随机两体系综下非集体转动行为的鲁棒性

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提纲

- 随机两体系综的定义
- 随机两体系综的非集体转动行为的鲁棒性
- 真实相互作用的随机扰动鲁棒性
- 剩余两体相互作用元的结构鲁棒性
- 总结

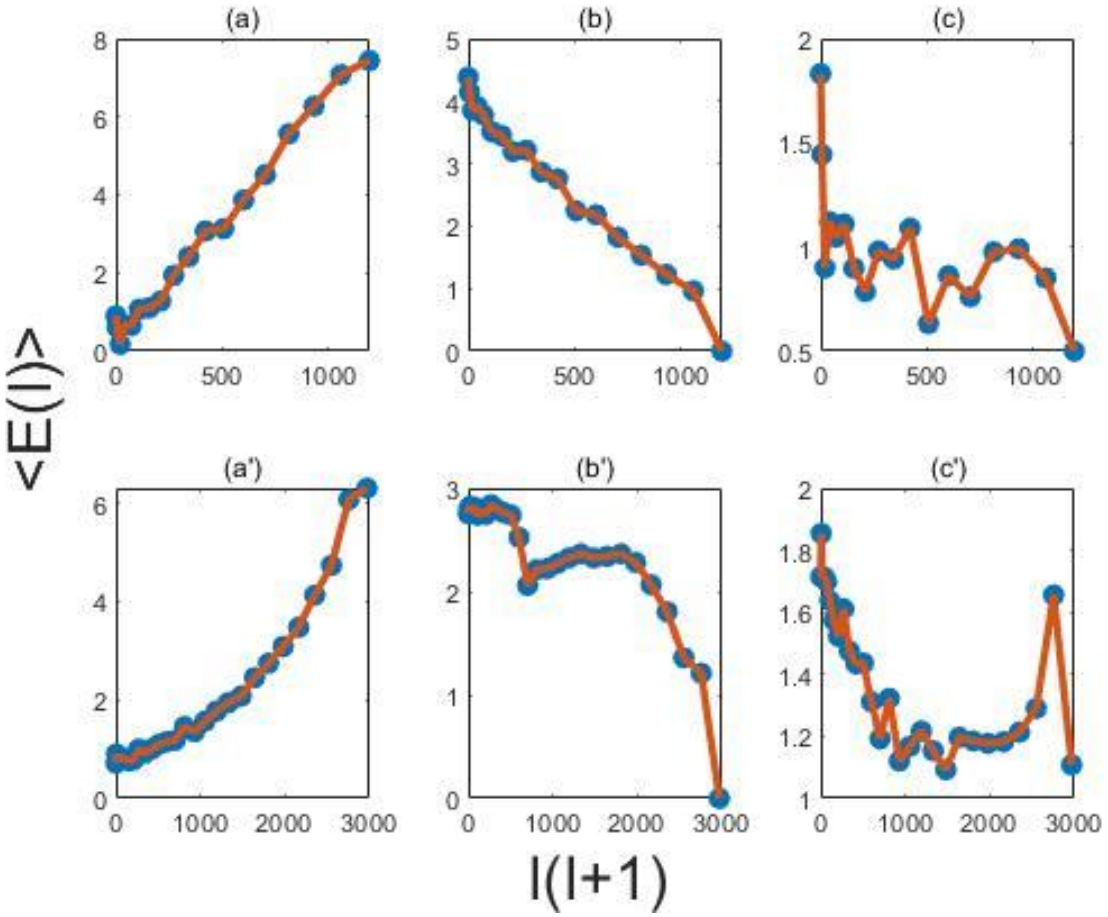
随机两体系综

$$\rho(G_J) = \frac{1}{\sqrt{2\pi}} \exp(-G_J^2/2),\ J = 0, 2, ..., 2j-1.$$

$$\rho(G_{JT}(j_1 j_2; j_3 j_4)) = \frac{1}{\sqrt{2\pi}\sigma} \exp\left(-\frac{G_{JT}(j_1 j_2; j_3 j_4)^2}{2\sigma^2}\right)$$

