

Recenti risultati per nuclei medio-pesanti nella ambito della teoria CBF

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$$\delta E[\Psi] = \delta \frac{\langle \Psi | H | \Psi \rangle}{\langle \Psi | \Psi \rangle} = 0.$$

$$\Psi(1,...,A)=F(1,...,A)\Phi(1,...,A).$$

$$\mathcal{F}(1,...,A) \quad = \quad \mathcal{S}\Big(\prod_{j>i=1}^A F_{ij}\Big) = \mathcal{S}\Big(\prod_{j>i=1}^A \sum_{p=1}^6 f^p(r_{ij}) \textcolor{blue}{O}_{ij}^p\Big)$$

$$O_{ij}^{p=1,6} \quad = \quad 1, \boldsymbol{\tau}_i \cdot \boldsymbol{\tau}_j, \boldsymbol{\sigma}_i \cdot \boldsymbol{\sigma}_j, (\boldsymbol{\sigma}_i \cdot \boldsymbol{\sigma}_j)(\boldsymbol{\tau}_i \cdot \boldsymbol{\tau}_j), S_{ij}, S_{ij}(\boldsymbol{\tau}_i \cdot \boldsymbol{\tau}_j)$$

Trattazione di nuclei sferici non saturati nello spin e nell'isospin (jj coupling):

$$\Phi_0(1, \dots, A) = \det[\phi^{t_i}(nljm)_i(x_j)]$$

$$\phi_{(nljm)_i}^{t_i}(x_j) = R_{(nlj)_i}^{t_i}(r_j) \sum_{\mu_i s_i} \langle l_i \mu_i 1/2 s_i | j_i m_i \rangle Y_{l_i m_i}(\hat{r}_j) \chi_{s_i}(j) \chi_{t_i}(j)$$

L'input dei calcoli

L'hamiltoniano è

$$H = \sum_{i=1}^A -\frac{\hbar^2}{2m} \nabla_i^2 + \sum_{i<j=1}^A V_{ij} + \sum_{i<j<k=1}^A V_{ijk}$$

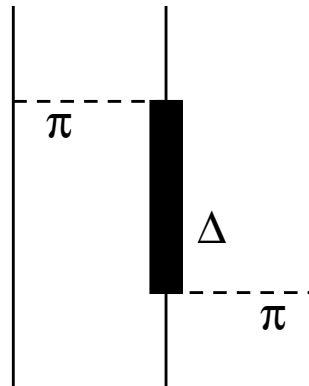
dove l'interazione a due corpi è data da:

$$V_{ij} = \sum_{p=1}^8 v^p O_{ij}^p$$

$$O_{ij}^{p=1,8} = [1, \boldsymbol{\sigma}_i \cdot \boldsymbol{\sigma}_j, S_{ij}, (\mathbf{L} \cdot \mathbf{S})_{ij}] \otimes [1, \boldsymbol{\tau}_i \cdot \boldsymbol{\tau}_j]$$

e l'interazione a tre corpi

$$V_3 = v_{ijk}^{2\pi} + v_{ijk}^R$$



Le regole di somma

$$S_1 = \frac{1}{A} \sum_{\alpha=p,n} \int d^3\mathbf{r}_1 \rho_1^\alpha(\mathbf{r}_1) = 1$$

