



Ground-state Properties and Decay Rates of Isotopic Chain of Molybdenum

Tuncay Bayram

Department of Physics, Faculty of Science, Karadeniz Technical University, Trabzon, Turkey

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Jameel-Un Nabi

University of Wah, Quaid Avenue, Wah Cantt 47040, Punjab, Pakistan

INTRODUCTION

- The production of energy in stars, the associated nucleosynthesis and supernova explosion dynamics are still investigated to deeper understanding how our universe works.
- It is the weak interaction mediated rates which dictate the terms and conditions for the process of nucleosynthesis and the dynamics of supernova explosions.
- The study of charge-changing transitions in stellar matter is one of the important inputs for core collapse simulation ([Hix et al. 2003](#); [Langanke et al. 2003](#)). The charge-changing transitions greatly effect the late evolutionary phases of massive stars. **EC**, **PC** and **β -decay** of nuclei in stellar core influence these transformations.
- Fermi and Gamow-Teller (GT) transitions govern both β -decay and EC rates. GT strength functions are required to calculate weak decay rates.

Hix, W.R., Messer, O.E.B., Mezzacappa, A., Liebendrfer, M., Sampaio, J., Langanke, K., Dean, D.J., Martinez-Pinedo, G.: Phys. Rev. Lett. 91, 201102 (2003)

Langanke, K., Martinez-Pinedo, G., Sampaio, J.M., Dean, D.J., Hix, W.R., Messer, O.E.B., Mezzacappa, A., Liebend Orfer, M., Th, J.H., Rampp, M.: Phys. Rev. Lett. 90, 241102 (2003)

- Previous simulation results show that weak rates on isotopes of Molybdenum (Mo) have a meaningful contribution during the development of phases of stars before they go supernova.
- The relative abundance coupled with the stellar weak rates on Mo isotopes may change the lepton-to-baryon content of the core material.
- The proton neutron quasi particle random phase approximation (**pn-QRPA**) is commonly used to perform calculation of stellar weak rates of heavy nuclei ([Nabi and Klapdor-Kleingrothaus 1999](#)).
- The relativistic mean field (**RMF**) model also is a successful model for obtaining various ground-state nuclear properties of finite nuclei not only on the stability line but also far away from stability. ([Ring 1996](#); [Bayram and Yilmaz 2013](#)).
- **RMF+ pn-QRPA** hybrid combinations have been performed to calculate half-lives and weak decay rates for Mo isotopic chain.
- Electron capture and β -decay rates have been calculated over an extensive range of temperature ($0.01 \times 10^9 K$ to $30 \times 10^9 K$) and density (10 to $10^{11} g/cm^3$).

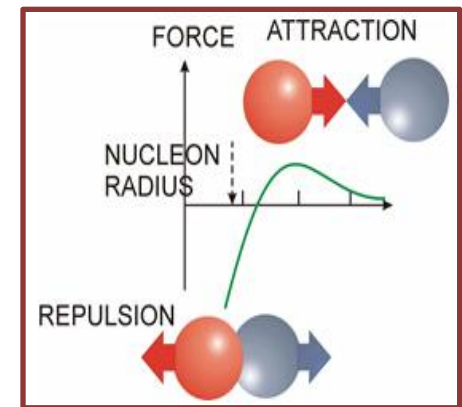
[Nabi, J.-U., Klapdor-Kleingrothaus, H.V.: At. Data Nucl. Data Tables 71, 149 \(1999\)](#)

[P. Ring, 1996 Prog. Theor. Phys. 37 193](#)

[T. Bayram and A. H. Yilmaz, 2013, Mod. Phys. Lett. A, 28, 1350068](#)

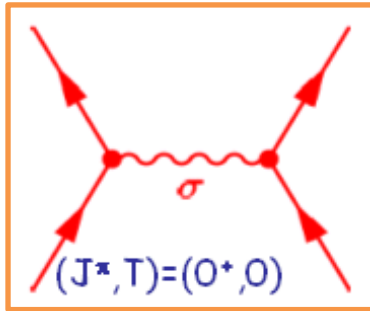
RMF Theory

- Nucleons are described as Dirac particles which interact via the exchange of various mesons and photons.
- These exchanges determine average potential where nucleons move independently as relativistic particles.
- The scalar σ and vector ω mesons are responsible for attractive and repulsive part of the interaction of nucleons, respectively.
- The isovector vector ρ -meson and photon are important for describing isospin-dependent effects and the electromagnetic interaction in nuclei, respectively.

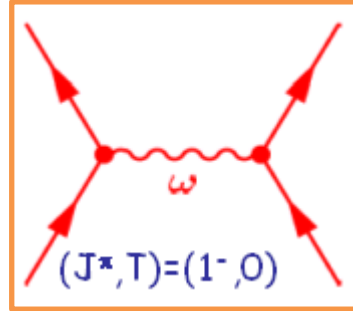


B.D. Serot and J. D. Walecka, 1986, *Adv. Nucl. Phys.* **16** 1
P. -G. Reinhard, 1989, *Rep. Prog. Phys.* **52** 439
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D. Vretenar D et. al., 2005, *Phys. Rep.* **409** 101
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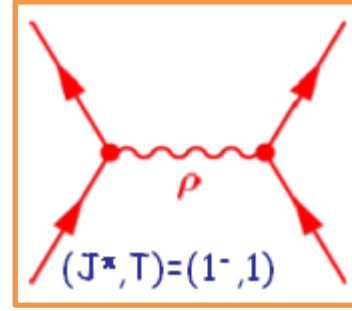
Walecka Model



Attractive s. field



Repulsive v. field



Iso-vector field

$$U(\sigma) = \frac{1}{2} m_\sigma^2 \sigma^2 + \frac{1}{3} g_3 \sigma^3 + \frac{1}{4} g_3 \sigma^4$$

$$\Omega^{\mu\nu} = \partial^\mu \omega^\nu - \partial^\nu \omega^\mu$$

$$\vec{R}^{\mu\nu} = \partial^\mu \vec{\rho}^\nu - \partial^\nu \vec{\rho}^\mu$$

$$F^{\mu\nu} = \partial^\mu A^\nu - \partial^\nu A^\mu$$

Free Dirac particle

Free meson fields

$$\mathcal{L} = \bar{\psi} (i\gamma^\mu \partial_\mu - M) \psi + \frac{1}{2} \partial^\mu \sigma \partial_\mu \sigma - U(\sigma) - g_\sigma \bar{\psi} \sigma \psi$$

$$- \frac{1}{4} \Omega^{\mu\nu} \Omega_{\mu\nu} + \frac{1}{2} m_\omega^2 \omega^\mu \omega_\mu - g_\omega \bar{\psi} \gamma^\mu \psi \omega_\mu$$

$$- \frac{1}{4} \vec{R}^{\mu\nu} \vec{R}_{\mu\nu} + \frac{1}{2} m_\rho^2 \vec{\rho}^\mu \vec{\rho}_\mu - g_\rho \bar{\psi} \gamma^\mu \vec{\tau} \psi \vec{\rho}_\mu$$

$$- \frac{1}{4} F^{\mu\nu} F_{\mu\nu} - e \bar{\psi} \gamma^\mu \frac{1-\tau_3}{2} A_\mu \psi$$

Interaction terms

Non-linear term

Free photon field

Euler-Lagrange eq.

$$\partial_\mu \left(\frac{\partial L}{\partial (\partial_\mu q_i)} \right) - \frac{\partial L}{\partial q_i} = 0$$