$$\sigma^2 = \frac{1}{2}(1 + \delta_{j_1 j_2; j_3 j_4})$$

非集体转动行为（单 j 核）



$$j = \frac{17}{2}, n = 6$$

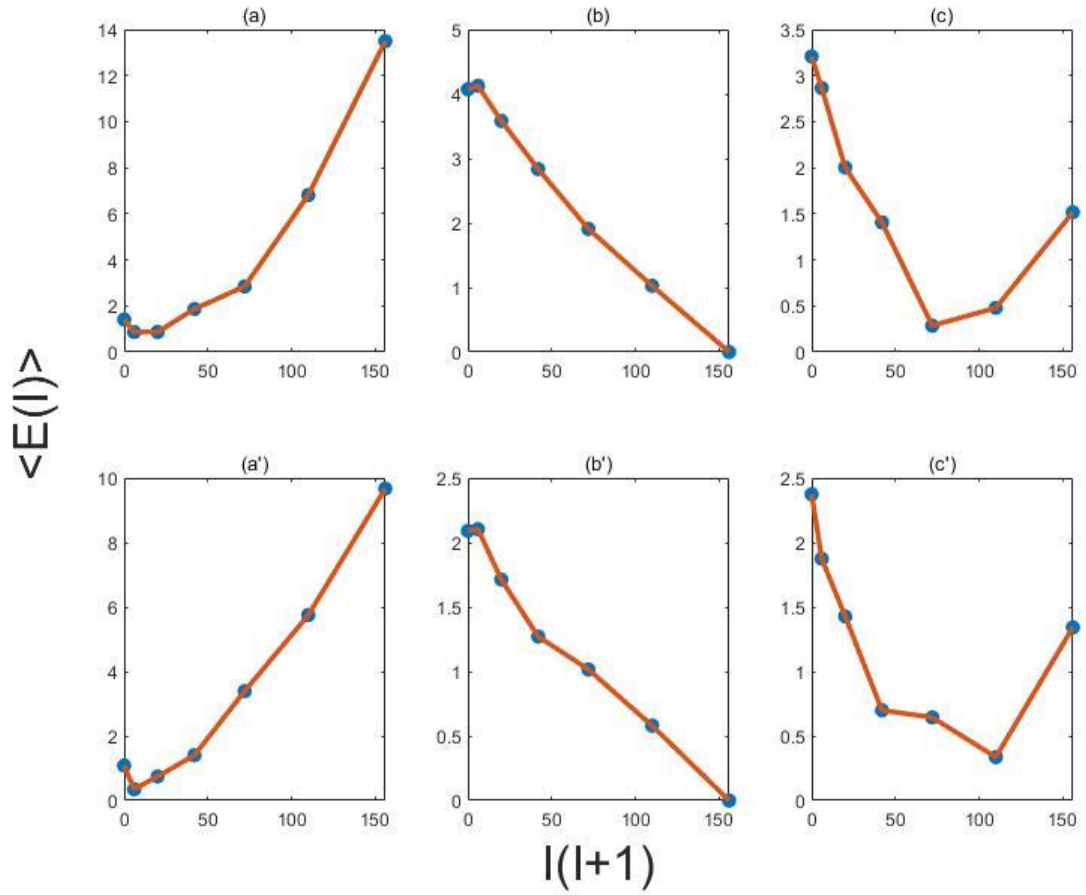
$$\begin{cases} (\boldsymbol{a}) & \boldsymbol{E(I=0) < E(I_{max})} \\ (\boldsymbol{b}) & \boldsymbol{E(I=0) > E(I_{max})且E(I_{max}) = 0} \\ (\boldsymbol{c}) & \boldsymbol{E(I=0) > E(I_{max})且E(I_{max}) \neq 0} \end{cases}$$

$$j = \frac{31}{2}, n = 4$$

非集体转动行为（偶偶核）

sd-shell

pf-shell

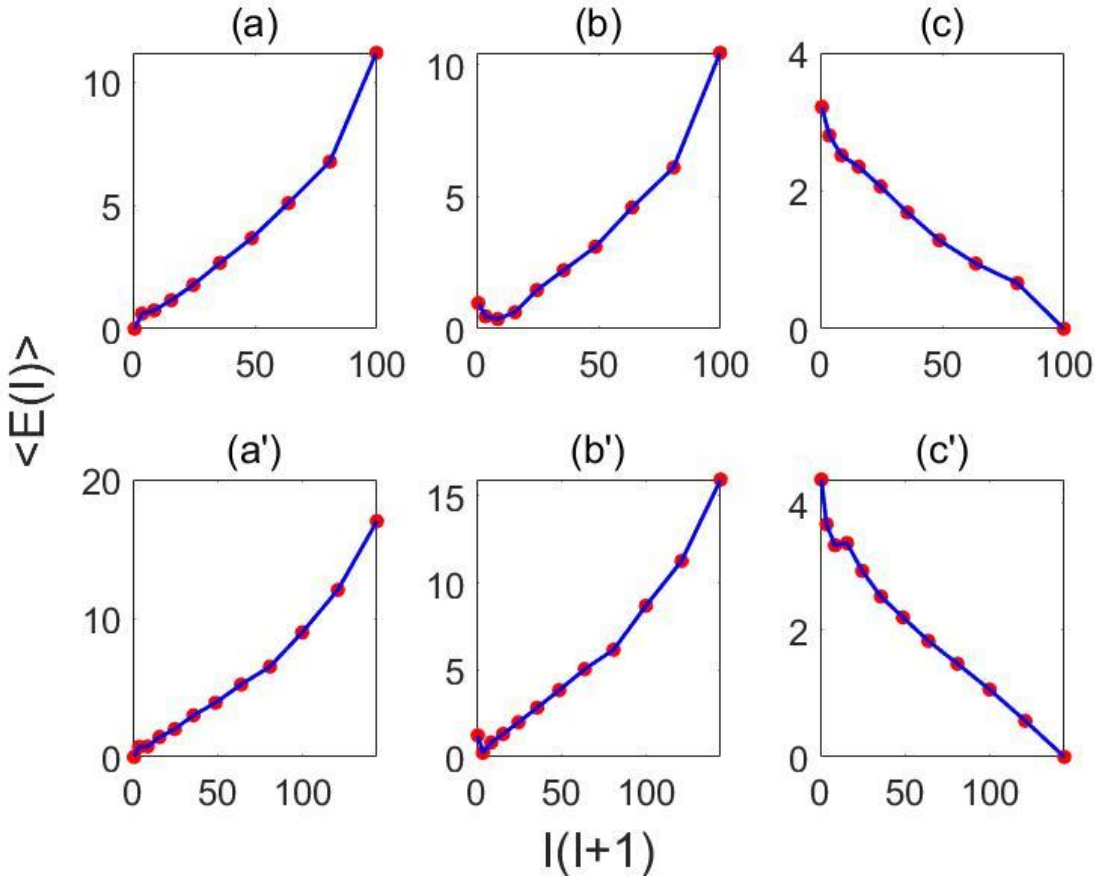


$$\begin{cases} (a) & E(I=0) < E(I_{max}) \\ (b) & E(I=0) > E(I_{max}) \text{且} E(I_{max}) = 0 \\ (c) & E(I=0) > E(I_{max}) \text{且} E(I_{max}) \neq 0 \end{cases}$$

