HEP AT SOA UNIV. FOR INDIA-JAPAN COLLABORATION

M.K. PARIDA

Center of Excellence in Theoretical and Mathematical Sciences(CETMS), Siksha 'O' Anusandhan University (SOAU), Bhubaneswar, India

DST Proj: SB/S2/HEP-011/2013; 15 May 2017: IOP

SOAU: NATIONAL RANKING & STRUCTURE:

1. NO.16(2015-16); No.20 (2016-17)
2. NAAC-A GRADE TWICE SINCE 2007; No.1 UNIV. IN ODISHA
3. 9 MAJOR INSTITUTES/SHOOLS INCLUDING INST. OF TECH. ED. & RES. (ITER)
4. SUM HOSP. AND INST.OF MED. SC.
5. 12 DEDICATED SPECIALISED RESEARCH CENTRES INCLUDING CETMS

SOAU:(CONTD.)

1. STUDENTS = 10,000, FACULTY=1100
2. FACULTY WITH NATIONAL FELLOWSHIPS/AWARDS=121
3. ONGOING: M. Sc.(Nano Sc.), M. Sc. (Bio Tech.)
4. M. Sc. (PHYS.) FROM 2017.
5. 57 EXTERNALLY FUNDED MAJOR PROJECTS, PLUS 7 FROM SOAU
6. HEP RES. ONGOING AT CETMS AND PHYS. DEPT.(ITER)

SOAU SCHOLARS, PUB. :

1. **SOAU FUNDED SCHOLARSHIPS FOR Ph.D.= 168**
2. **SOAU Ph.D. DEGREE AWARDEE = 155**
3. **TOTAL PUB. $>$ 3800**

HEP:FACULTY & SCHOLARS

1. ONE SR. PROF., ONE ASST. PROF. AT CETMS
2. ONE PROF. ONE ASST. PROF. AT PHYS. DEPT (ITER)
3. TWO PDFs. (Ph.D. FROM SINP AND BARC) EXPERTISE IN INO SIM. AND NEUTRINO MASS MATRICES AND TEXTURES
4. HEP: 11 JRFS WORKING FOR Ph. D.

HEP PUB.& THRUST AREAS

1. TOTAL (CAREER PUB.)= 190
2. 6 IN PHYS.REV. LETT.
3. 159 IN PHYS. LETT.B, PRD, JHEP, NPB, EPJC,JCAP, ADV.IN HEP. IJMP,ETC.
4. CETMS PUB W.E.F. 2012 $>$ 45
5. WIDE VIS.& COLL. EXP:INDO-AMERICAN, INDO-EUROPEAN, ICTP ASSO. , SABBATICAL VISITS

PUB.& THRUST AREAS

1. FACULTY: INVITED REFEREES OF INT. JNLS.
2. A NUMBER OF CONF. PAPERS AND INVITED TALKS.
3. CETMS THRUST AREA (ONE OF MANY EX.): SUCCESSFUL CONFRONTATION OF SM LIMITATION NEUTRINO MASS, BARYON ASY., DARK MATTER, COUPLING UNIFICATION, ORIGIN OF PARITY VIOL.(ALL IN ONE MIN. MODEL)

PUB.& THRUST AREAS

1. **EXPECTED NEW SIGNALS AT LHC,W_R, Z_R,BOSONS,DIPHOTON EXCESS, DM AT XENON100, LUX, IceCube, PLANCK,FERMI-LAT, ETC.**
2. **ORIGIN OF FLAVOR, ORIGIN OF NEUTRINO MIXINGS AND CP-PHASES**
3. **REPRESENTING ALL FERMION MASSES AND MIXINGS THRO' HIGH-SCALE QUARK-LEPTON UNIFICATION**