Dirac equation

$$\left\{ \gamma^\mu \left(i\partial_\mu + g_\omega \omega_\mu + g_\rho \vec{\tau} \vec{\rho}_\mu + e \frac{(1-\tau_3)}{2} A_\mu \right) + (M + g_\sigma \sigma) \right\} \psi_i = 0$$

Klein-Gordon equations for mesons

$$\left\{ \partial^\nu \partial_\nu + \partial_\sigma U(\sigma) \right\} \sigma = -g_\sigma \rho_s$$

$$\left\{ \partial^\nu \partial_\nu + m_\omega^2 \right\} \omega^\mu = g_\omega J^\mu$$

$$\left\{ \partial^\nu \partial_\nu + m_\rho^2 \right\} \vec{\rho}^\mu = g_\rho \vec{J}^\mu$$

$$\partial^\nu \partial_\nu A^\mu = e J_p^\mu$$

Densities for σ , ω , ρ mesons and photons.

$$\rho_s(x) = \sum_{i=1}^A \bar{\psi}_i(x) \psi_i(x)$$

$$J^\mu(x) = \sum_{i=1}^A \bar{\psi}_i(x) \gamma^\mu \psi_i(x)$$

$$\vec{J}^\mu(x) = \sum_{i=1}^A \bar{\psi}_i(x) \gamma^\mu \vec{\tau} \psi_i(x)$$

$$J_p^\mu(x) = \sum_{i=1}^A \bar{\psi}_i(x) \gamma^\mu \frac{(1-\tau_3)}{2} \psi_i(x)$$

These equations can be solved iteratively by considering spherical, axially deformed and triaxially deformed symmetric case.

T. Niksic et al., 2014, *Comput. Phys. Commun.* **185** 1808

pn-QRPA Model

Hamiltonian

$$H^{qrpa} = H^{sp} + V^{pairing} + V_{GT}^{pp} + V_{GT}^{ph}$$

Parameters

$\chi=64.6/A$, $\kappa=5.6/A$, Δ_n , Δ_p , Q values, NPP, β_2

$$\Delta_n = \Delta_p = 12/\sqrt{A}(\text{MeV})$$

The EC and β -decay rates of Mo isotopes transforming from i th parent state to the j th daughter state in stellar matter were determined by

$$\lambda_{ij}^{EC(\beta^-)} = \ln 2 \frac{f_{ij}^{EC(\beta^-)}(T, \rho, E_f)}{(ft)_{ij}} \rightarrow ft_{ij} = D/B_{ij}$$

$$D = 6143 \text{ s (Hardy and Towner)}$$

$$B_{ij} = (g_A/g_V)^2 B(GT)_{ij} + B(F)_{ij}$$

$$-1.2694 \text{ (Nakamura)}$$

The reduced GT ($\Delta J^\pi = 1^+$) transition probabilities

$$B(GT)_{ij} = \frac{1}{2J_i + 1} \left| \langle j \| \sum_l \tau_{\pm}^l \vec{\sigma}^l \| i \rangle \right|^2$$

The reduced Fermi ($\Delta J^\pi = 0^+$) transition probabilities

$$B(F)_{ij} = \frac{1}{2J_i + 1} \left| \langle j \| \sum_l \tau_{\pm}^l \| i \rangle \right|^2$$

$$f_{ij}^{\beta^-} = \int_1^{w_m} w \sqrt{w^2 - 1} (w_m - w)^2 F(+Z, w) (1 - Z_-) dw$$

$$f_{ij}^{EC} = \int_{w_m}^{\infty} w \sqrt{w^2 - 1} (w_m + w)^2 F(+Z, w) Z_- dw$$

$$Z_- = \left[\exp\left(\frac{w - 1 - E_f}{kT}\right) + 1 \right]^{-1}$$

$$\lambda^{EC(\beta^-)} = \sum_{ij} P_i \lambda_{ij}^{EC(\beta^-)}$$

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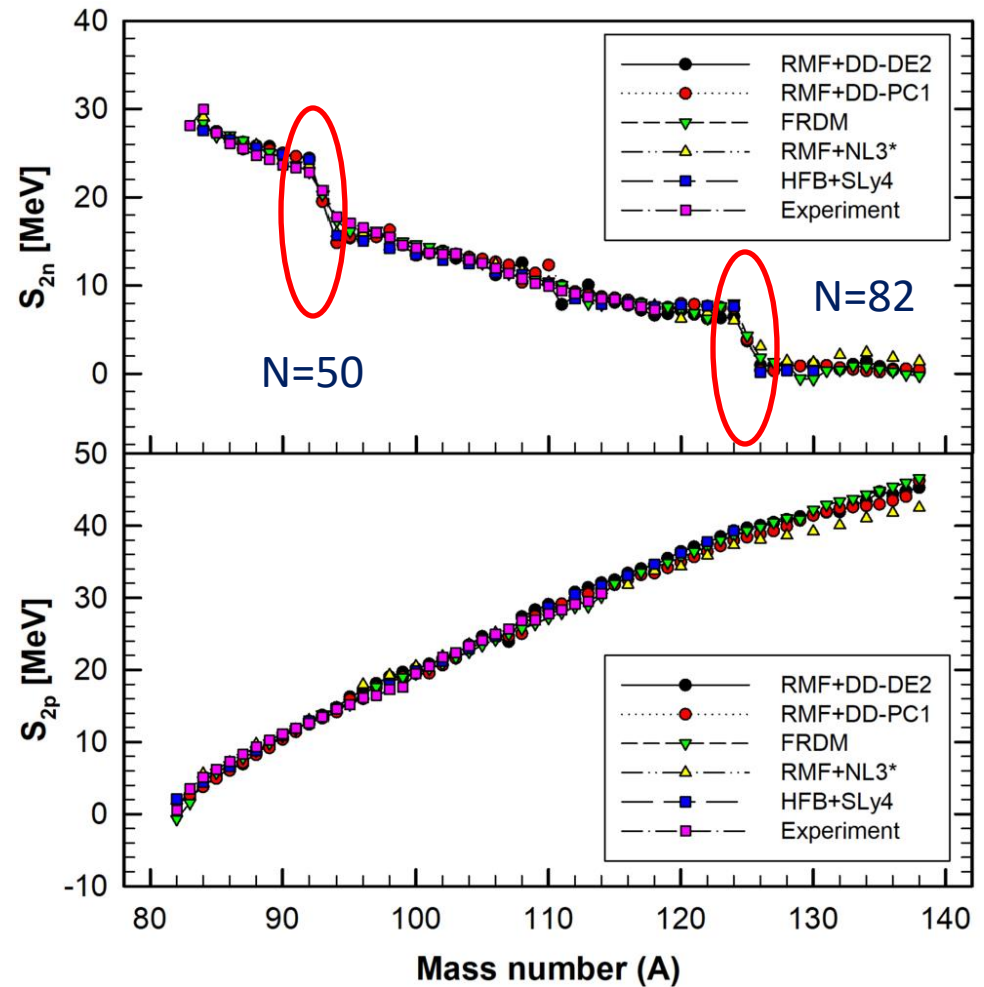
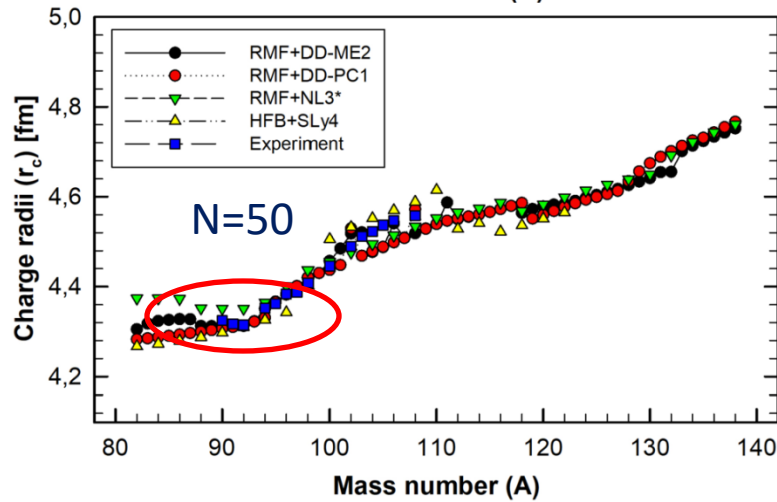
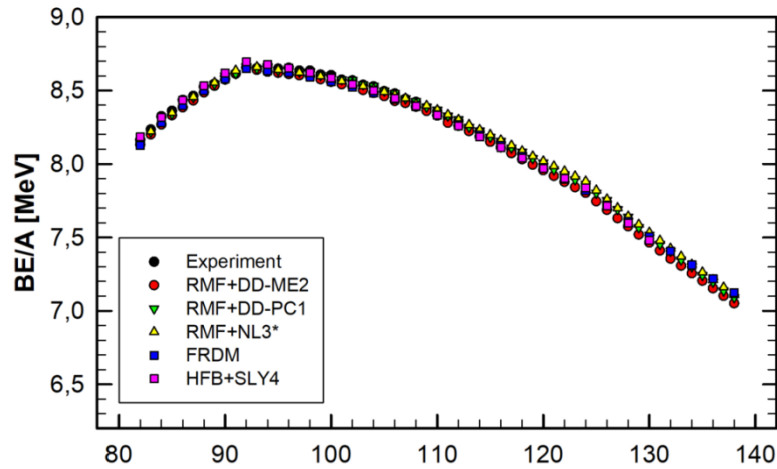
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Dr. Tuncay Bayram