非集体转动行为（奇A核）

sd-shell

pf-shell



$$\begin{cases} (a) & E\left(I=\frac{1}{2}\right)=0 \\ (b) & E\left(I=\frac{3}{2},\frac{5}{2},\frac{7}{2}\right)=0 \\ (c) & E(I_{max})=0 \end{cases}$$

转动与振动峰

$$R_I = \frac{E_{I_1} - E_{0_1}}{E_{2_1} - E_{0_1}}$$

$$R_4 = \frac{E_{4_1} - E_{0_1}}{E_{2_1} - E_{0_1}}$$

$$R_6 = \frac{E_{6_1} - E_{0_1}}{E_{2_1} - E_{0_1}}$$

$$R_8 = \frac{E_{8_1} - E_{0_1}}{E_{2_1} - E_{0_1}}$$

vibrational mode:

$$E_I \sim I, R_4 \sim 2$$

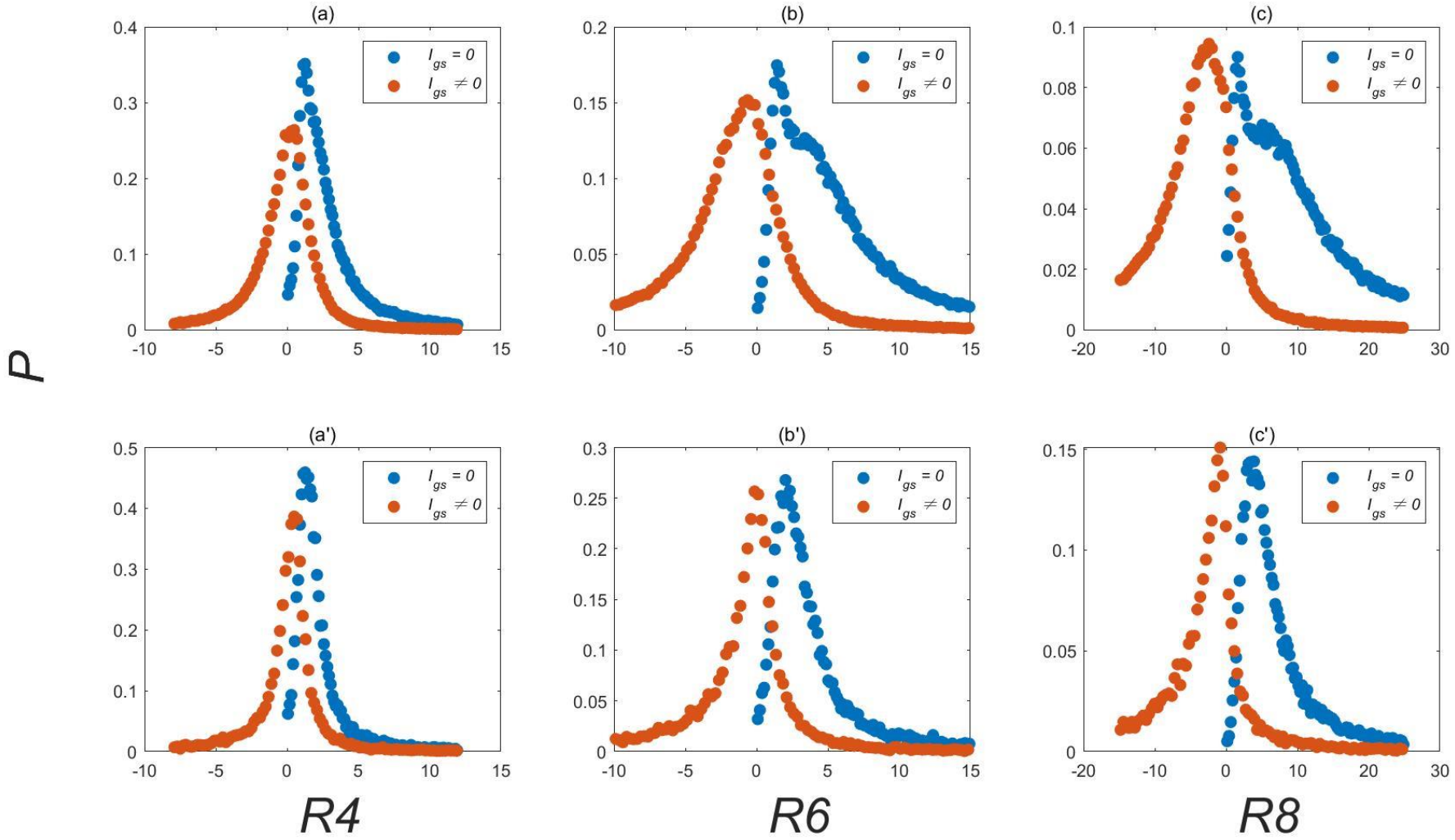
rotational mode:

$$E_I \sim I(I+1), R_4 \sim 3.33$$

转动与振动峰

sd-shell

pf-shell



转动与振动峰

$$R'_I = \frac{E_{I_1} - E_{0_1}}{E_{4_1} - E_{0_1}}$$

$$R'_6 = \frac{E_{6_1} - E_{0_1}}{E_{4_1} - E_{0_1}}$$

$$R'_8 = \frac{E_{8_1} - E_{0_1}}{E_{4_1} - E_{0_1}}$$

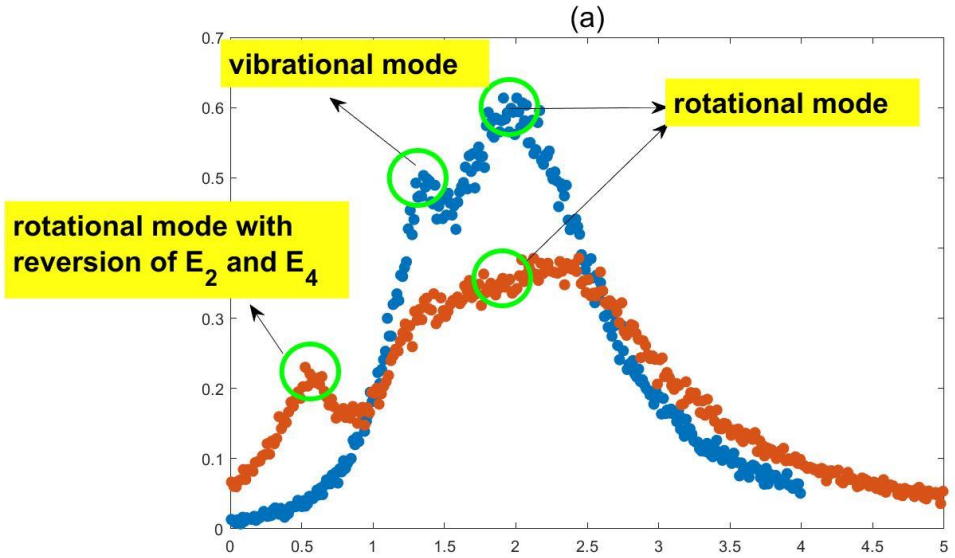
vibrational mode:

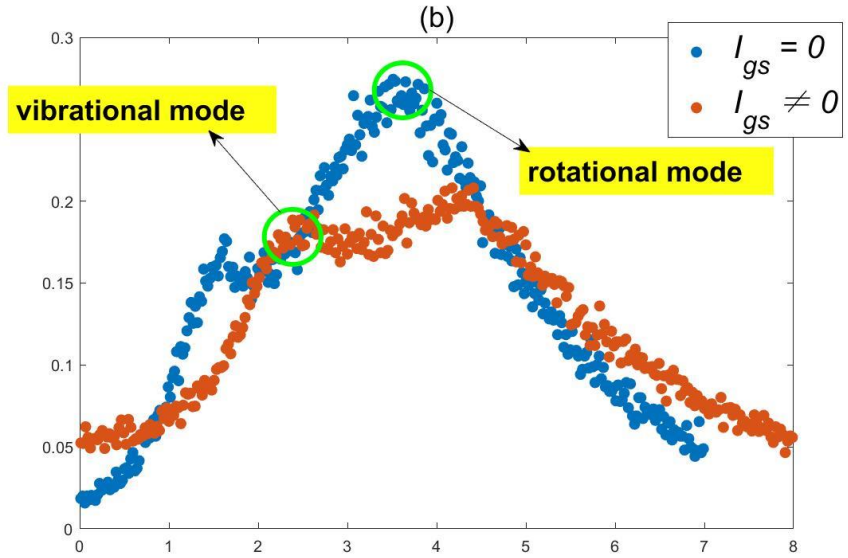
$$E_I \sim I, R'_6 \sim 1.5, R'_8 \sim 2$$

rotational mode:

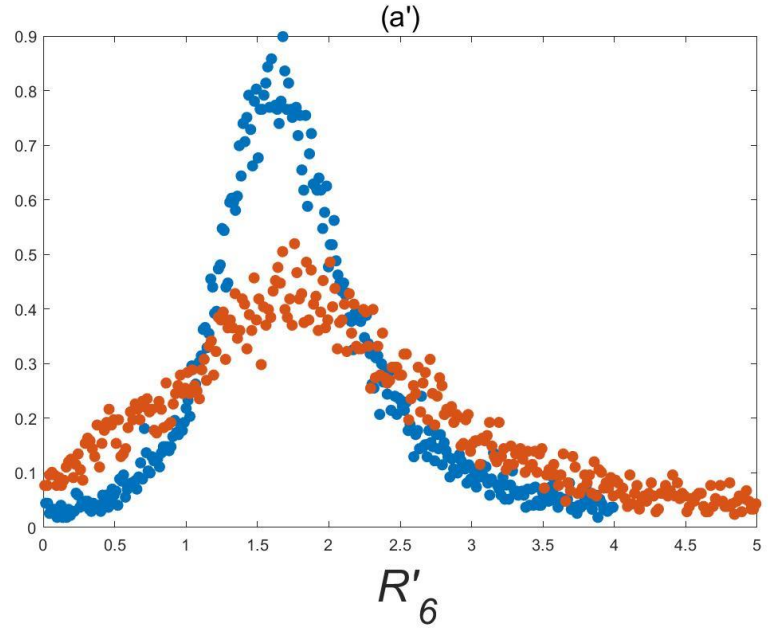
$$E_I \sim I(I + 1), R'_6 \sim 2.1, R'_8 \sim 3.6$$

