

CURRICULUM VITAE OF ARUN V KULKARNI

Personal Details

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Date of Birth :- 10th August'1960
Gender :- Male
Religion :- Hindu
Marital Status :- Married (Spouse is housewife)

Contact Details

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Education :-

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| H.Sc. (Science) | 1976 | Delhi Kannada School, Lodhi Road, New Delhi |
| BSc. (Physics Hon.) | 1980 | Hans Raj College, University of Delhi, Delhi 110007 |
| MSc.(Physics) | 1982 | Hans Raj College University of Delhi, Delhi 110007 |
| Ph.D (Nuclear Physics) | 1994 | Dept. of Physics & Astronomy, Univ. of Wyoming, Laramie, WY-82071. USA. |

Ph.D Thesis

Title :- A calculation of $\frac{d^2\sigma}{d\Omega dT_\pi}$ (Double differential scattering cross sections) for inclusive $\pi^-^4\text{He}$ Double Charge Exchange at $T_\pi^{in} \leq 270 \text{ MeV}$.

Adviser :- Prof. Glen A Rebka, Dept. of Physics & Astronomy, University of Wyoming, Laramie WY -82071 USA.

Abstract :- :-

Pi-nuclear scattering calculations that use multiple scattering usually require the knowledge not only of the pi-nucleon interaction in free space but also its modification inside a nuclear medium. A relativistic 2 body model consisting of the pion, the i^{th} nucleon, and the residual nucleus called the core, is developed. In this model the nucleon-core separation in coordinate space is approximated by the separation between the Center of Mass of the of the π - i^{th} nucleon subsystem called the Composite and the Core. An Instant form of Dynamics is employed to introduce interactions between the pion & the nucleon and between the πN Composite and the Core. The Composite-Core Hamiltonian is assumed to admit no bound states. The relativistic 3-body total Hamiltonian is then diagonalized by *nested separable* eigenfunctions. This diagonalization allows the construction of an expression for the matrix elements of the medium modified πN scattering operator τ_i in the lab frame in terms of the CM πN free space t-matrix elements. Terms that are quadratic in the N t-matrix elements in this expression are neglected.

The Sequential Single Charge eXchange (SSCX) mechanism contribution to the inclusive $\pi^-^4\text{He}$ Double Charge eXchange (DCX) is calculated using only the double scattering term of the Watson multiple scattering series. The τ – matrix elements obtained from this 3-body model are used for the first scattering . It contains explicit dependence upon the matrix elements of the Composite- Core scattering operator $t_{\pi\text{N-C}}$. This explicit dependence is ignored in the second scattering. The pole of the intermediate pion green function is fixed from the 3-Body model considerations and the requirement that the pion be on its mass shell at the pole.

The calculated inclusive cross sections $\frac{d^2\sigma}{d\Omega dT_\pi}$ are compared with the Kinney et.al. experimental results and essential agreement with the spectrum for the incident pion kinetic energy $T_\pi^{in} = 120 \text{ MeV}$ is found. At higher values of $T_\pi^{in} < 270 \text{ MeV}$ only qualitative agreement with experiment is claimed. Zeroing $t_{\pi\text{N-C}}$ changes the cross section magnitudes by $< 5 \%$. The presence of the P33 partial wave, the choice of the appropriate width in the momentum space of the Gaussian Wave function for the ground state of ^4He , and the inclusion of both single and double spin flip amplitudes are found to be important.

Work Experience :-

My entire work experience has been in the Birla Institute of Technology & Science (BITS) now known as BITS-Pilani. I joined BITS Pilani in Rajasthan in Nov-1995, and worked there until May-2004. The Goa Campus (later renamed as K.K. Birla Goa Campus) started in the academic session 2004-05 and I transferred from Pilani to Goa to be in the newly started campus. The table below summarizes my progress in BITS from the starting date to the present.

| | Month/Year | Position | Campus | Location |
|----|-----------------------|--------------|--------|----------------------------|
| 1. | Nov-1995 to Jan -2000 | Lecturer | Pilani | Pilani, Rajasthan - 333031 |
| 2. | Feb-2000 to May-2004 | Assist. Prof | Pilani | Pilani, Rajasthan - 333031 |
| 3. | June-2004 to Jan-2005 | Assist Prof | Goa | Zuarinagar, Goa - 403726 |
| 4. | Jan-2005 to July-2010 | Assoc. Prof | Goa | Zuarinagar, Goa - 403726 |
| 5. | July-2010 to present | Professor | Goa | Zuarinagar, Goa - 403726 |