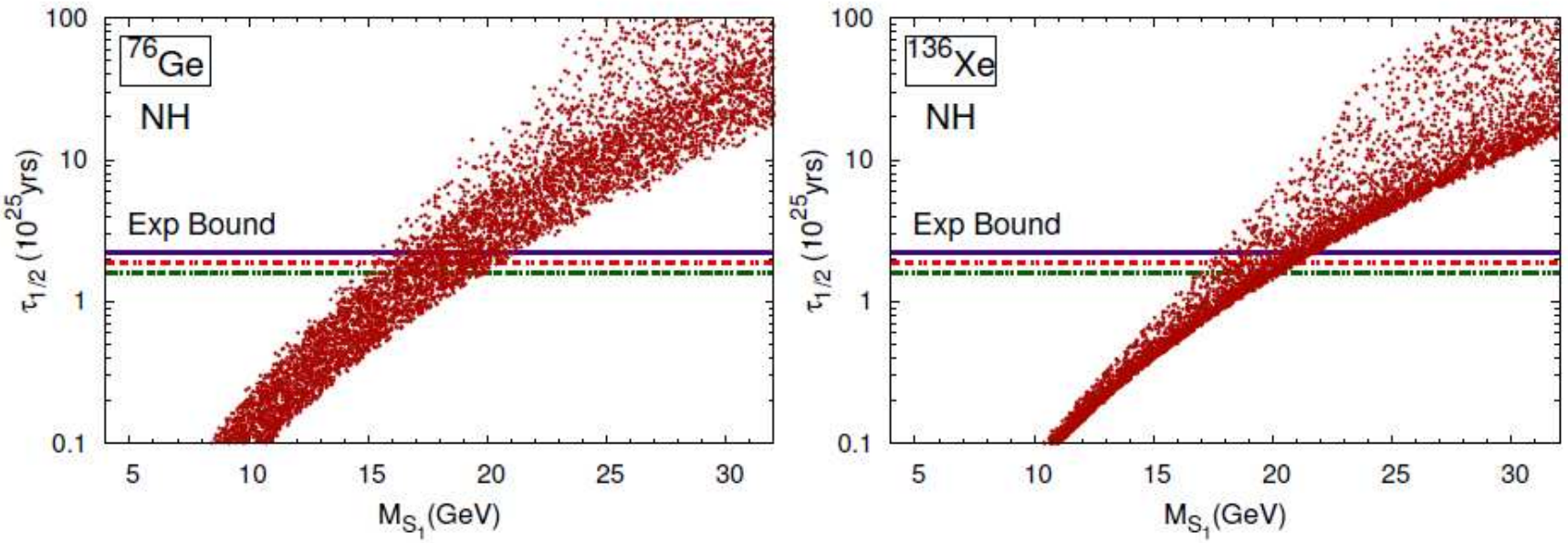
THRUST AREAS: NEUTRINO PHYS.

1. **MASS GEN. MECHANISM IN THREE BROAD CLASSES:(i)CONVENTIONAL HIGH-SCALE SEESAW: TYPE-I,Type-II..,**
   (ii) FINE-TUNED/TEXTURED LOWER SCALE SEESAW,
   (iii) SINGLET FERMION ASSISTED TeV SCALE SEESAW: CETMS HAS SEVERAL NEW & ORIGINAL CONTRIBS.

THRUST AREAS: NEUTRINO PHYS.

1. UNDER (iii): CETMS DISCOVERY OF TYPE-I SEESAW CANCELLATION IN SO(10) DESPITE HEAVY N'S: JHEP(2013),JHEP(2014).
2. SINGLET FERMION ASSISTED NEW DOMINANT SEESAW:INVERSE,LINEAR,TYPE-II:EPJC(2015),NPB(2016),AHEP(Review)(2017).
3. CETMS PREDICTION OF NEW LIGHT MAJORANA FERMION SINGLET (MASS $\simeq$ 1-10 GeV) DOMINATING $\beta\beta_{0\nu}$ AND MANIFEST IN DILEPTON PROD. AT LHC WITH DISPLACED VERTICES.

FIG.1.NEW MAJ.FERMION SINGLET FOR DOUBLE BETA DECAY $\tau \geq 10^{25}$ Yrs. EVEN WITH NH m_ν



CETMS THRUST AREAS AND PREDICTIONS.