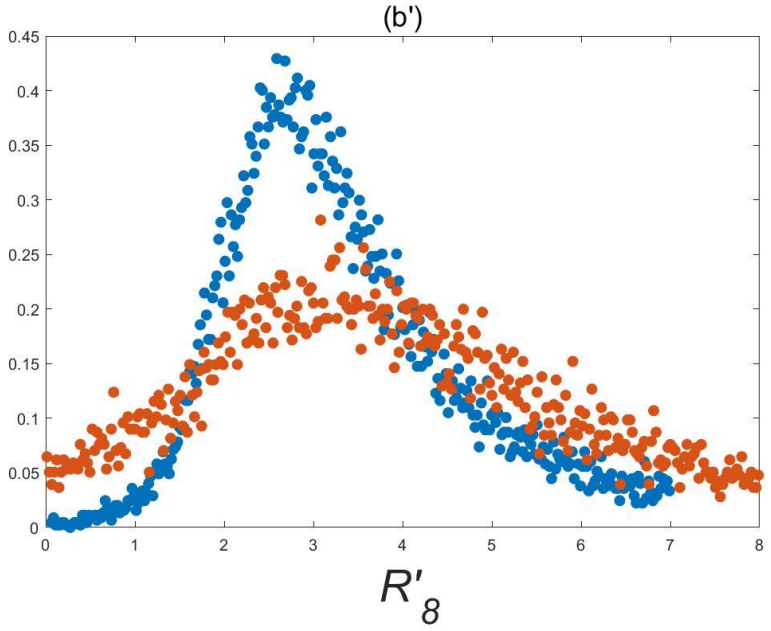
sd-shell





pf-shell





真实相互作用的随机扰动

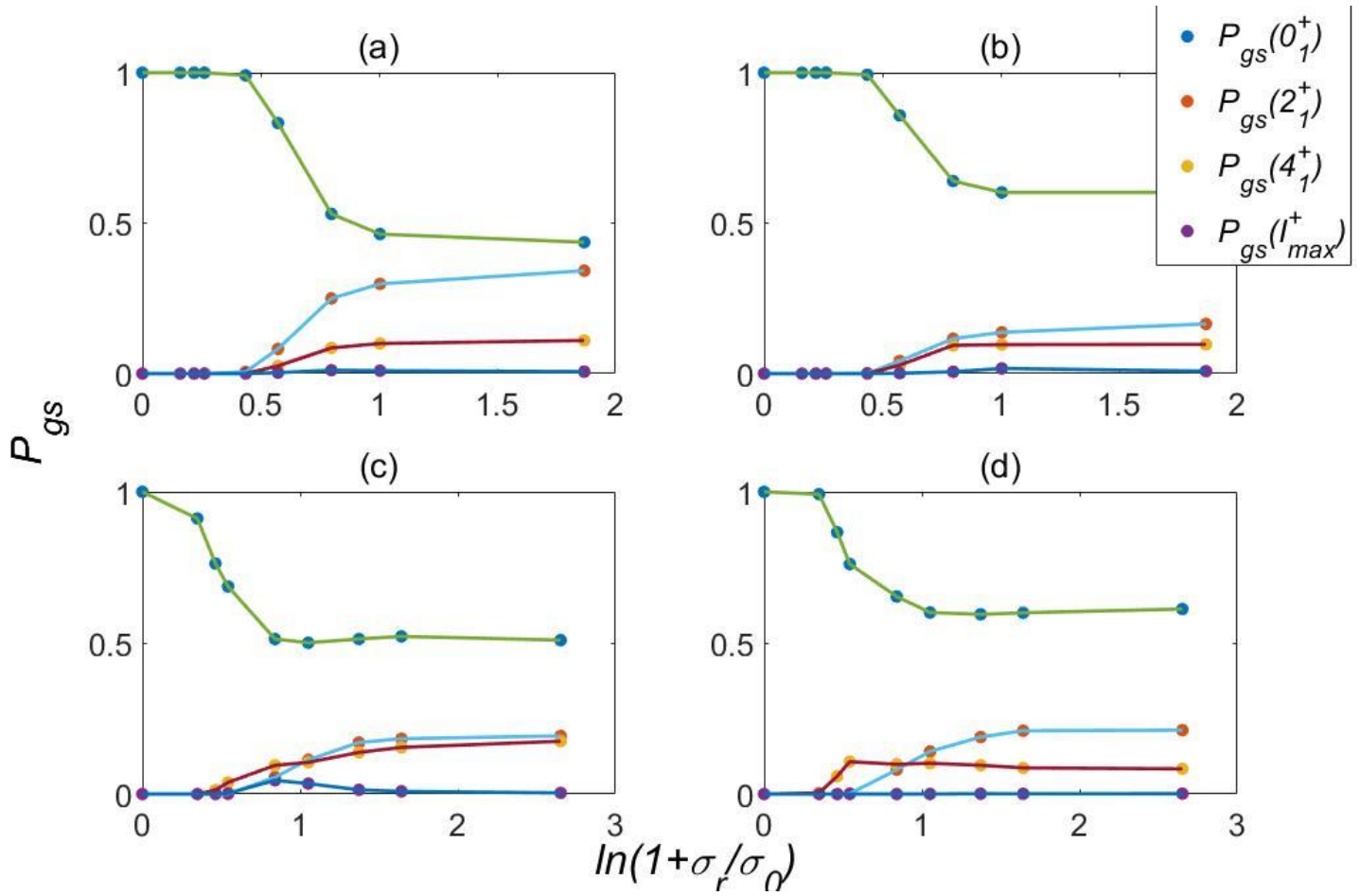
$$G_{JT}(j_1 j_2; j_3 j_4) = G_{JT}^{real}(j_1 j_2; j_3 j_4) + G_{JT}^{TBRE}(j_1 j_2; j_3 j_4)$$