Research Interests :-

- Nuclear Physics :-** Few body systems, Intermediate energies, pi-Nuclear Physics, Multiple Scattering Calculations, Optical potentials, Hadron Physics.
- Theoretical Physics: -** Foundations of Quantum Mechanics, General Relativity, Quantum Field Theory, Non Equilibrium Statistical Mechanics.
- Numerical E & M: -** Developing finite element techniques to solve Laplace-Poisson equation for tip-sample configuration found in Scanning Tunneling and Atomic Force Microscopes.
- Physics Teaching: -** Am interested in interacting with school & college teachers to devise ways of improving physics teaching and generating and sustaining student interest in Physics.

Theses Guided :-

Guided two Masters Thesis one in Nuclear Scattering and another in Calculation of tunneling currents in STM (both in the Pilani Campus)

External Examiner of M.Sc. Theses Submitted to Goa University :-

- 1) Title:- Bose Hubbard Model with 3-body Constraints by Mayuresh Aiya. M.Sc. Thesis Dissertation evaluated by me in April'2011.
- 2) The following 3 Theses were all guided by Dr. S. Prasanna Kumar, Scientist (G) at The National Institute of Oceanography (NIO) Goa. These 3 dissertations were hand delivered to me 3rd June'2009 by a University Official for me to evaluate. Evaluations posted by me on 25th June'2009. Each thesis was undertaken by 2 students who submitted a joint dissertation.
 - a) Title :- Tides along the West Coast of India by Savia Lourenco and Shashikala Rane.
 - b) Title:- Sound Speed Structure in the Western Indian Ocean & its application by Edvin Antao and Shilpa Tamburkar.
 - c) Title :- Remote Sensing of Sea Surface height and its variability in the Arabian Sea. by Effie Carvalho & Teja Prabhu Desai.

Student Projects Guided (First Degree):-

A. Study Oriented Project (SOP) Course Nos. :- BITS C323/BITS C324

1. Quantum Fields in Curved Spaces.
BITS C 491 Special Projects. S. R. Nesar, ID. No. 2008B5TS041GReport submitted on 28th Nov'2011. Grade Awarded A

2. Finite Element Calculations in Electricity & Magnetism.
 Combined project undertaken by 2 students (Goa Campus)
 1) Shah Preyas Janak ID No. 2008B5A3356G and
 2) Sarthak Sourav Mahopatra ID No. 2008B5A3210G.
 Report Submitted on 07th May'2011. Grade awarded to both students A
3. Behavior of Electromagnetic Fields near Material Surfaces.
 Sachin Bhatt ID. No. 2008B5A3599G. (Goa Campus)
 Report Submitted on 10th May'2011. Grade awarded A
4. Review of Design & Operation of STM & AFM & Calculation of the Tunneling Probability for different Potential barriers.
 Nishith Shekhar Tripathi, ID No. 2007A1PS398G. (Goa Campus)
 Project report submitted 10th May'2010. Grade awarded A
5. Radiation in Accelerated Frames of References.
 Arun T. Madhav ID No 2000B5A3711 (Pilani Rajasthan)
 Report Submitted on 10th May'2004. Grade awarded A
6. Electrodynamics in non-inertial frames of Reference.
 Arun T. Madhav. ID No 2000B5A3711 (Pilani Rajasthan)
 Report Submitted on 10th Dec'2003. Grade awarded A
7. A Report on Multiple Scattering (Nuclear Physics)
 Janani. S. ID. No. 1999B5PS652 (Pilani Rajasthan)
 Report Submitted on 10th May'2003, Grade awarded A