1. **SM EXTNS, WITOUT OR WITH LEFT-RIGHT GAUGE THORIES;SO(10) AND E_6 ...**
2. **GUTS, D-PARITY, ITS CONSERVATION AND SPONTANEOUS BREAKING R-PARITY, MATTER PARITY, DARK MATTER PRODUCTION AND STABILITY ...**
3. **LHC VERIFIABLE TeV SCALE W_R, Z_R BOSONS FROM SO(10) COMPATIBLE WITH ν DATA, AND EXPTLY. ACCESSIBLE LFV Br. RATIOS AND $\beta\beta_{0\nu}$**

PIONEERING IDEAS FOR TESTS: T2K, T2HK, KATRIN

1. **RG ORIGIN OF ALL ν-MIXINGS:HIGH SCALE MIXING UNIFICATION.(cf:PAPERS BY R.N. MOHAPATRA, M. K.PARIDA(CETMS), G. RAJASEKARAN (2003-2016).**
2. **SANJIB AGRAWALLA, MKP, R.N. MOHAPATRA, G. RAJASEKARAN, PRD(2007):AT M_{GUT}: NEUTRINO MIXINGS=QUARK MIXINGS, RG GIVES ALL ν- MIXINGS AT M_Z INCLUDING $\theta_{13} = 8 - 10$ degrees. DIRAC AND MAJ CP PHASES ARE CORRELATED.**

PIONEERING DISCOVERIES

1. **MATTER PARITY ORIGIN OF RADITIVE SEESAW WITH INERT DOUBLETS AND WIMP DARK MATTER.**
2. **THEOREMS ON ALL VANISHING HIGH SCALE UNCERTAINTIES IN $\sin^2\theta_W$ IN GUTs:PRL(1991),PRL(1992).**
3. **THEOREM ON ALL VANISHING HIGH SCALE UNCERTAINTIES ON PATI-SALAM SYMMETRY BREAKING SCALE IN GUTs:PRD(1998).**

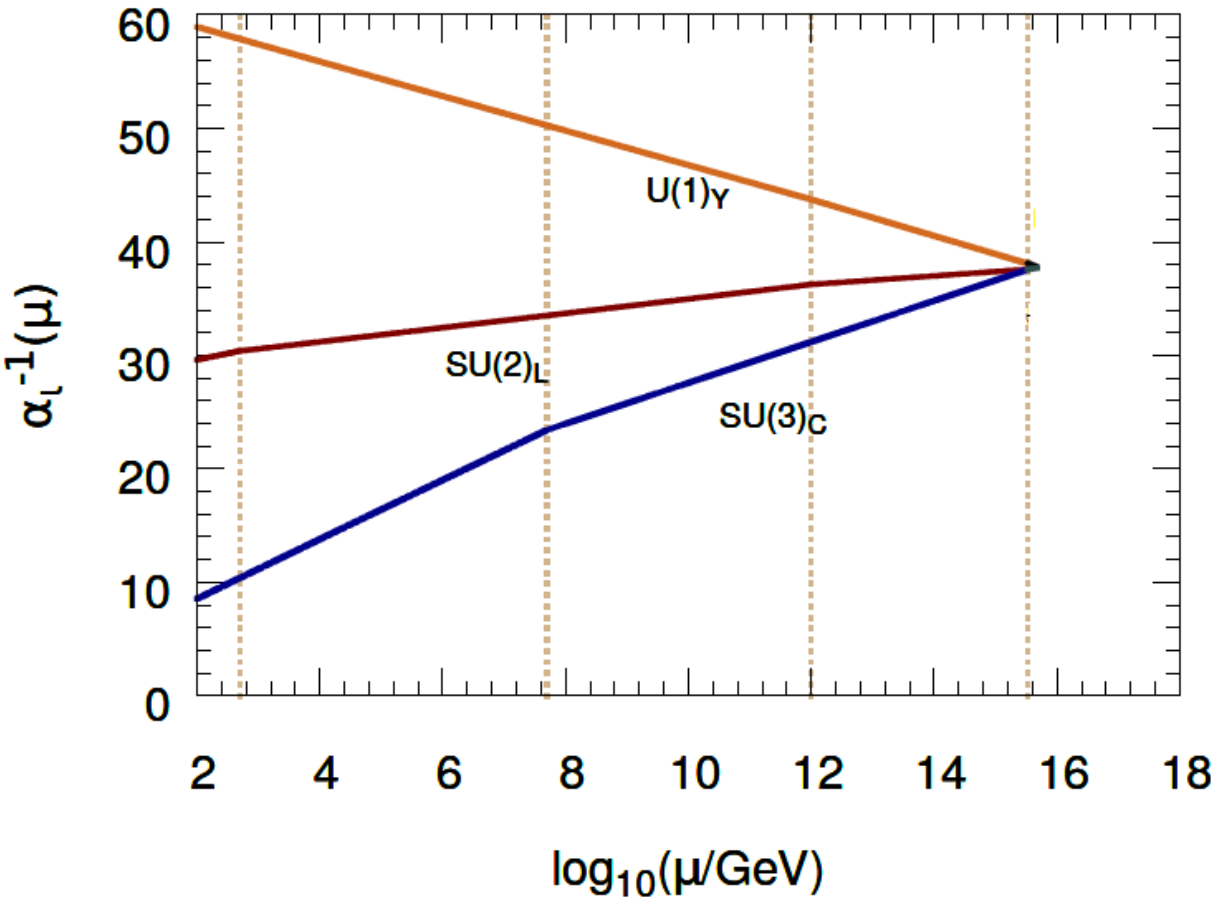
RECENT ACADEMIC CONN. WITH SUPER K. AND HYPER K.