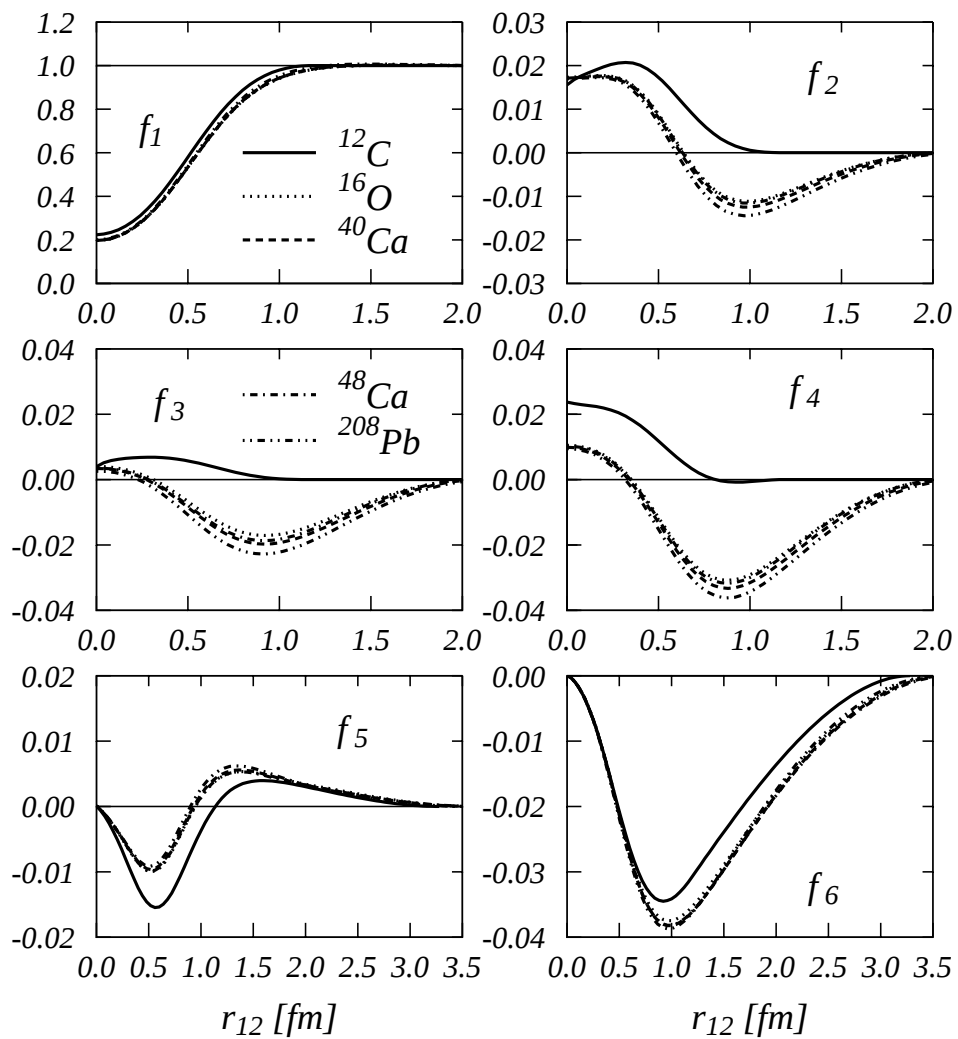
$$S_2 = \frac{1}{A(A-1)} \sum_{\alpha\beta=p,n} \int d^3\mathbf{r}_1 d\mathbf{r}_2 \rho_{2,1}^{\alpha\beta}(\mathbf{r}_1, \mathbf{r}_2) = 1$$

	^{12}C	^{16}O	^{40}Ca	^{48}Ca	^{208}Pb
$S_{1,J}^p$	1.000	1.000	1.000	1.000	0.999
$S_{1,J}^n$	1.000	1.000	1.000	0.999	0.999
$S_{1,SOC}^p$	0.997	1.006	1.008	0.994	1.002
$S_{1,SOC}^n$	0.997	1.006	1.008	0.996	1.000
$S_{2,J}$	1.004	1.003	1.001	1.000	0.998
$S_{2,SOC}$	0.996	0.998	0.978	0.994	1.003