B. Computer Oriented Project (COP) Course Nos. :- BITS C331/BITS C335

1. Simulation & Study of solutions of the Boltzmann Transport Equation.
 BITS GC 331 Computer Oriented Project jointly undertaken by 2 students from Goa Campus
 1) S. Gayathri ID. No. 2004S1P8383 and
 2) Soumyarupa De ID. No. 2004P7PS475
 Report submitted on 28th April'2007. Grade Awarded A
2. Parallel Computing for Numerical Solution of Laplace's Equation
 Combined project undertaken by 2 students from Pilani Rajasthan
 1) Mallipreddi Rajesh ID. No. 1999B5A7599 and
 2) Aruna Rajan ID. No. 1999B5A7676
 Report submitted on 10th Dec'2002. Grade awarded to both students A

3. Software Development for administration of Large Multi-Section Courses & Labs and online viva & computerized record keeping of marks in MT-1 Labs.
S. Satish ID. No. 1998B4A2437 (Pilani Rajasthan)
Report Submitted 3rd Dec'2001. Grade awarded A

Publications :-

1. Study of the electrostatic force between a conducting tip in proximity with a metallic surface: Theory & Experiment. Journal of Applied Physics Vol 88, No.11, pp 6940 Dec'2000.
2. Force on a Conducting Tip near a Metallic Surface coated with a polarizable Dielectric layer: Theory and Experiment. e-Journal of Surface Science and Nanotechnology, Vol 9 (2011), pp 206-209 (This paper was presented at the 13th International Conference on NonContact Atomic Force Microscopy (NC-AFM2010), Ishikawa Ongakudo, Kanazawa Japan 31st July to 4th Aug'2010)

Workshops & Conferences attended :-

- 1) India – Panda [Proton (Anti) and Nuclei at Darmstadt] Collaboration Meeting at International Center Goa during 11th to 15th March'2013. Was also member of the Organizing Committee.
- 2) DAE- BRNS Workshop on Hadron Physics & the India-Panda Project meeting at BARC Mumbai, Training School Campus. 31st Oct to 04th Nov'2011
- 3) The SERC DST preparatory school in Theoretical High Energy Physics (THEP) organized in BITS-Goa Campus during 20th Oct to 15th Nov'2010 (Was also a member of the organizing Committee)
- 4) Field Theoretical Aspects of Gravity (FTAG-5) held in BITS- Goa in Dec'2006. (Was also a member of the organizing Committee)
- 5) 41st BRNS National Workshop on Radiochemistry & Applications of Radioisotopes conducted jointly by BITS-Pilani, Rajasthan & Indian Assoc. of Nuclear Chemists & Allied Scientists (IANCAS) 15th -22nd Oct'2000.
- 6) Summer Nuclear Physics Institute at TRIUMF, Vancouver, British Columbia, Canada (Aug -1990)
- 7) Summer Nuclear Physics Institute at TRIUMF, Vancouver, British Columbia Canada (Aug -1989)
- 8) Summer Institute (QED & Nonlinear Optics), New Mexico USA (May-1985)

- 9) NATO Summer Institute (Foundations of Quantum Mechanics) Santa Fe New Mexico (June – 1985)
- 10) NATO Summer Institute (QED & Nonlinear Optics) Boulder Colorado USA (June-1984)

Courses Taught :-

I have taught several courses during my academic career in BITS, some of these are listed below. Text books and reference material identified by author names (indicated in parenthesis) are provided as an aid in gauging the level at which each course was taught. Many of these courses were taught multiple times. Year and semester wise breakup details have not been maintained.