1. D. -G. Lee, R.N. Mohapatra, M. K. Parida, M. Rani "Proton lifetime prediction in minimal non-SUSY SO(10).." , PR D51 (1995) 229-235; Cit.=70; 10 FROM SUPER K. AND HYPER K.
2. (Hyper K.)K. Abe et al. arXiv:1109.1262; (Super K.) H. Nishino et al. Phys. Rev. Lett. (2009), H. Nishino , Ph. D. Thesis (Tokyo Univ.) (2009); (Super K.) M. Shiozawa et al. Phys. Rev. Lett. 81 (1998) 3319. ETC....

NEW CETMS RESULTS FOR SUPER-K: JHEP 04(2017)075.

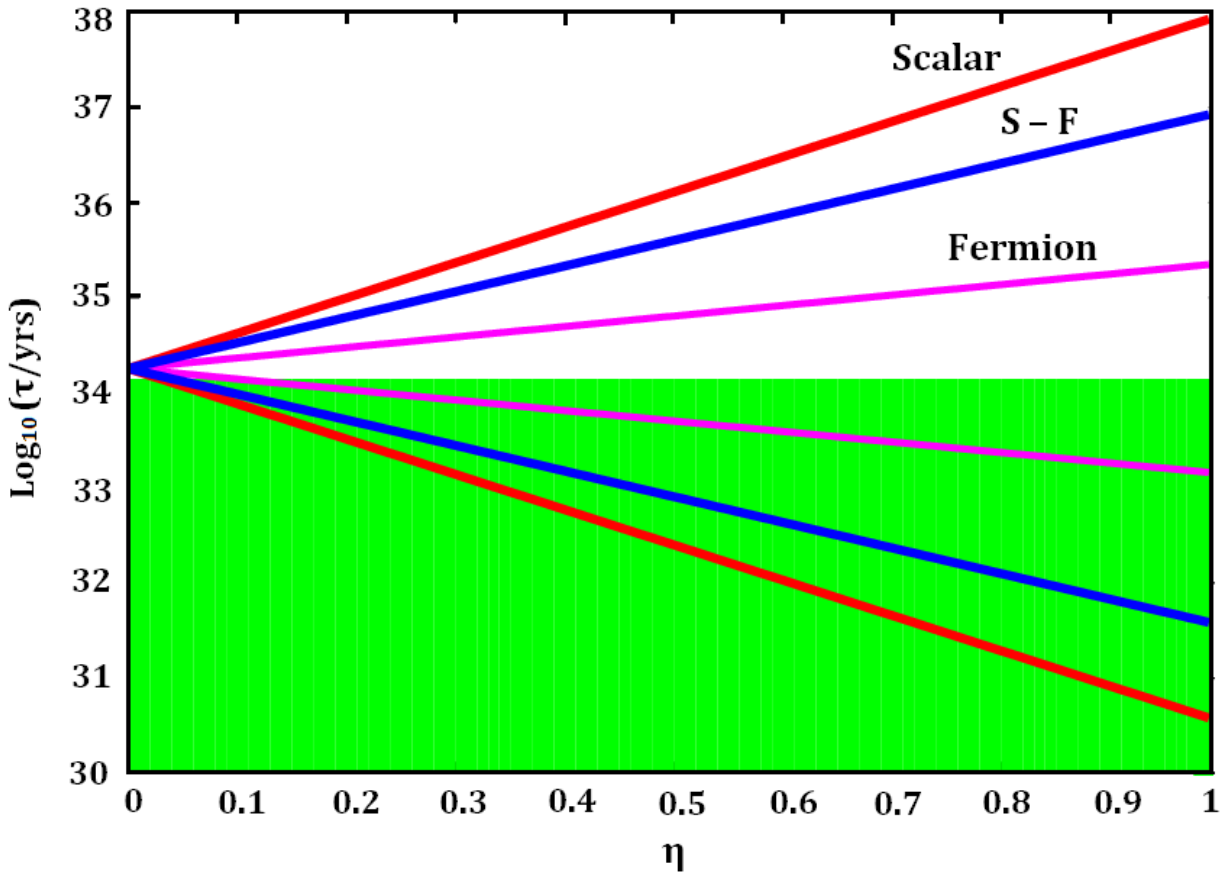
1. **ALL SM LIMITATIONS CONFRONTED NOW IN ONE MODEL:NO SUSY, DIRECT BREAKING: SO(10) $\rightarrow$ SM**
2. **FERMIONIC DM AT ~ 500 GeV, Type-I PLUS Type-II HYBRID SEESAW,BARYOGENESIS VIA LEPTOGENESIS,NATURAL GUT SCALE PARITY RESTORATION, HIGH POTENTIAL FOR PeV MASS DM DECAY FOR IceCube Neutrinos**

FIG.2. SM COUPLINGS UNIFICATION IN THE (ALL IN ONE) MINIMAL MODEL.