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RESULTS



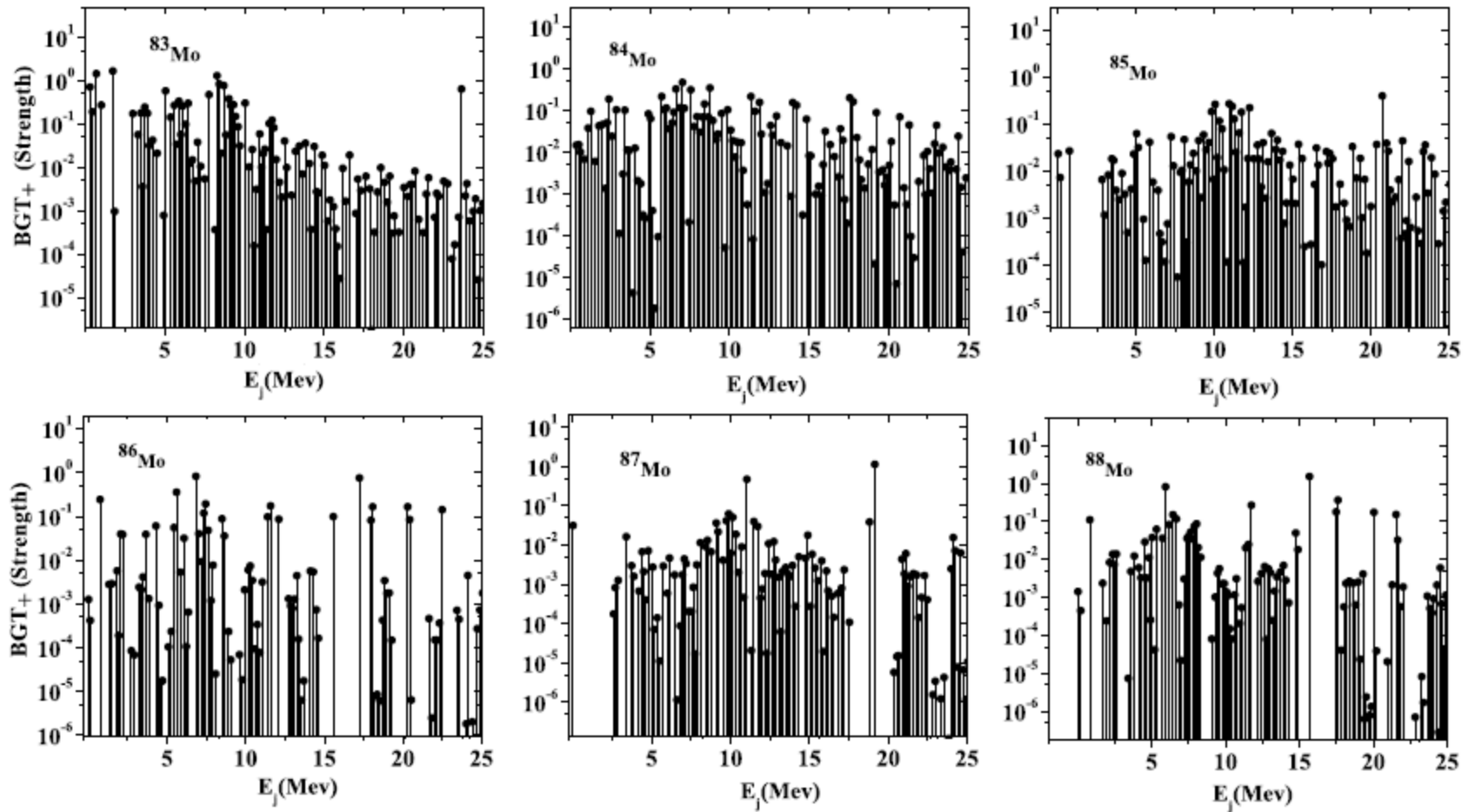
The calculated ground-state properties of Mo isotopes using RMF model with DD-ME2 interaction

Isotope	BE/A [MeV]	S_n [MeV]	S_p [MeV]	S_{2n} [MeV]	S_{2p} [MeV]	r_c [fm]	β_2	Q_T [barn]
^{82}Mo	666.734	–	–	0.262	2.300	4.305	0.000	–0.749
^{83}Mo	680.680	13.946	–	0.882	3.772	4.318	–0.001	–1.022
^{84}Mo	694.550	13.870	27.816	1.725	5.202	4.324	–0.220	–386.224
^{85}Mo	708.131	13.581	27.451	2.523	6.286	4.326	–0.219	–391.789
^{86}Mo	721.162	13.031	26.612	2.984	6.944	4.328	–0.216	–124.423
^{87}Mo	733.590	12.428	25.459	3.036	8.544	4.327	–0.206	–382.741
^{88}Mo	746.794	13.204	25.632	–2.630	4.507	4.313	0.089	168.503
^{89}Mo	759.356	12.562	25.766	4.577	10.689	4.312	0.072	139.889
^{90}Mo	771.713	12.357	24.919	5.060	11.794	4.310	0.002	4.520
^{91}Mo	783.996	12.283	24.640	5.616	12.903	4.311	0.000	0.785
^{92}Mo	796.152	12.156	24.439	6.188	13.747	4.312	0.001	1.590
^{93}Mo	803.533	7.381	19.537	6.604	14.764	4.323	0.001	2.778
^{94}Mo	811.005	7.473	14.853	7.198	16.265	4.351	0.141	298.515
^{95}Mo	818.910	7.905	15.377	7.912	17.123	4.367	0.167	359.236
^{96}Mo	826.751	7.842	15.746	8.346	18.149	4.383	0.193	424.506
^{97}Mo	834.582	7.831	15.672	8.757	19.053	4.401	0.219	489.413
^{98}Mo	842.419	7.837	15.668	9.167	19.675	4.420	0.246	557.900
^{99}Mo	849.145	6.726	14.563	9.558	20.173	4.430	0.247	570.316
^{100}Mo	855.849	6.704	13.430	9.716	20.839	4.457	0.305	715.077
^{101}Mo	862.776	6.927	13.630	10.041	21.524	4.485	0.355	848.025
^{102}Mo	869.713	6.937	13.864	10.407	22.269	4.518	0.408	989.265
^{103}Mo	875.853	6.140	13.078	10.783	23.475	4.521	0.392	967.161
^{104}Mo	882.254	6.400	12.541	11.465	24.635	4.477	–0.221	–553.322