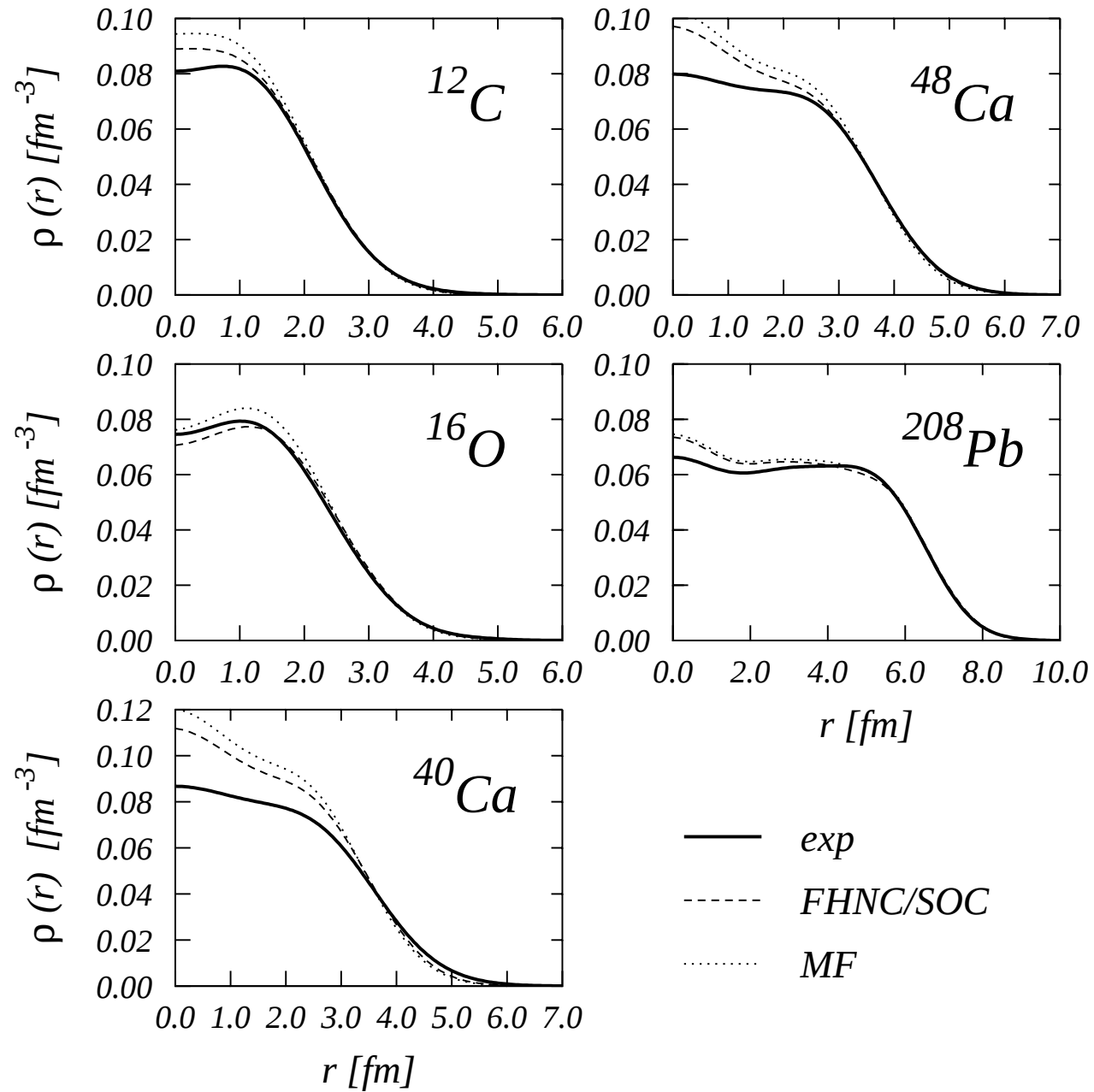
Le energie dello stato fondamentale in MeV per nucleone

		^{12}C	^{16}O	^{40}Ca	^{48}Ca	^{208}Pb
$v'_8 +$ UIX	T	27.13	32.33	41.06	39.64	39.56
	V_{2-body}^6	-29.13	-38.15	-48.97	-46.60	-48.43
	V_{LS}	-0.25	-0.38	-0.39	-0.35	-0.45
	V_{Coul}	0.67	0.86	1.96	1.57	3.97
	$T + V(2)$	-1.58	-5.34	-6.34	-5.74	-5.35
	V_{3-body}	0.66	0.86	1.76	1.61	1.91
	E	0.91	-4.49	-4.58	-4.14	-3.43
$v_{14} +$ $UVII$	T	24.63	29.25	37.70	36.47	36.48
	V_{2-body}^6	-27.08	-35.84	-47.16	-44.86	-46.87
	V_{LS}	0.05	0.03	0.07	0.09	0.04
	V_{Coul}	0.68	0.88	2.02	1.59	4.03
	$T + V(2)$	-1.72	-5.68	-7.37	-6.71	-6.32
	V_{3-body}	0.54	0.69	1.28	1.15	1.41
	$E(UIX)$	-1.18	-4.99	-6.09	-5.56	-4.91
	E_{exp}	-7.68	-7.97	-8.55	-8.66	-7.86