SOAU PRED.[JHEP04(2017)075]:FOR SUPER-K.

1. **FIG.3: POTON LIFETIME PRED. IN THE (ALL IN ONE) MODEL . GREEN REGION RULED OUT BY SUPER K.**



SUMMARY

1. SOA UNIV. HAS EXCELLENT FACILITIES AND ACADEMIC ATMOSPHERE FOR HIGH QUALITY RESEARCH WITH EXPERIENCED FACULTY, PDF, and GR.STUDENTS.
2. THE UNIV. HAS CAPABILITY TO ENHANCE STUDENT, SCHOLAR AND FACULTY STRENGTH SUITABLE FOR COLLABORATION. M.SC.(PHYS.) STARTED FROM 2017.

SUMMARY (CONTD.)

1. CETMS AT SOA UNIV. HAS PRODUCED MANY NEW RESULTS ACCESSIBLE TO EXPTS. NEW RESULTS SUMMARISED HERE FROM MINIMAL SO(10) (ALL IN ONE MODEL !!) COULD BE TESTED BY SUPER K./HYPER K. PROTON DECAY SEARCHES. NEW FERMION SINGLET MAY BE ACCESSIBLE TO T2K OR T2HK WITH UPGRADED BEAM ENERGY AND DOUBLE BETA DECAY EXPTS.
2. FROM MASS HIRARCHY MEASUREMENTS QD NATURE OF NEUTRINOS CAN BE ASCERTAINED. THEN HUM IS AUTOMATIC. ALL NEUTRINO MIXINGS HAVE RG ORIGIN.