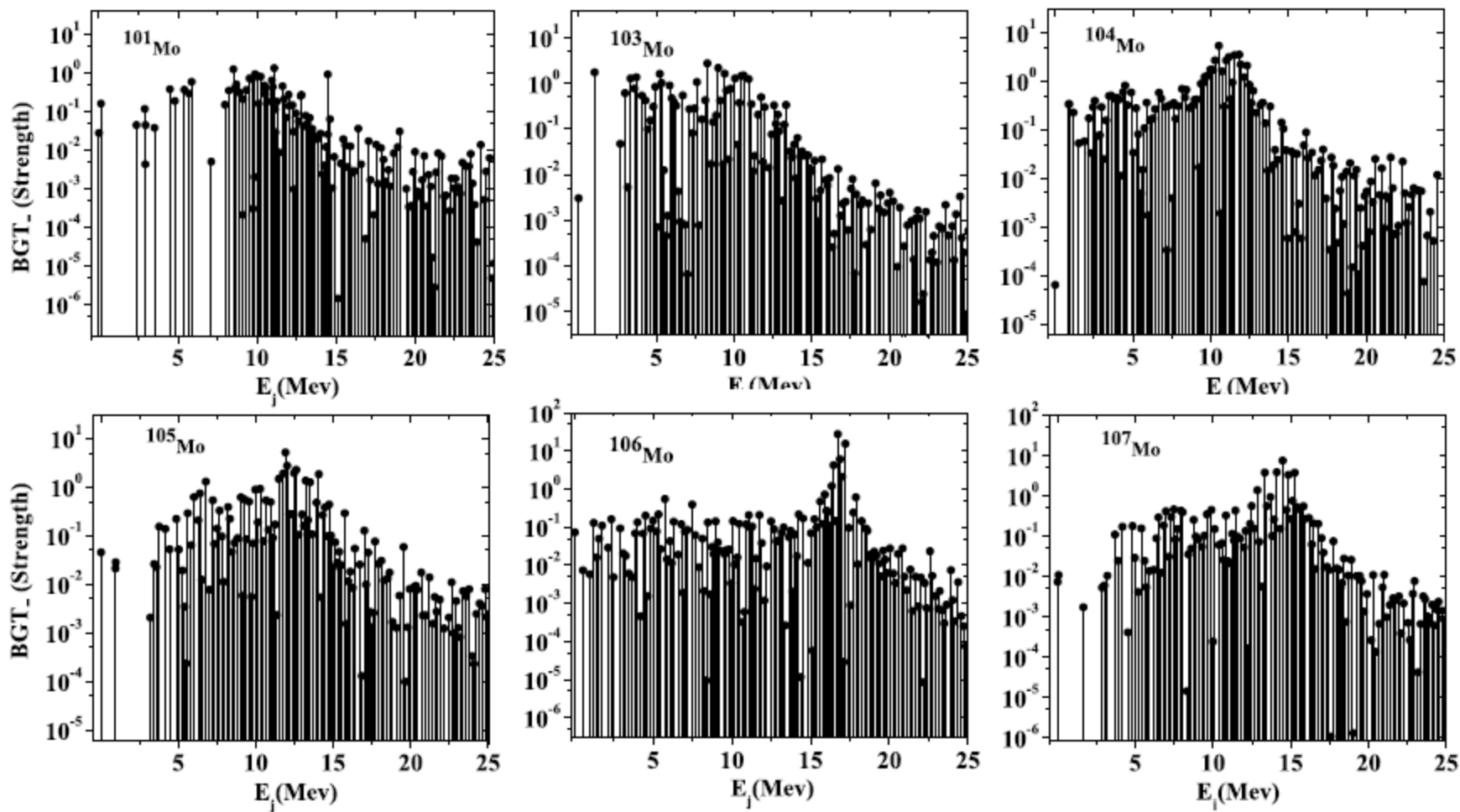
Supplementary files can be requested from authors.

Isotope	BE/A [MeV]	S_n [MeV]	S_p [MeV]	S_{2n} [MeV]	S_{2p} [MeV]	r_c [fm]	β_2	Q_T [barn]
¹⁰² Mo	871.813	6.904	13.917	10.067	20.676	4.529	0.413	10.028
¹⁰³ Mo	878.462	6.649	13.553	10.636	21.637	4.469	-0.230	-5.677
¹⁰⁴ Mo	885.030	6.568	13.217	11.078	22.742	4.479	-0.231	-5.792
¹⁰⁵ Mo	891.452	6.423	12.990	11.517	23.870	4.488	-0.232	-5.915
¹⁰⁶ Mo	897.712	6.260	12.683	17.668	24.837	4.498	-0.233	-6.040
¹⁰⁷ Mo	903.780	6.068	12.328	12.175	32.639	4.508	-0.234	-6.159
¹⁰⁸ Mo	908.079	4.299	10.367	11.273	25.019	4.572	0.374	9.997
¹⁰⁹ Mo	915.171	7.091	11.390	13.253	27.436	4.529	-0.238	-6.455
¹¹⁰ Mo	920.388	5.217	12.308	13.699	28.298	4.539	-0.240	-6.615
¹¹¹ Mo	925.163	4.776	9.993	14.112	29.141	4.546	-0.235	-6.563
¹¹² Mo	929.693	4.530	9.306	14.481	29.882	4.551	-0.224	-6.340
¹¹³ Mo	934.109	4.416	8.946	14.814	30.532	4.556	-0.210	-6.048
¹¹⁴ Mo	938.449	4.339	8.756	15.140	31.161	4.561	-0.197	-5.751
¹¹⁵ Mo	942.700	4.251	8.591	15.479	31.826	4.566	-0.185	-5.494
¹¹⁶ Mo	946.805	4.105	8.357	15.844	32.547	4.573	-0.177	-5.320
¹¹⁷ Mo	950.668	3.863	7.968	16.223	33.199	4.580	-0.171	-5.231
¹¹⁸ Mo	954.243	3.575	7.438	16.480	33.430	4.586	-0.166	-5.151
¹¹⁹ Mo	958.225	3.982	7.557	16.800	34.148	4.551	-0.012	-0.364
¹²⁰ Mo	962.191	3.966	7.948	17.182	34.922	4.560	-0.009	-0.271
¹²¹ Mo	966.079	3.888	7.854	17.561	35.691	4.568	-0.005	-0.169
¹²² Mo	969.872	3.793	7.681	17.918	36.434	4.577	0.000	0.002
¹²³ Mo	973.622	3.750	7.543	18.306	37.205	4.586	0.000	-0.017
¹²⁴ Mo	977.291	3.669	7.419	18.687	37.955	4.593	0.000	-0.014
¹²⁵ Mo	977.505	0.214	3.883	18.894	38.402	4.600	0.004	0.133
¹²⁶ Mo	977.686	0.181	0.395	19.104	38.835	4.606	0.012	0.411
¹²⁷ Mo	977.846	0.160	0.341	19.327	39.273	4.613	0.032	1.121
¹²⁸ Mo	978.189	0.343	0.503	19.771	39.913	4.635	0.114	4.050
¹²⁹ Mo	978.717	0.528	0.871	20.242	40.747	4.656	0.153	5.483
¹³⁰ Mo	979.261	0.544	1.072	20.571	41.410	4.674	0.178	6.456
¹³¹ Mo	979.673	0.412	0.956	20.845	41.946	4.689	0.192	7.058
¹³² Mo	979.962	0.289	0.701	21.096	42.403	4.701	0.201	0.002
¹³³ Mo	980.165	0.203	0.491	21.337	42.596	4.713	0.208	7.847

Supplementary files can be requested from authors.