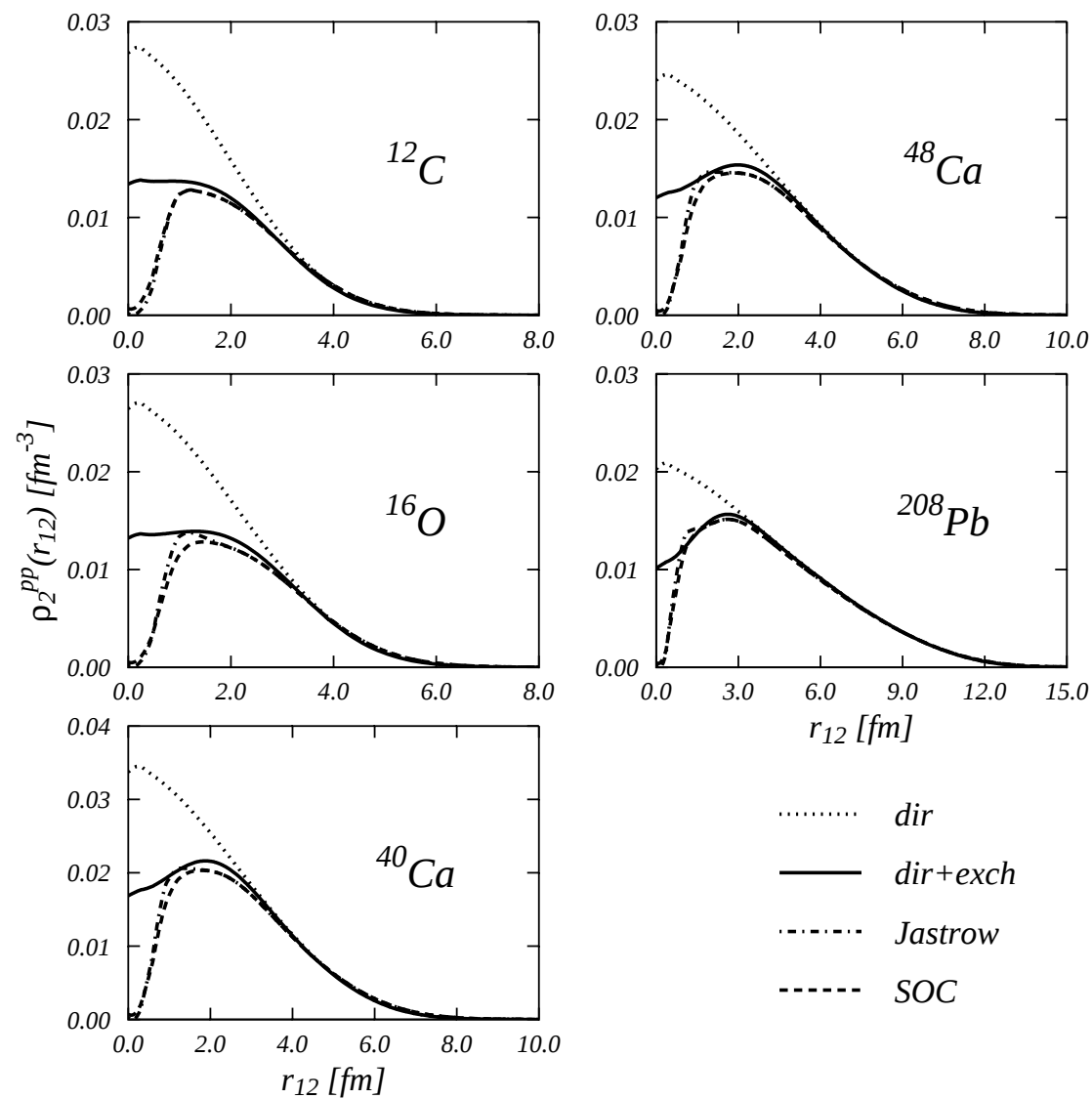
Le funzioni di correlazione



Distribuzioni di carica

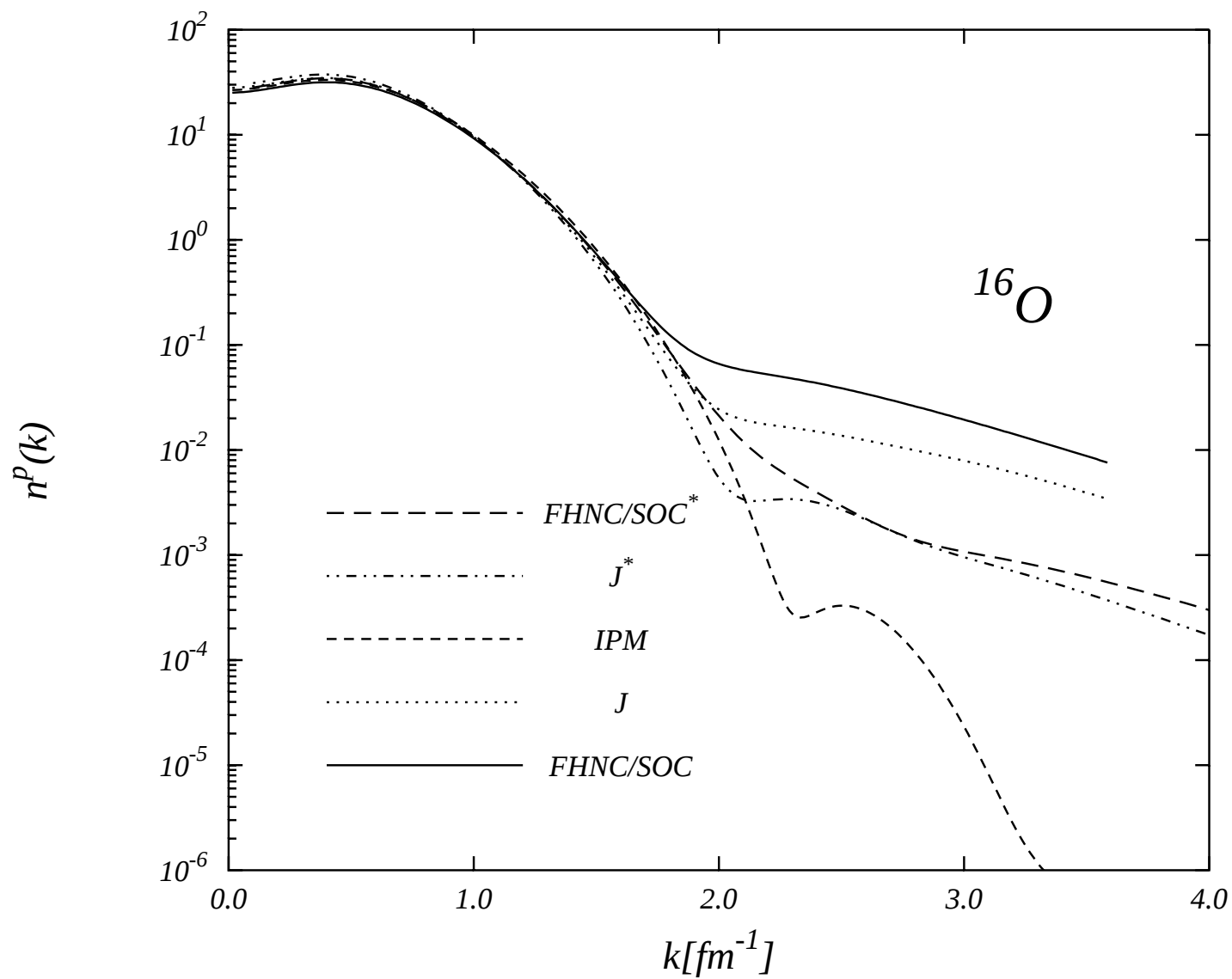