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| Physics I | A first course for entering freshmen Covers Mechanics, Waves & Oscillations & Optics. (Resnick Halliday & Walker, also Kleppner & Kolenkov, & also A.P. French, & by H.J. Pain) |
| Physics II | Electricity & Magnetism (D.J. Griffiths) |
| Measurement Tech.-I | A 2 nd yr 1 st sem. Undergrad. Expt. Techniques course. |
| Modern Physics | A 2 nd yr, undergraduate course for Physics Students. (Beisier, Tipler, Eisberg & Resnick) |
| Thermodynamics | Undergraduate Engineering Science course (Text book by :- Van Wylen, Sonntag & Borgnakke) |
| Math. Methods of Physics | Partial Diff. equations of Physics and Green functions (C. Harper, & Habermann both published by Prentice Hall) |
| Complex Analysis | Advanced Elective usually offered by the Maths Dept. for MSc. Maths students. (Churchill, Fisher, Raemmert, Knopp) |
| Classical Mechanics | A first yr MSc. level course. (Goldstein, Micheal Calkin) |
| Quantum Mechanics I | A first yr MSc. level course. (Schwabl, Schiff, Bohm etc.) |
| Quantum Mechanics II | An advanced course offered as an elective (Cohen Tannoudji Vol II, M.E Rose, Greiner, Sakurai, etc.) |
| Theory of Relativity | Elective Course at the senior undergraduate level. (Richard Mould, Robert Resnick, Foster & Nightingale, Weinberg) |
| Statistical Mechanics | MSc.-Level one- semester course (Sears & Sallinger + Kerson Huang) |
| Electromag. Theory I | MSc.-Level one-semester course. (Griffiths, Jackson etc) |
| Electromag. Theory II | An advanced course offered as an elective. (Jackson, Panofsky & Phillips) |
| Nuclear Physics | MSc.-Level course. (Blatt & Weisskopf, Feshbach & deShalit, S.M. Wong, Ashok Das & Ferbel, Gladiola Erba etc.) |
| Quantum Field Theory | M.Sc. level Elective for senior students. (Bjorken & Drell Vol 1, QED by Greiner) |
| Theoretical Physics | M.Sc Level, Reading Course covering Field Quantization for Senior Students. (Ashok Das). |

Administrative Experience:-

In the Pilani Campus (1995 – 2004)

1. Served as Instructor for 2nd Year BITS Students for PS-I in BARC (B'bay) May-July 1996. Had to fight with Director BARC to obtain accommodation for students in the BARC Campus. This facility was initially promised to our students, but was then withdrawn due to the conducting of the International Mathematics Olympiad in BARC at the same time. Some vacant quarters were later temporarily allotted to BITS students for the duration of the program.
2. Served as a Nonresident Warden for Krishna Bhavan (Boys Hostel) for 4 years (May-97 to May-2001)
3. Other duties some time during Aug'1998 to Aug'2002 (2 years each)
 - 1) Disciplinary Committee Member under Dean Student Welfare.
 - 2) Coordinator of Student Counseling services.
 - 3) Library Committee member.
4. Served as PS-I Instructor in Pune Center, (May-July 2000) and during this time established contact with C-DAC Pune, as a result of which BITS opened a PS-II program with C-DAC, and its employees enrolled in DLPD programs in BITS.
5. In the following year (May-July 2001) as PS-I Instructor, I established contact with Mahindra British Telecom, (MBT-Pune) leading to their employees pursuing BITS-DLPD programs
6. Lead a team of 4 invigilators on NTPC invigilation duties once in NTPC-Talcher, Orissa, and once in NTPC-Charkhi-Dadri, Delhi
7. Faculty Coordinator of the Physics Journal Club for the Physics Group in BITS Pilani for one year.
8. Served as Vice President of the Indian Physics Association (IPA) Pilani Chapter for 2 years.
9. Conducted ITW (Intensive Teaching Workshop) in BITS Pilani for newly joined faculty members earmarked for transfer from the Pilani Campus to the Goa Campus during the 2nd Sem'2003-04
10. Senate Member from 2001 to present.

In the Goa Campus (2004 – Present)

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| Chief Warden | From July-2004 to April'2009 in BITS-Pilani, Goa Campus. |
| ITW BITS-Goa | Coordinator of ITW in BITS-Goa in Jan-May 2005 for newly joined faculty members teaching at the Goa Campus. |
| Convener | Disciplinary Committee. (2007 – 2009) |
| Member | Faculty Recruitment Committee for Physics and Biology Departments in 2011-12. |
| Chairperson | Faculty Recruitment Committee for Mathematics from 2011 to present and for Physics Department from 2012 to present. |
| Member | Doctoral Research Committee (DRC) from 2011 to present. |

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| Member | Doctoral Advisory Committee for 2 Ph.D. Students. |
| Member | Task force on Academic Programs & Pedagogy (APP) from Aug-2009 to Aug'2012. This Task force was constituted by Chancellor Shri Kumar Mangalam Birla and the VC to help steer BITS-Pilani to achieve higher levels of excellence in teaching and research. |

