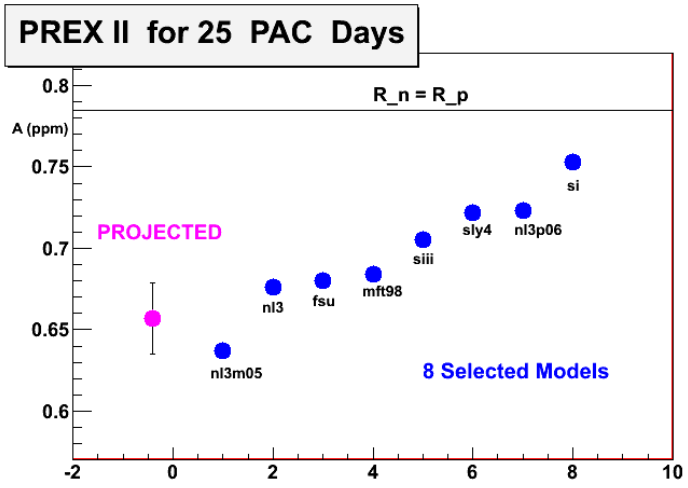
Neutron Skin = R_N - R_P = 0.33 + 0.16 - 0.18 fm

FUTURE: PREX-II

PREX-II Approved by PAC (Aug 2011)

"A" Rating 35 days run in 2013 / 2014





Impulse Approximation limitations to the (e,e'p) reaction on ^{209}Bi, ^{208}Pb and ^{12}C

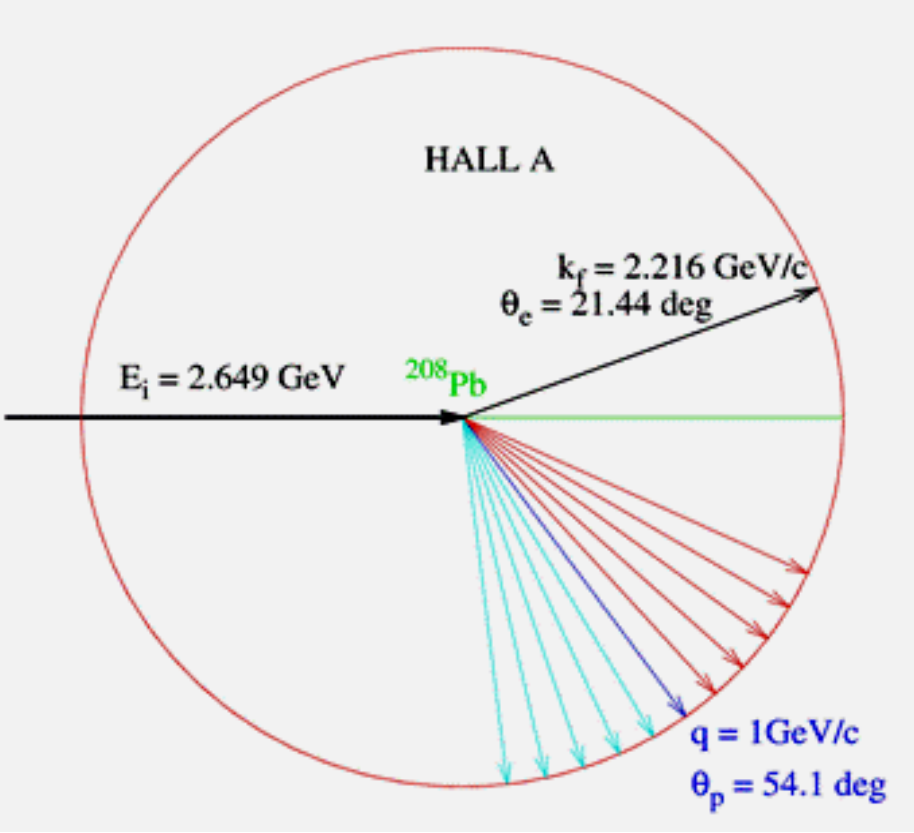
Jefferson Lab, Newport News, VA
and the Hall A Collaboration