Matrici densità

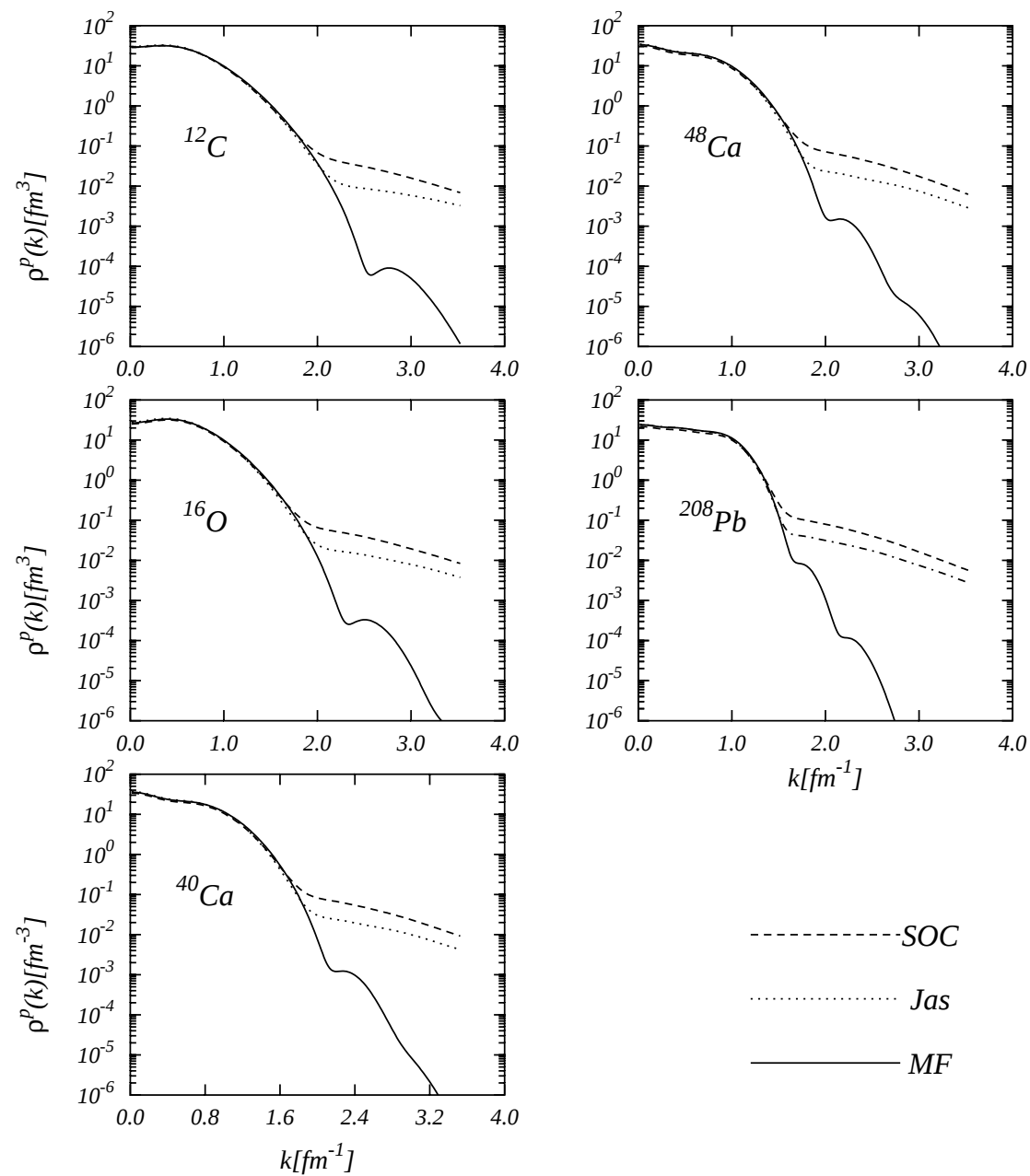


$$\rho_2^{\alpha\beta,p}(\mathbf{r}_1, \mathbf{r}_2) = \frac{A(A-1)}{\langle \Psi | \Psi \rangle} \int dx_3 \dots dx_A \Psi^* \mathcal{P}^\alpha(1) O^p(x_1, x_2) \mathcal{P}^\beta(2) \Psi$$