Speaker (Resource Person) at UGC Refresher Courses :-

1. Organized by the Academic Staff College and the Physics Dept. Goa Univ. on 12th Feb'2008. Title :- Topics in Solid State Physics. Delivered 2 lectures, each of 90 minutes duration.
2. Organized by the Academic Staff College and the Physics Dept., Goa Univ. on 16th Jan'2007. Title:- Electrical & Thermal Conductivity of Solids. Delivered 2 lectures, each of 90 minutes duration.
3. Organized by the Chemistry Group of BITS Pilani Rajasthan-333031, in Dec'2003. Title:- Topics in Quantum Mechanics A series of 6 lectures each 90 minutes long for the 21 day UGC refresher course in Chemistry.

Co-Curricular Activities :-

1. **Member** Board of Studies in Physics. Goa University, Appointed on 16th April'2012 for a period of 3 years.
2. **President**, Indian Association of Physics Teachers (IAPT) Goa Regional Council (Goa RC) Re-elected on 24th Dec'2012 for a period of 2 years.
3. **President**, Indian Association of Physics Teachers (IAPT) Goa Regional Council (Goa RC). From Feb' 2010 to Dec'2012.
4. **Vice President**, IAPT (Goa RC), From April'2006 to Jan'2010.
5. **Participant** of OCSC (Orientation cum Selection Camp) for Physics Theory for winners of InPhO (Indian Physics Olympiad) organized by HBCSE (Homi Bhabha Center for Science Education) 14th May to 21st May'2012.
6. **Participant** of Resource Generation Camps (RGC) organized by Homi Bhabha Center of Science Education (HBCSE) for Physics Olympiad work, 3 years in a row during the following times :- 6th-10th Feb'2011, 4th-7th Sept'2010, and 19th-22nd Sept'2009.
7. **Organized** Science Day celebrations in BITS- Pilani, Goa Campus, on 28th Feb'09. Events were Lectures, Science Quiz for undergraduate students in Colleges of Goa, and Poster Competition. Prize money budget was Rs 7500/-
8. **Organized** Science Day celebrations in BITS- Pilani, Goa Campus on 28th Feb'2012 in association with IAPT Goa RC. Events were Quiz for School Children, & Afternoon Lectures in Mathematics & Physics.
9. **Convener** of IAPT organized, SCERT (Goa Govt.) sponsored Workshop for Physics School & College Teachers, hosted by BITS-Pilani, Goa Campus during 22nd- 23rd Nov'2008. Also gave a talk titled – Elementary Particles.

10. **Convener** of the GEDC (Goa Educational Development Corporation) sponsored Motivational Workshop for School Students on 2 occasions held in BITS-Goa. The first time was during 27th to 28th Jan'2007 and the second time during 2nd to 3rd Feb'2008.
11. **Convener** of the Teachers Training Workshop for H.Sc. School Teachers. Sponsored by Govt. of Goa and organized by BITS –Pilani, Goa Campus, on 26th and 27th Nov'2005.

Public Talks :-

1. Invited Talk at the Indian Association of Physics Teachers (IAPT), Goa Regional Council (Goa RC) annual convention held at Condola College, Goa on 7th March'2009. Talk Title :- Some Thoughts on Physics Teaching.
2. Invited Speaker for IAPT (Goa Regional Council) Convention held in Govt. College Quepem, Goa on 15th Dec'2007. Title :- Elementary Particles
3. Science Day Talk titled C.V. Raman & the Raman Effect, talk delivered in BITS-Pilani Goa Campus on 2nd March'2007.
4. National Seminar on Science – Religion and the Future of Humanity. Invited talk Title:- Physics & Religion. Talk delivered at St. Xavier's College Auditorium, Mapusa, Goa, on 4th Feb'2006.
5. Invited Talk, Title Careers in Science and Technology Talk addressed to children of Navy Personnel, delivered at the Rajhans Auditorium (Opp. Navy Children's School) Vasco, Goa on 24th Oct'2006.

Hobbies:-

1. Reading Classic English Literature & English Translations of Indian Classics.
2. Listening to Hindustani Classical vocal & Instrumental Music.
3. Cooking & Eating good Vegetarian Food.
4. Watching Classical Indian & Foreign English Movies.