E06-007

Spokepersons: *K. Aniol, A. Saha, J.M. Udías, G. Urciuoli*
Students: *Juan Carlos Cornejo, Joaquin Lopez Herraiz*
Research Associate: *Alexandre Camsonne*

Experiment (E06-007)

- We measured $^{208}Pb(e,e'p)^{207}Tl$ cross sections at true quasielastic kinematics (x_B=1, q=1 GeV/c, ω=0.433 GeV/c) and at both sides of q
- This has never been done before for A>16 nucleus



- **Determine momentum distributions**: $0<p_{miss}<500$ MeV/c
- **Determine A_{TL}** by measuring cross sections on either side of q
- **Determine the spectroscopic factors dependence with Q^2**

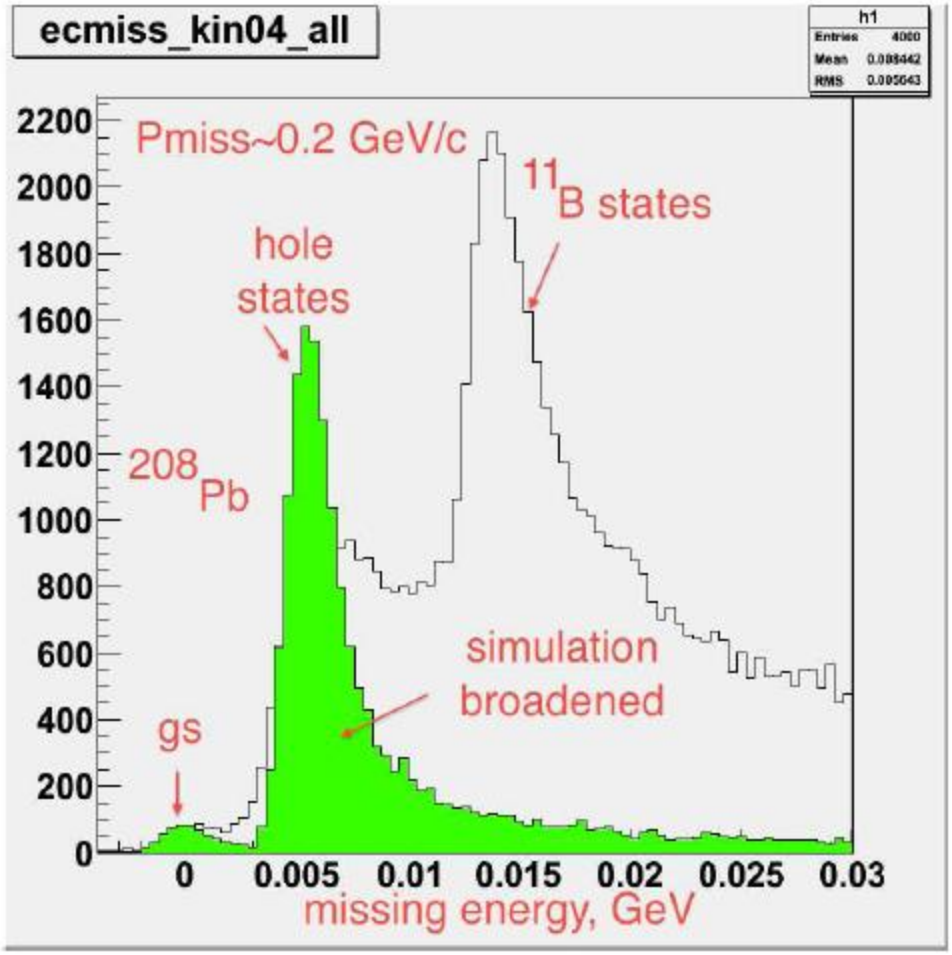


Figure 1. Kin04, centered at $p_{miss} = 0.2$ GeV/c for the $^{209}Bi(e,e'p)^{208}Pb$ reaction. The ^{11}B states are broadened because Bi kinematics are used to reconstruct the missing energy spectrum.

