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Mean Field Theoretical Structure of He and Be Isotopes

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Abstract

The structures of He and Be isotopes are investigated using Hartree-Fock approach

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$$Z_n = \frac{1}{n}(x_1 Z_{n-1} + 2x_2 Z_{n-2}) \tag{1}$$

1 [1]

The grand canonical partition function $Z(\vec{x})$ is Eq.(??) and the probability distribution $P_n(\vec{x})$ of $n = \sum_k kn_k$ pions is Eq.(??). The present work is a continuation of the approach developed in Ref.[?] which is based on Feynman path integral methods [?].

I. PION PROBABILITY DISTRIBUTION

A. Negative binomial (NB) distribution

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REFERENCES

[1] M. Seya, M. Kohno, and S. Nagata, Prog. Theor. Phys. **65**, 204 (1981).
 [2] Y. Kanada-En'yo, H. Horiuchi, and A. Ono, Phys. Rev. **C52**, 628 (1995); Y. Kanada-En'yo and H. Horiuchi, Phys. Rev. **C52**, 647 (1995).
 [3] S.H. Hong and S.J. Lee, J. Korean Phys. Soc. **35**, 46 (1999).

TABLE I: The binding energy per nucleon E_B , root mean square radius R , and quadrupole moment Q of the lowest state of He isotopes.

	${}^4\text{He}$	${}^6\text{He}$	${}^8\text{He}$	${}^{10}\text{He}$	${}^{12}\text{He}$
E_B (MeV)	4.16	3.04	2.62	1.95	1.50
Q_{total} (fm ²)	0.06	6.28	0.81	223.36	439.99

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FIG. 1: χ vs $\xi < n >$ for $a = 1/2$ (solid line; LC), 1 (dash; NB), 2 (dash-dot; Geo), 3 (dot), 4 (dash-dot-dot-dot). For Poisson distribution $\xi = 0$ and $\chi = 1$.

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\bibliography{....} : make bibliography and use BIBTEX
\bibitem[lbl]{key} : bibliography entry for citation key [with lbl as label]
\cite[note]{keys} : cite references keys [with added note]

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Sentences and Paragraphs

```

quotes : '.....'      ‘‘.....’’
dashes : intra-word -   number range --   punctuation ---
spacing : small \,      inter-word \      unbreakable ~      sentence-ending period \@.
special characters :   $ \$      & \&      % \%      # \#      { \{      } \}      _ \_
emphasis : {\em .....}
unbreakable text : \mbox{.....}
footnotes : \footnote{.....}
date : \today
line break : \\

```

line fill : \dotfill \hrulefill

Type Style

{\bf}

roman \rm italic \it CAPS \sc emphasis \em slant \sl

type \tt bold \bf SSrf \sf

bold math symbols \boldmath

Type Style

{\small}

\tiny \scriptsize \footnotesize \small \normalsize

\large \Large \LARGE \huge \Huge

Accents and Symbols

\‘{o} \’{o} \"{o} \^{o} \~{o} \={o} \.{o}

\u{o} \v{o} \H{o} \t{oo} \c{o} \d{o} \b{o}

\dag dagar \ddag double dagar \S section \P paragraph

\copyright \pounds

Sectioning and Table of Contents

\part \chapter \section \subsection \subsubsection \paragraph \subpa

\appendix start appendix

\tableofcontents make table of contents

Mathematical Formulars

`$.....$` or `\(.....\)` : in-text formular
`\[.....\]` : displayed formula
`\begin{equation}` `\end{equation}` : numbered equation
`\begin{eqnarray}` `\end{eqnarray}` : 3-coulum equations array
 `\nonumber` ; omits equation number
 `eqnarray*` ; omits all
`_{}{....}` : subscript
`^{}{....}` : superscript
' : prime
`\frac{n}{d}` : fraction
`\sqrt[n]{arg}` : n-th root of arg, `\sqrt{arg}` square root of arg
`\ldots` ... `\cdots` `\vdots` `\ddots`
Greek letters : `\alpha` `\beta` `\omega` `\Omega`
`\nabla` `\sum` `\prod`
`\vec` `\cdot` `\times` `\otimes` `\oplus` `\cap` `\cup`
delimiters : `\left` ... `\right` `\left{...}``\right}` `[]` `|` `<` `>` `\left.` `\right.`
`\overline{expr}`
space : thin `\.` medium `\:` thick `\;` negative thin `\!`

Displayed Paragraphes

`\begin{quote}` `\end{quote}` : short displayed quote
`\begin{quotation}` `\end{quotation}` : long displayed quote
`\begin{center}` `\end{center}` : centered lines separated by `\\`
`\begin{verse}` `\end{verse}` : `\\` between lines, blank line between stanzas
`/backslash/begin{verbatim}` `/backslash/end{verbatim}` :

in typewriter font exactly as formatted

Lists

`\begin{itemize}` `\end{itemize}` : ticked items
`\begin{enumerate}` `\end{enumerate}` : numbered items
`\begin{description}` `\end{description}` : labeled items
`\item` or `\item[label]`