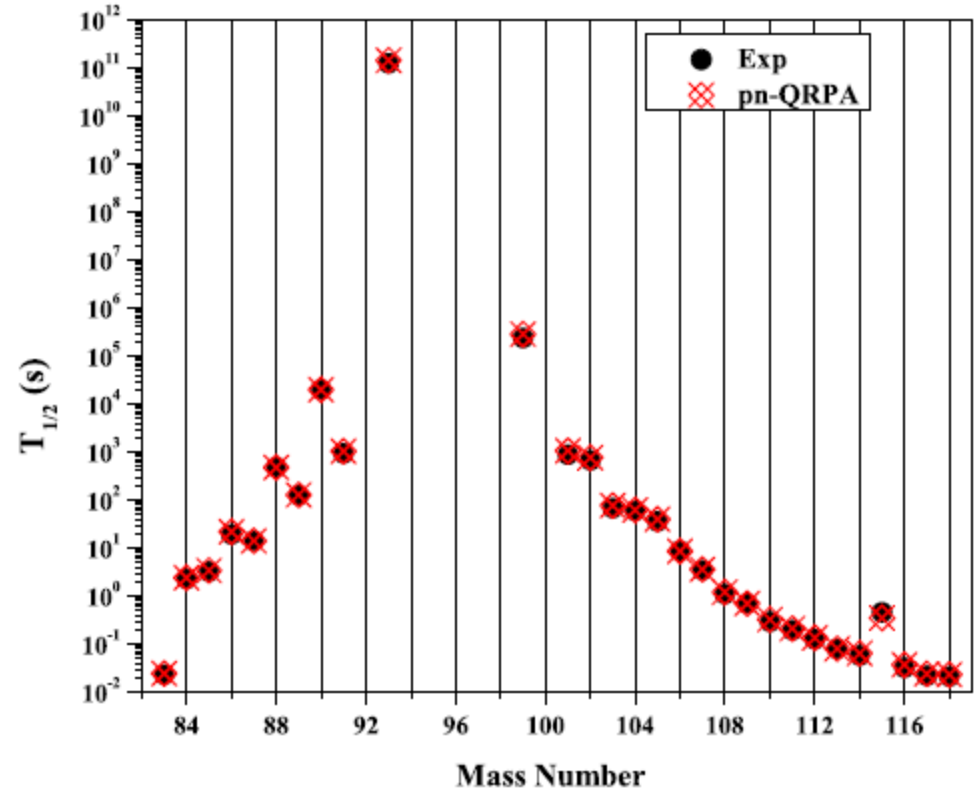
The pn-QRPA calculated GT strength distributions of 83–88Mo in daughter nuclei in the EC direction



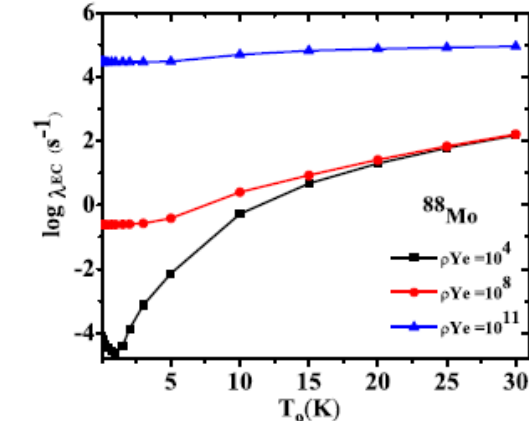
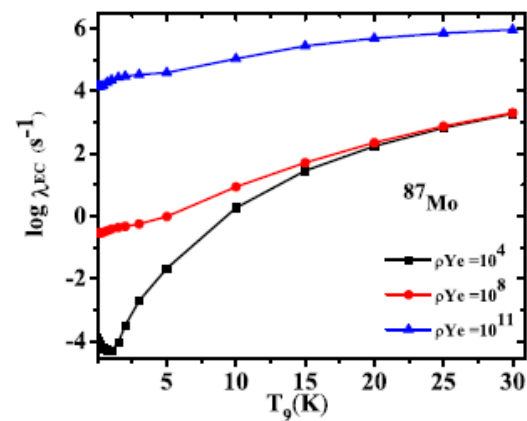
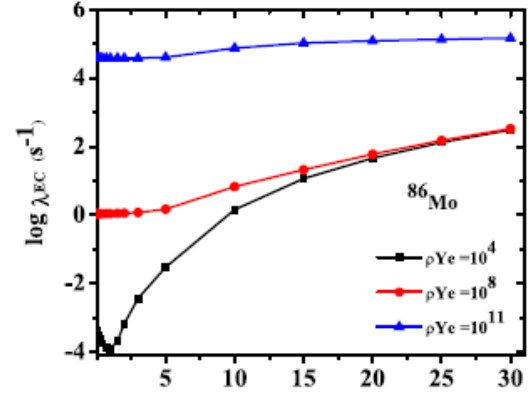
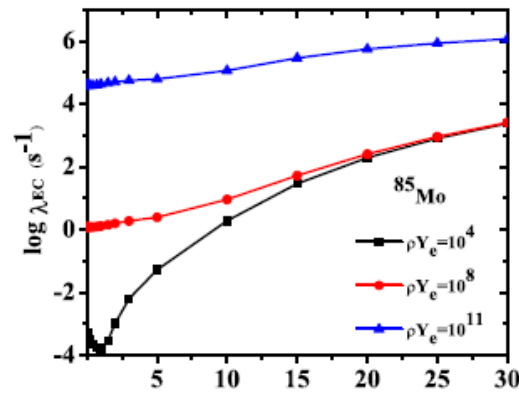
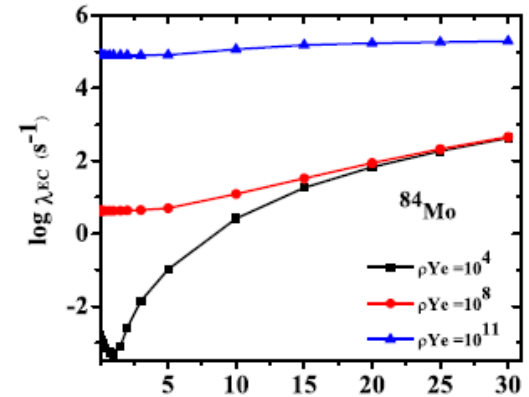
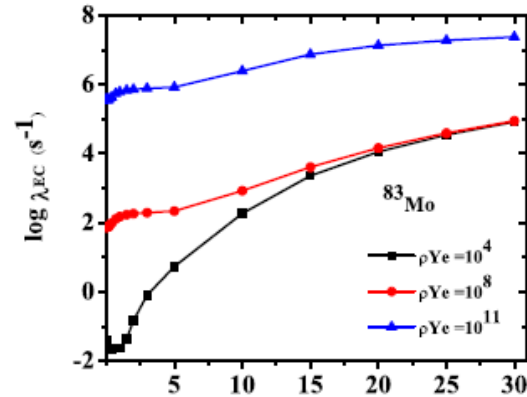
The pn-QRPA calculated GT strength distributions of ¹⁰¹Mo and ¹⁰³–¹⁰⁷Mo in daughter nuclei in the β -decay direction