Table 1. $^{209}Bi(e,e'p)^{208}Pb$, March 2007. Cross sections in nbarn/sr^2/MeV. Radiative corrections have been applied. A 13% uncertainty due to radiative corrections is included in the ground state cross sections and an additional 5% uncertainty from radiative corrections is included in the hole states cross sections. Theoretical cross sections are from the Madrid group. Theory assumes one proton in the 1h9/2 shell and includes out of plane cos(ϕ) terms. Theory is integrated over the simulation. Hole states include counts between 2.4 MeV to 7 MeV excitation.

kin	θ_p	$p_{miss}(GeV/c)$	data, gs	Theory gs	hole states
kin02	59.83	0.1	0.112 ± 0.022	0.120	2.35 ± 0.13
kin03	48.37	-0.1	0.099 ± 0.023	0.0651	2.09 ± 0.13
kin04	65.36	0.2	0.132 ± 0.019	0.166	1.93 ± 0.11
kin05	42.58	-0.2	0.117 ± 0.022	0.0894	0.99 ± 0.06
kin06	71.44	0.3	0.0095 ± 0.005	0.0094	0.08 ± 0.01
kin07	36.76	-0.3	0.033 ± 0.026	0.00477	0.10 ± 0.03

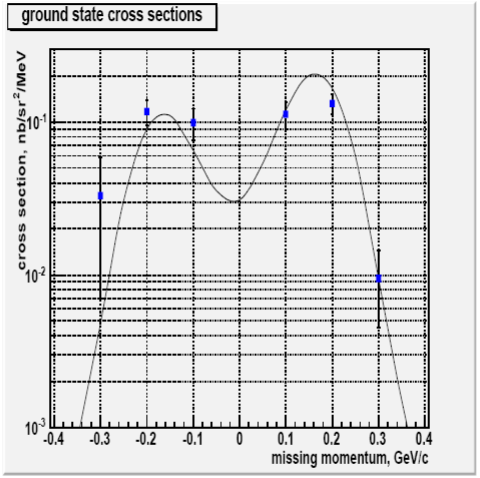


Figure 2. Absolute comparison of RDWIA theoretical prediction(solid line) vs data(squares) for the ground state cross section of the $^{209}Bi(e,e'p)^{208}Pb$ reaction for $E_e = 2.649$ GeV. Theory assumes there is one proton in the 1h9/2 state in ^{209}Bi.