$$\sigma^2 = \frac{1}{2}\sigma_r^2(1 + \delta_{j_1 j_2; j_3 j_4})$$

真实相互作用的随机扰动----基态0自旋几率

sd-shell

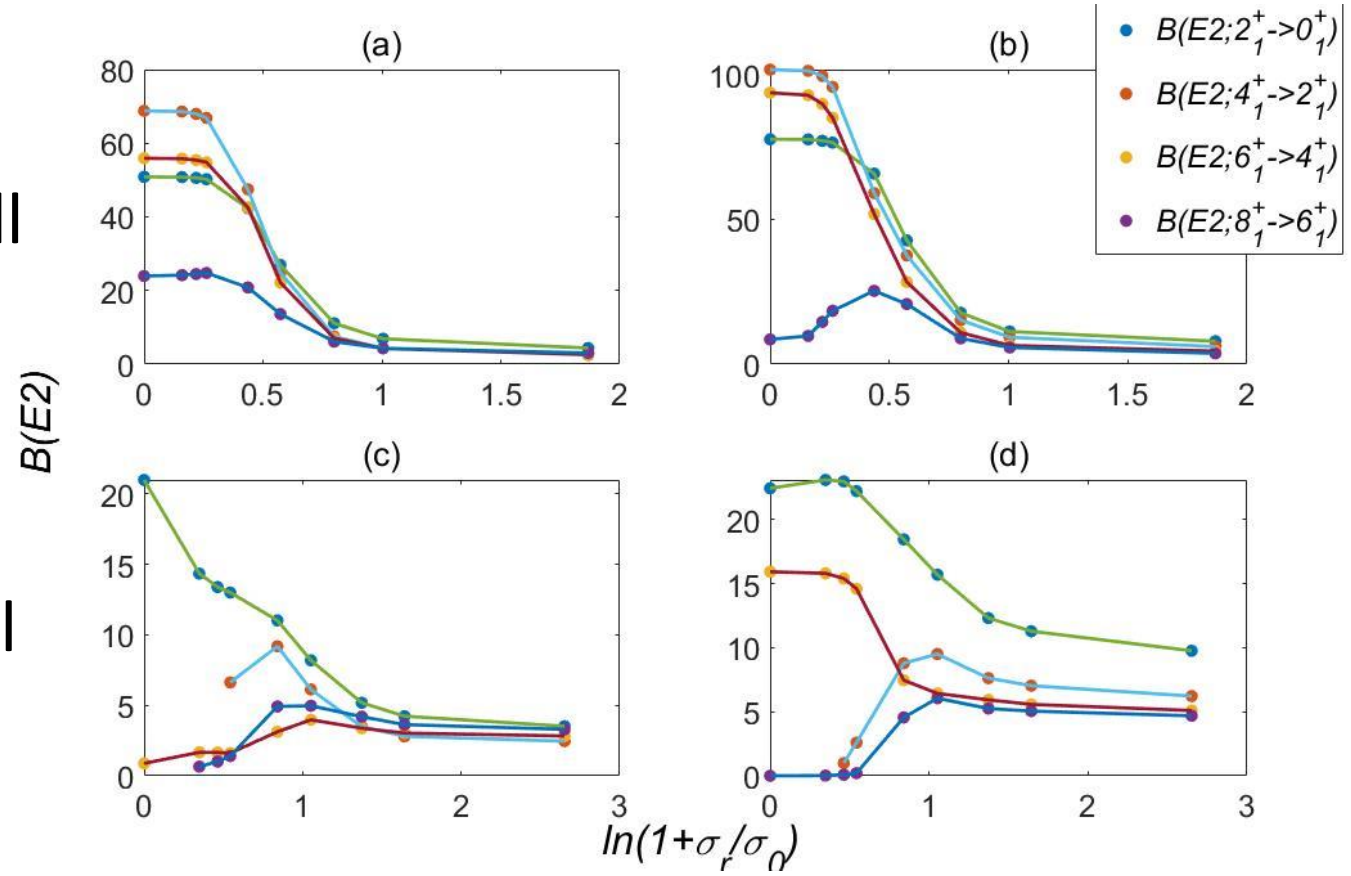
pf-shell



真实相互作用的随机扰动---BE2

sd-shell

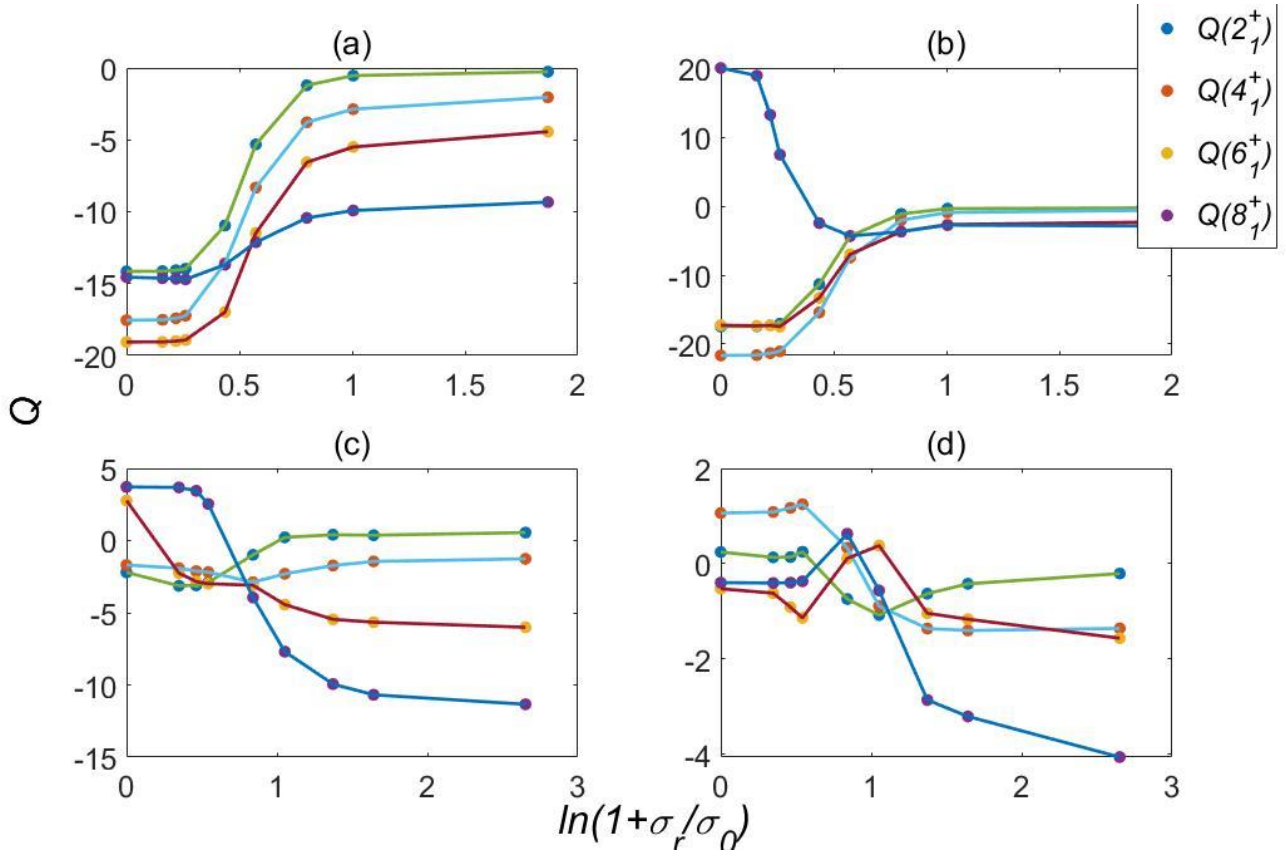
pf-shell



真实相互作用的随机扰动-----电四极矩

sd-shell

pf-shell