Nuclei	\bar{E}_+	\bar{E}_-	Nuclei	\bar{E}_+	\bar{E}_-
^{82}Mo	1.58	4.48	^{112}Mo	3.24	13.6
^{83}Mo	4.64	4.23	^{113}Mo	5.85	14.5
^{84}Mo	3.50	3.39	^{114}Mo	9.90	21.2
^{85}Mo	2.87	5.31	^{115}Mo	12.0	24.9
^{86}Mo	3.13	3.59	^{116}Mo	4.12	20.3
^{87}Mo	3.98	6.87	^{117}Mo	5.23	14.6
^{88}Mo	2.32	3.38	^{118}Mo	10.8	7.14
^{89}Mo	3.51	6.26	^{119}Mo	12.8	9.06
^{90}Mo	2.01	3.44	^{120}Mo	11.4	7.59
^{91}Mo	4.56	3.06	^{121}Mo	13.2	9.18
^{92}Mo	9.21	15.1	^{122}Mo	14.2	10.9
^{93}Mo	15.1	16.4	^{123}Mo	15.3	11.0
^{94}Mo	8.38	18.0	^{124}Mo	14.3	13.2
^{96}Mo	7.07	20.6	^{125}Mo	17.5	12.1
^{98}Mo	5.84	16.0	^{126}Mo	12.6	8.73
^{99}Mo	22.5	21.9	^{127}Mo	15.5	12.1
^{100}Mo	4.93	19.3	^{128}Mo	13.2	9.31
^{101}Mo	8.67	9.93	^{129}Mo	15.7	13.2
^{102}Mo	4.39	5.64	^{130}Mo	14.9	4.95
^{103}Mo	5.21	7.60	^{131}Mo	17.1	11.7
^{104}Mo	2.76	9.77	^{132}Mo	19.0	10.3
^{105}Mo	4.32	11.4	^{133}Mo	15.5	11.1
^{106}Mo	1.24	16.1	^{134}Mo	13.9	9.36
^{107}Mo	2.59	13.4	^{135}Mo	15.9	11.4
^{108}Mo	2.58	17.3	^{136}Mo	13.8	9.42
^{109}Mo	1.41	18.9	^{137}Mo	8.56	8.77
^{110}Mo	2.24	10.7	^{138}Mo	14.3	9.66
^{111}Mo	4.37	10.2	—	—	—

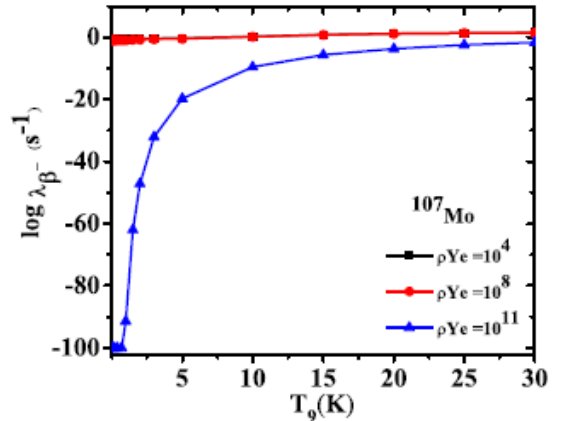
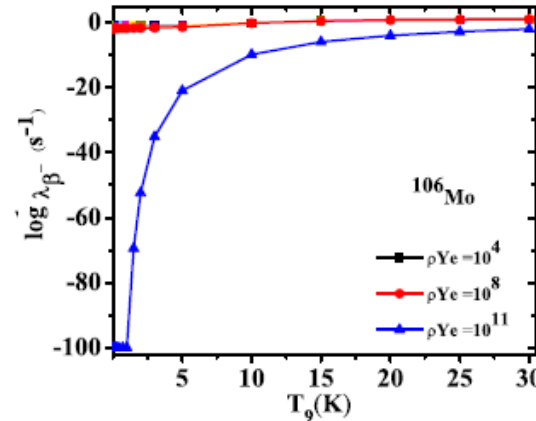
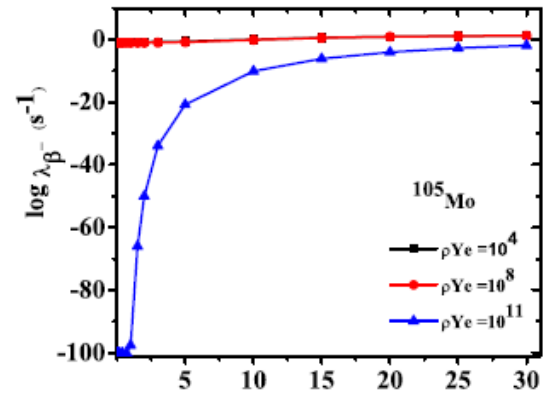
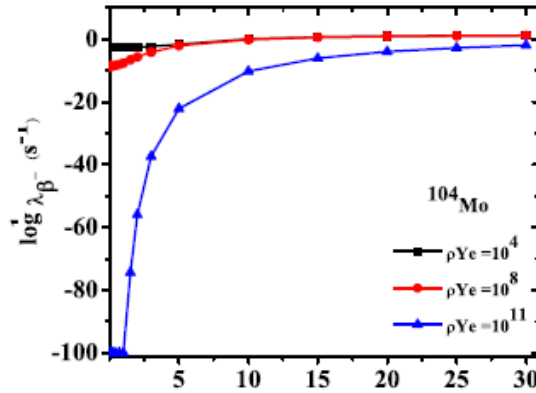
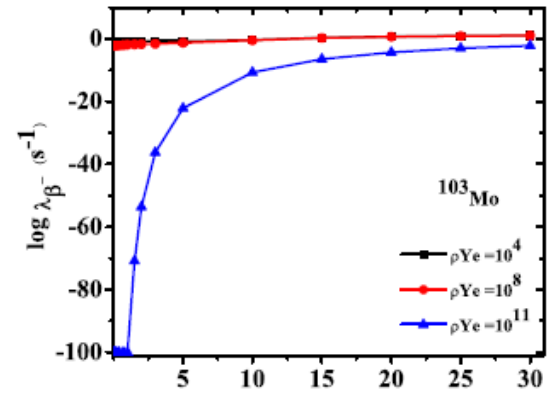
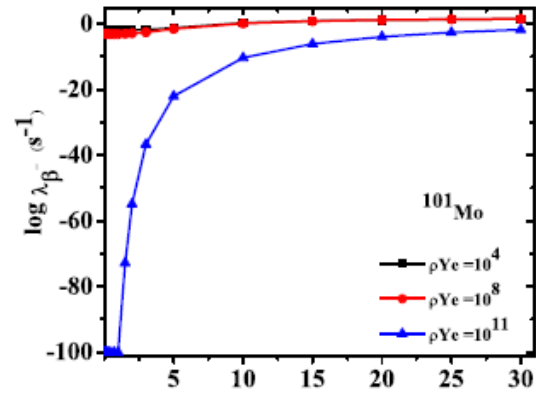
The pn-QRPA calculated centroid of GT strength distributions of Mo isotopes along EC (\bar{E}_+) and β -decay (\bar{E}_-) directions