Distribuzioni dei momenti

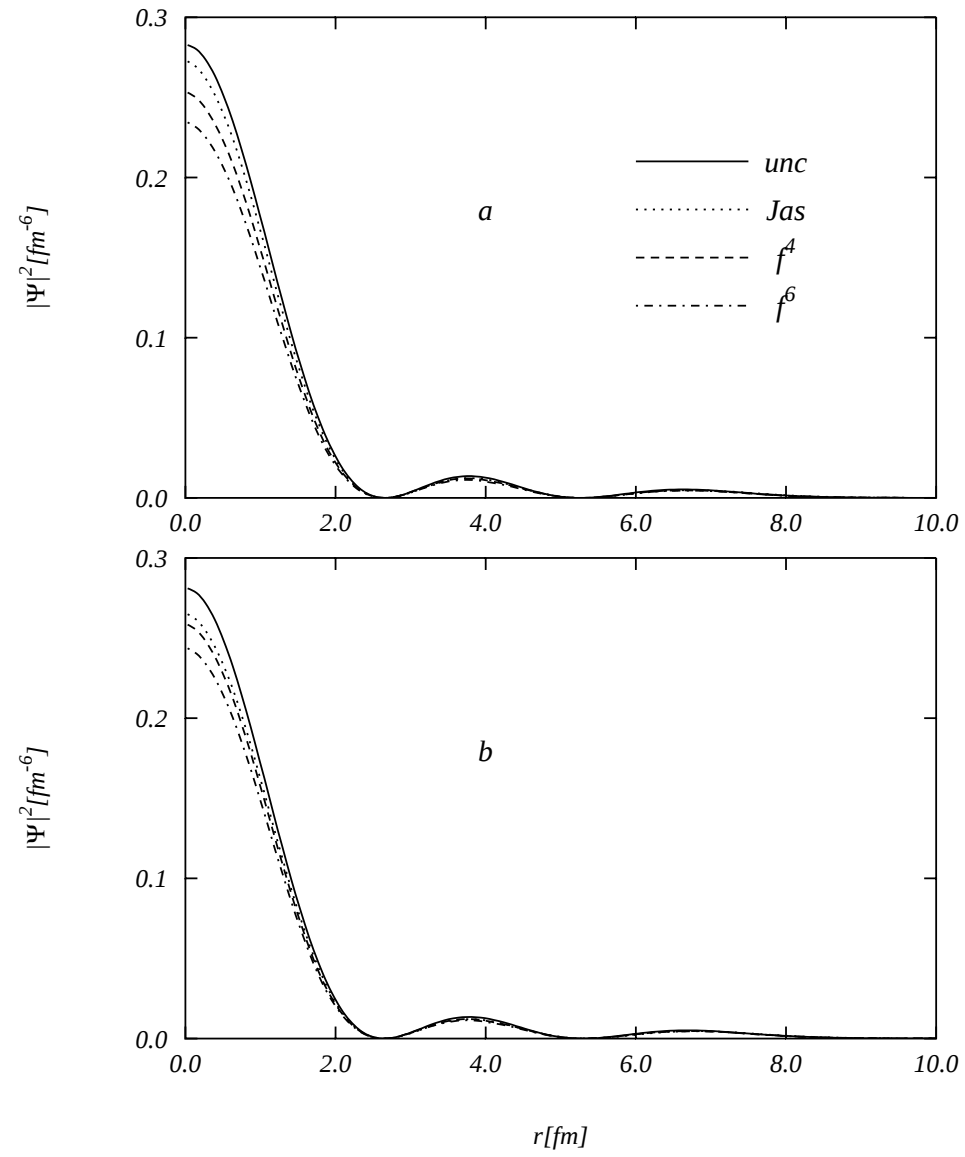


Distribuzioni dei momenti

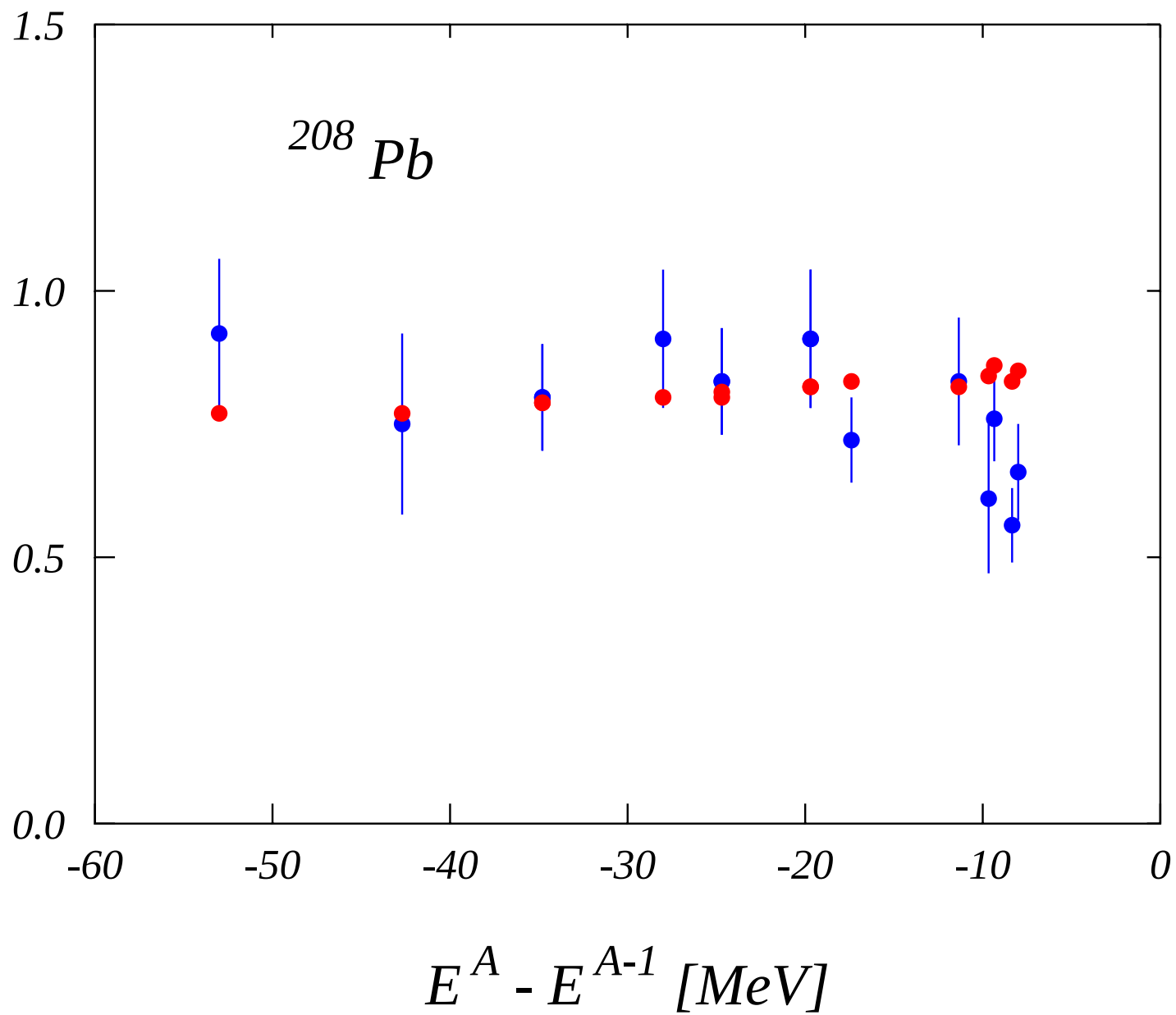


Funzioni quasi buca

$$\psi_n(\mathbf{r}) = \langle \Psi_n^{A-1} | a(\mathbf{r}) | \Psi^A \rangle$$



occupation numbers



Sviluppi

- calcolo della funzione spettrale e di sezioni d'urto di reazioni di tipo $(e,e'p)$
- Nuclei non sferici
- Hypernuclei
- Formulazione di una teoria RPA correlata per lo studio degli stati eccitati