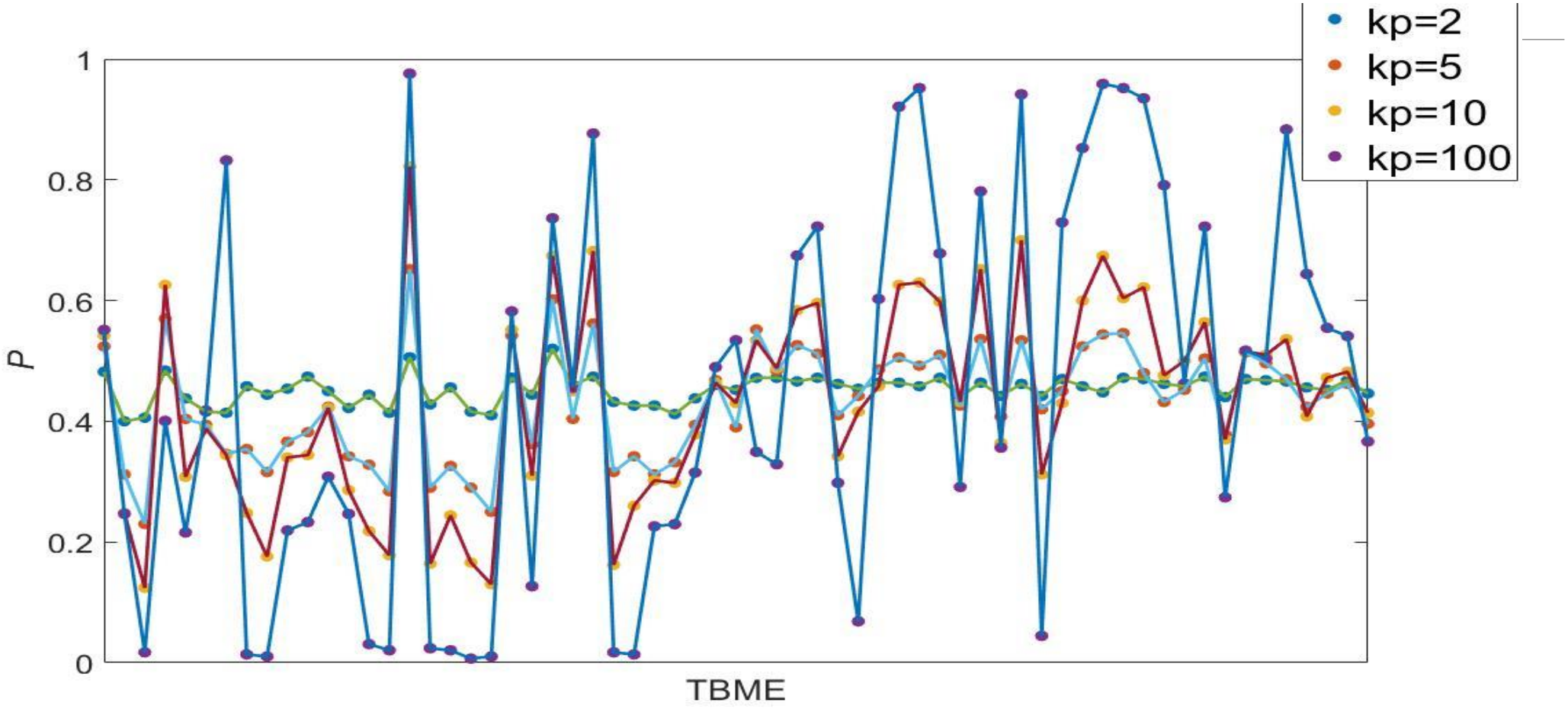
剩余两体矩阵元的对基态0自旋的贡献

$$\rho(G_{JT}(j_1j_2;j_3j_4)) = \frac{1}{\sqrt{2\pi}\sigma}\exp\left(-\frac{G_{JT}(j_1j_2;j_3j_4)^2}{2\sigma^2}\right)$$

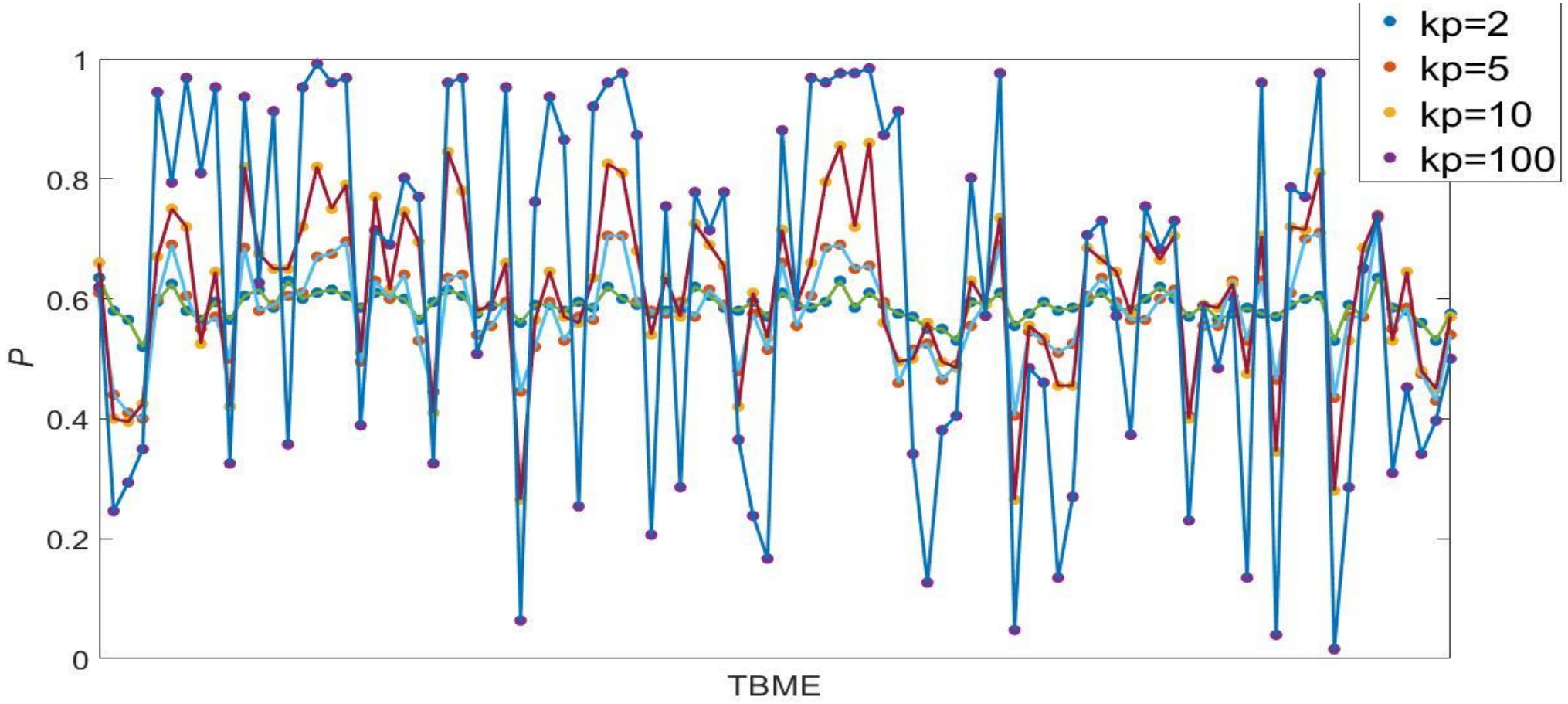
$$\sigma^2 = \frac{1}{2}k_p\sigma_r^2(1+\delta_{j_1j_2;j_3j_4})$$

one of the two-body matrix elements is enhance by a coefficient k_p

Cases for *sd*-shell



Cases for *pf*-shell



总结

- 我们研究了原子核在随机相互作用下基态非0自旋下的非转动集体行为，发现了yrast带能谱的能级期望值与$I(I+1)$的正相关性，与基态0自旋的结果一致
- 我们研究了原子核在真实相互作用下增加随机相互作用的扰动，通过研究基态0自旋几率和电磁跃迁的相变点，寻找真实相互作用和随机相互作用的临界点
- 我们研究了随机相互作用下基态0自旋占优的来源，通过加强每一项两体矩阵元获得其对基态0自旋几率的贡献

谢谢！