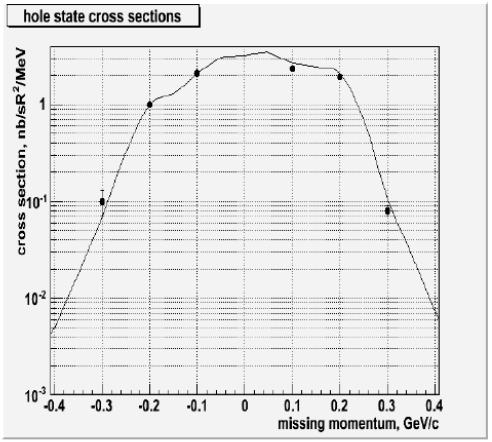
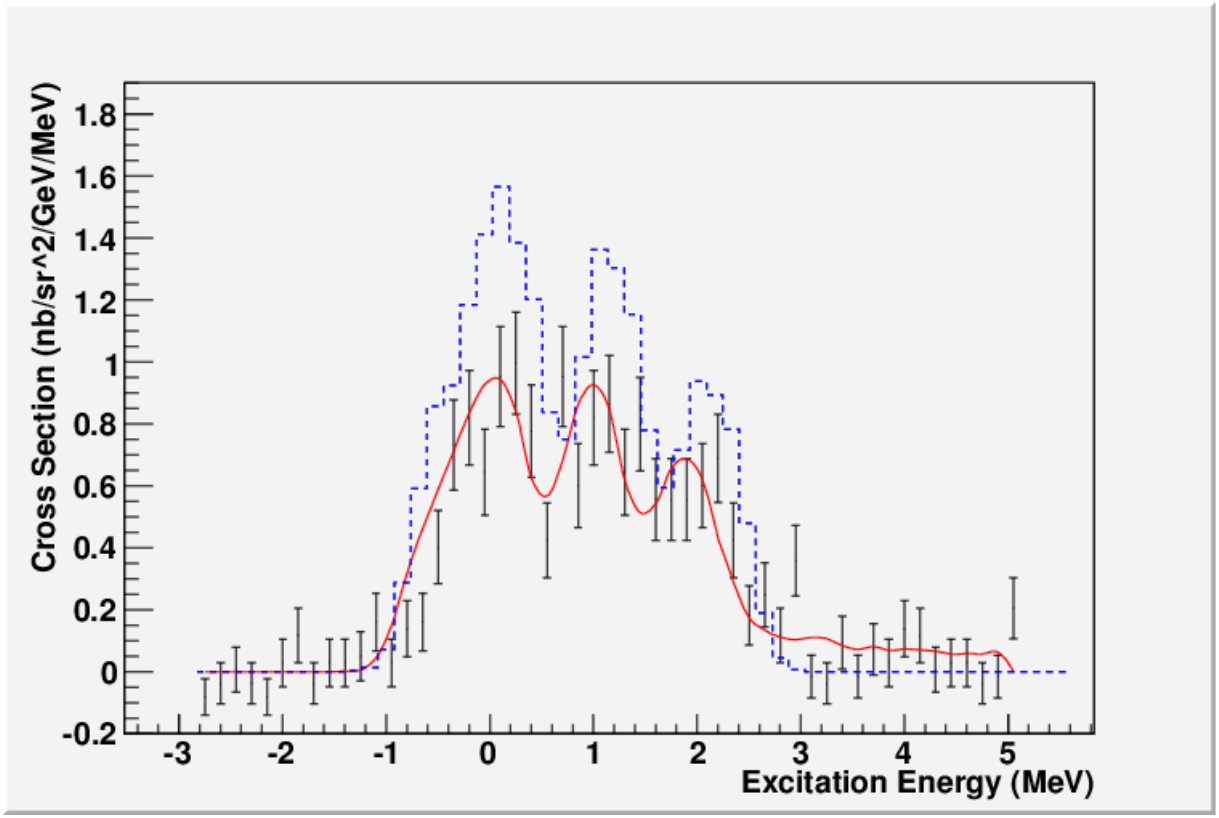


Figure 4. Holes state cross sections compared to theory. Theory is fitted to data at p_{miss} = -0.1 and -0.2 GeV/c. Theory = 0.759*(2d3/2 + 2d5/2) + 0.615*(1h11/2).

Experiment E94-107
Hypernuclear spectroscopy
^{9}Be (e,e'k^{+}) $^{9}_{\Lambda}$Li reaction


Cross Section (nb/sr^2/GeV/MeV)
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-3
-2
-1
0
1
2
3
4
5
Excitation Energy (MeV)

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(La Sapienza, 5-9 settembre 20011

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Scientific Program

Topics

•Atomic parity violation
•Charge Symmetry Breaking Quark Distributions
•Electric Dipole Moment
•Electron-Ion Collider
•Electroweak

Physics at Colliders
•Extensions of the Standard Model
•Future Facilities and Electroweak Physics
•Hadronic Parity Violation
•Neutrino Physics
•Parity Violating Electro Scattering
•Parity Violation and QCD in Nuclei
•Polarimetry
•Polarized Electron Sources
•Tests of the Standard Model
•Two-Boson Radiative Corrections

68 partecipanti,

52 talk,

I Proceedings verranno pubblicati su Nuovo Cimento C

(ultimi cinque contributi da consegnare all'editore)