Line Breaking

`\linebreak[n]` : force a line break, $0 \leq n \leq 4$
`\nolinebreak[n]` : forbid a line break, $0 \leq n \leq 4$
`\\[len]` : start new line and leave len vertical space
`\-` : permit hyphenation
`\sloppy` : allow loose lines
`\begin{sloppypar}` `\end{sloppypar}` : allow loose lines in paragraphs

Page Breaking

`\pagebreak[n]` : force a page break, $0 \leq n \leq 4$
`\nopagebreak[n]` : forbid a page break, $0 \leq n \leq 4$
`\samepage` : forbid page breaking except between paragraphs
`\newpage` : start a new page
`\clearpage` : print all figures and tables and start a new page

Length

units ; cm em ex in pc pt mm

`\newlength{cmd}` : define cmd to be a length
`\setlength{cmd}{len}` : set length cmd to len
`\addtolength{cmd}{len}` : add len to length cmd
`\sttewidth{cmd}{txt}` : set cmd to width of txt
only one setting works in one page or in one box
normal font size; 2.31ex

Space

`\hspace{len}` : make len horizontal space;
`\hspace*{len}` works even at beginning of line
`\hfill` : make infinitely stretchable horizontal space
`\vspace{len}` : leave len vertical space;
`\vspace*{len}` works even at beginning of page

Boxes

`\mbox{...}`
`\makebox[wd][pos]{...}` : make box of width wd putting text at pos
pos ; left(l), right(r), or center (default)
`\fbox{text}`
`\framebox[wd][pos]{text}` : same as `\mbox` or `\makebox` but draws frame around box
`\newsavebox{cmd}` : defines cmd be a bin for saving boxes
`\sbox{cmd}{text}`
`\savebox{cmd}[wd][pos]{text}` : same as `\mbox` or `\makebox` but saves box in bin cmd
`\usebox{cmd}` : print box saved in bin cmd
`\begin{minipage}[pos]{wd} \end{minipage}` :
make parbox of width wd, aligned by pos at top(t), bottom(b), or center (default) 1

`\parbox[pos]{wd}{....}` : same as minipage for small text, no displayed environments

Pictures

`\unitlength`

`\begin{picture}(x,y)(x',y')` `\end{picture}` :

picture of size $x \times y$ in unit of `\unitlength` with lower left corner at (x',y')

`\put(x,y){....}` : put object at point (x,y)

`\multiput(x,y)(Deltax,dely){n}{....}` :

make n copies of object with first at (x,y) and others offset by $(Deltax,dely)$

`\makebox(x,y)[pos]{....}` :

make $x \times y$ box pos, top(t), bottom (b), left (l), right (r) and centered (c)

`\framebox` and `\savebox` have analogous form

`\dashbox{d}(x,y)[pos]{....}` : like `\makebox` but puts dashed lines of length d around box

`\line(h,v){l}` : line with slope of diagonal h/v and horizontal extent l (length l if $h=v$)
integer $0 \leq h,v \leq 6$

`\vector(h,v){l}` : same as `\line` but with arrowhead ; $0 \leq h, c \leq 4$

`\circle{d}` : draw circle of diameter d ; `\circle*{d}` for solid disk

`\oval(x,y)[part]`: draw $x \times y$ partial oval [part] ; t, b, l, r

`\shortstack[pos]{....}` : like `\begin{tabular}[pos]`

`\frame{....}` : draw frame around object

line thickness : `\thinlines` `\thicklines`

`\serlength{\unitlength}{0.01in}` ; default length; 1 pt (point) = 1/72 inch

use this before entering picture mode

Figures and Tables

`\begin{figure}[loc]` `\end{figure}` : make floating figure

loc : here (h), top (t), bottom (b) of a page or full page (p)
`\bedin{table}[loc]` `\end{table}` : make floating table
`\caption{.....}` : make figure or table caption

Tabbing Environment

Rows separated by `\\`
columns determined by
`\=` : set tab stop
`\>` : go to next tab stop
`\kill` : throw away line

Array and Tabular Environments

`\begin{array}[pos]{cols}` `\end{array}` : use for formular
`\begin{tabular}[pos]{cols}` `\end{tabular}` : use for text
items separated by `&` and rows by `\\`
pos aligns with top (t), bottom (b), or center (default)
cols entries format columns :
l left-justified column
r right-justified column
c centered column
| vertical rule
`@{.....}` text or space between columns
`*{n}{...}` equivalent to n copies of ...
`\multicolumn{n}{col}{.....}` : span next n columns with col format
`\hline` : draw horizontal line between rows
`\cline{i-j}` : horizontal line across columns i--j

Definitions

`\newcommand{cmd}[n]{.....}` :
define new command cmd [with n arguments] to be

`\newenvironment{nam}[n]{beg}{end}` :
define new environment nam [with n arguments]

`\newtheorem{nam}{cap}` :
define a theorem-like environment nam captioned by cap

Numbering

`\setcounter{ctr}{n}` : set counter ctr to be n

`\addtocounter{ctr}{n}` : add n to counter ctr

counters for page, section, etc

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