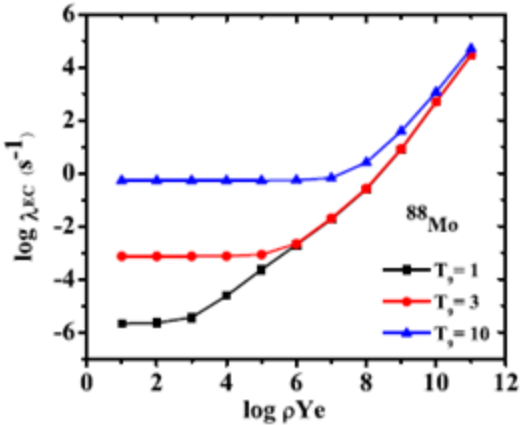
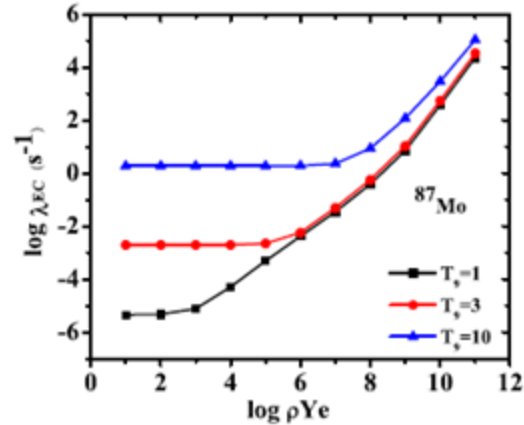
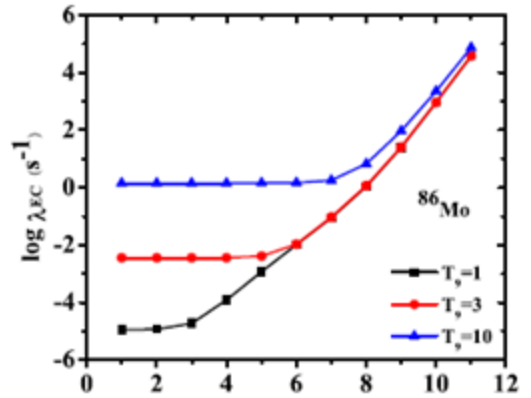
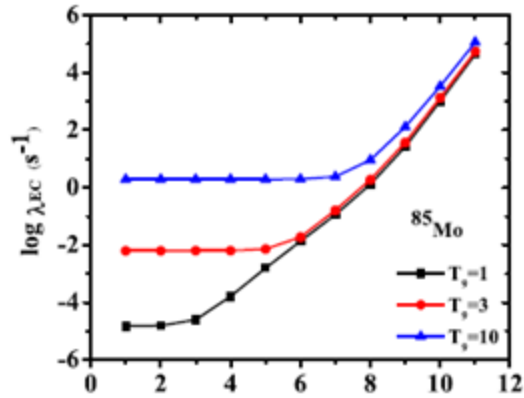
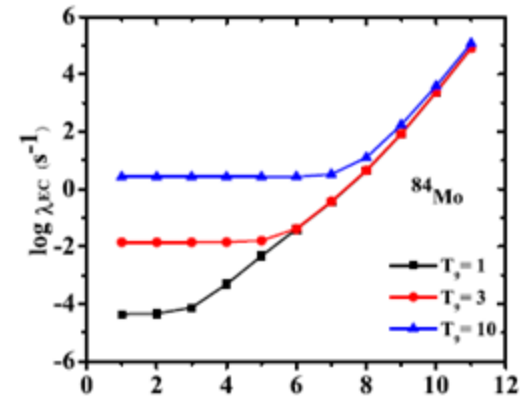
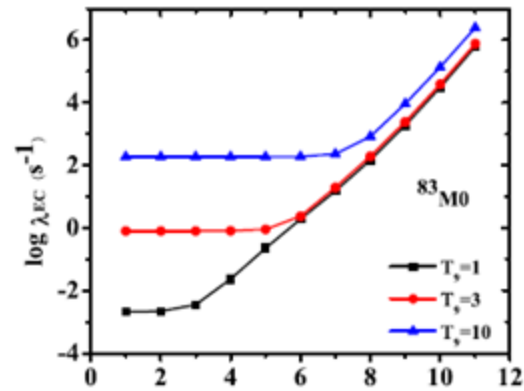
The pn-QRPA calculated EC rates on $^{83-88}\text{Mo}$ at selected density as a function of stellar temperature. The density in legend is represented by ρY_e having units of g/cm^3 . T_9 is the core temperature in units of 10^9 K. The EC rates are given in log (to base 10) scale having units of s^{-1}



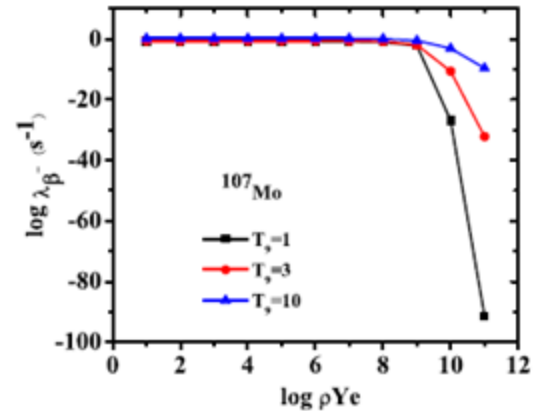
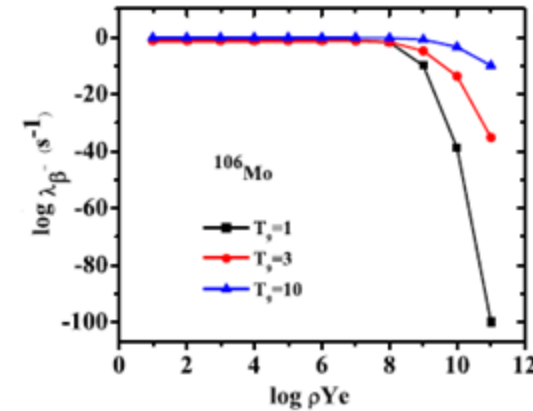
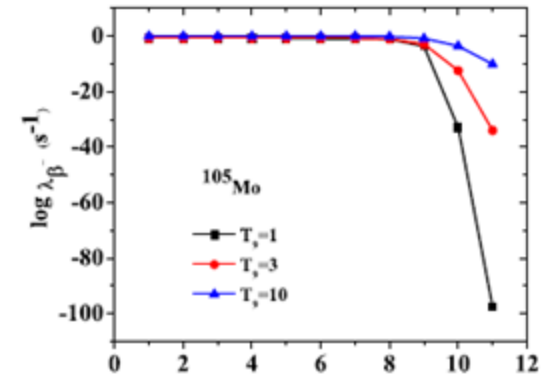
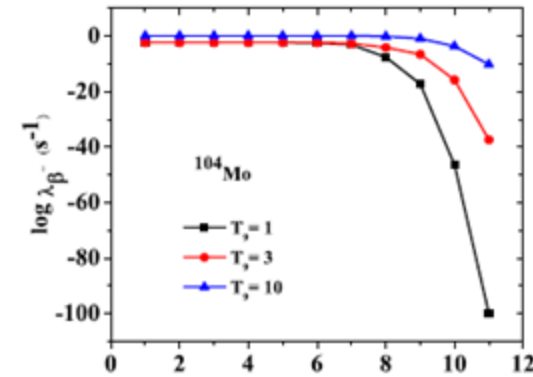
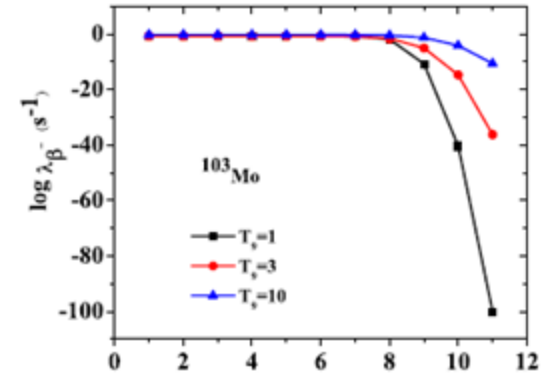
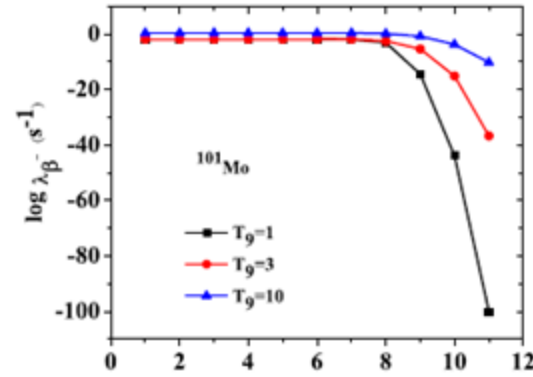
The pn-QRPA calculated β -decay rates on ^{101}Mo and $^{103-107}\text{Mo}$ at selected density as a function of stellar temperature. The density in legend is represented by ρY_e having units of g/cm^3 . T_9 is the core temperature in units of 10^9 K. The β -decay rates are given in log (to base 10) scale having units of s^{-1}



The pn-QRPA calculated
EC rates on $^{83-88}\text{Mo}$ at selected
temperature as a function of
stellar density.



The pn-QRPA
calculated β -decay rates on
 ^{101}Mo and $^{103-107}\text{Mo}$ at
selected temperature as a
function of stellar density.



The pn-QRPA calculated EC and β -decay rates of Mo isotopes at fixed density of 10^7 g/cm^3 as a function of core temperature. The decay rates are tabulated in log to base 10 scale in units of s^{-1}

Nuclei	ρY_e	T_9	EC	β -decay	Nuclei	ρY_e	T_9	EC	β -decay
^{82}Mo	10^7	1.00×10^9	-4.86×10^{-1}	$< -1.00 \times 10^2$	^{112}Mo	10^7	1.00×10^9	-6.39×10^1	6.62×10^{-1}
	10^7	10.0×10^9	6.57×10^{-1}	$< -1.00 \times 10^2$		10^7	10.0×10^9	-3.89×10^0	1.19×10^0
	10^7	30.0×10^9	3.23×10^0	$< -1.00 \times 10^2$		10^7	30.0×10^9	2.38×10^0	2.01×10^0
^{83}Mo	10^7	1.00×10^9	1.18×10^0	$< -1.00 \times 10^2$	^{113}Mo	10^7	1.00×10^9	-5.87×10^1	9.58×10^{-1}
	10^7	10.0×10^9	2.36×10^0	$< -1.00 \times 10^2$		10^7	10.0×10^9	-3.89×10^0	1.19×10^0
	10^7	30.0×10^9	4.92×10^0	$< -1.00 \times 10^2$		10^7	30×10^9	2.86×10^0	2.5×10^0
^{84}Mo	10^7	1.00×10^9	-4.60×10^{-1}	$< -1.00 \times 10^2$	^{114}Mo	10^7	1.00×10^9	-7.19×10^1	1.04×10^0
	10^7	10.0×10^9	5.11×10^{-1}	$< -1.00 \times 10^2$		10^7	10.0×10^9	-4.23×10^0	1.46×10^0
	10^7	30.0×10^9	2.63×10^0	$< -1.00 \times 10^2$		10^7	30.0×10^9	2.48×10^0	2.18×10^0
^{85}Mo	10^7	1.00×10^9	-9.46×10^{-1}	$< -1.00 \times 10^2$	^{115}Mo	10^7	1.00×10^9	-6.50×10^1	8.58×10^{-1}
	10^7	10.0×10^9	3.76×10^{-1}	$< -1.00 \times 10^2$		10^7	10.0×10^9	-3.59×10^0	1.36×10^0
	10^7	30.0×10^9	3.38×10^0	$< -1.00 \times 10^2$		10^7	30.0×10^9	2.84×10^0	2.23×10^0
^{86}Mo	10^7	1.00×10^9	-1.06×10^0	$< -1.00 \times 10^2$	^{116}Mo	10^7	1.00×10^9	-7.66×10^1	1.50×10^0
	10^7	10.0×10^9	2.47×10^{-1}	$< -1.00 \times 10^2$		10^7	10.0×10^9	-4.80×10^0	2.00×10^0
	10^7	30.0×10^9	2.49×10^0	$< -1.00 \times 10^2$		10^7	30.0×10^9	2.20×10^0	2.68×10^0
^{87}Mo	10^7	1.00×10^9	-1.46×10^0	$< -1.00 \times 10^2$	^{117}Mo	10^7	1.00×10^9	-6.95×10^1	2.53×10^{-1}
	10^7	10.0×10^9	3.61×10^{-1}	$< -1.00 \times 10^2$		10^7	10.0×10^9	-3.90×10^0	8.65×10^{-1}
	10^7	30.0×10^9	3.28×10^0	$< -1.00 \times 10^2$		10^7	30.0×10^9	2.35×10^0	1.81×10^0
^{88}Mo	10^7	1.00×10^9	-1.74×10^1	$< -1.00 \times 10^2$	^{118}Mo	10^7	1.00×10^9	-8.16×10^1	8.48×10^{-1}
	10^7	10.0×10^9	-1.87×10^{-1}	$< -1.00 \times 10^2$		10^7	10.0×10^9	-5.00×10^0	1.30×10^0
	10^7	30.0×10^9	2.18×10^0	$< -1.00 \times 10^2$		10^7	30.0×10^9	2.35×10^0	2.01×10^0

Supplementary files can be requested from authors.

Conclusion

- Supernova explosion mechanism may be better understood if one can have a reliable estimate of EC and β^- -decay rates which may also contribute to a deeper comprehension of the nucleosynthesis processes associated with the supernova explosions.
- The RMF model with density-dependent interaction forces (DD-ME2 and DD-PC1) has been employed for calculations of ground-state nuclear properties of Mo isotopes starting from p-dripline to n-dripline ($A=82-138$).
- Binding energies per nucleon, neutron and proton separation energies, charge radii, total electric quadrupole moments and deformation parameter of electric quadrupole moments have been obtained in agreement with available experimental data.
- β_2 parameters obtained from RMF model with DD-ME2 interaction has been used in pn-QRPA model calculation of terrestrial and stellar decay rates.
- The relative comparison of EC and β^- -decay rates on 55 isotopes of Mo may help core-collapse simulators to model the evolution of stars in a more reliable fashion before they go supernova.



Nuclear structure properties and decay rates of molybdenum isotopes

Jameel-Un Nabi¹ · Tuncay Bayram²

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Abstract Electron capture and β^- decay are the dominant decay processes during late phases of evolution of heavy stars. Previous simulation results show that weak rates on isotopes of Molybdenum (Mo) have a meaningful contribu-

Keywords Electron capture and β -decay rates · Nuclear ground-state properties · Gamow-Teller strength · pn-QRPA model · RMF model · Molybdenum isotopes · Stellar evolution

Thank you very much!