Mathematics and Physics Laboratory Group

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Refereed academic journal

[kihara-101-074-01:2016] Hiroshi Kihara. A local finiteness theorem for corings over semihereditary rings. *Archiv der Mathematik*, 106(6):507–513, 2016.

The fundamental theorem on coalgebras asserts that coalgebras are locally finite in the case where the ground ring is a field. We prove the local finiteness theorem of corings under the semihereditarity condition on the base algebra and the projectivity condition on a coring. This result generalizes not only the fundamental theorem on coalgebras but also Hazewinkel's result on the local finiteness of coalgebras over a principal ideal domain and Bergman's unpublished result on the local finiteness of corings over a semisimple Artinian rings.

[kihara-101-074-02:2016] Hiroshi Kihara. Rational cup product and algebraic K0-groups of rings of continuous functions. *Proceedings of the Edinburgh Mathematical Society*, page in press, 2018.

A connected space is called a C0-space if its rational cup product is trivial. A characterizing property of C0-spaces is obtained. This property is used to calculate the algebraic K0-group K0(CF(X)) of the ring of continuous functions for infinite dimensional complexes X.

[kihara-101-074-03:2016] Hiroshi Kihara, Ken ichi Maruyama, and Nobuyuki Oda. The group of self-homotopy equivalences of the m-fold smash product of a space. *Topology and its Applications*, 217(February):70–80, 2017.

Let $E(X)$ be the set of homotopy classes of self-homotopy equivalences of a space X. The set $E(X)$ is a group by composition of homotopy classes. We study the group $E(X^{\bigwedge m})$ for the m-fold smash product $X^{\bigwedge m}$. We show that the two obvious homomorphisms $\phi : Sm \to E(X^{\bigwedge m})$ and $\psi : E(X)^m \to E(X^{\bigwedge m})$ define a bigwd $\Psi : E(X)^m Sm \to E(X^{\bigwedge m})$ for any space X, where $E(X)^m Sm$ is the semi-direct product of the product group $E(X)^m$ by the symmetric group Sm . We show that in most cases the homomorphism $\phi : Sm \to E(X^{\bigwedge m})$ is a monomorphism and the kernel of Ψ is isomorphic to the kernel of ψ. The injectivity of Ψ is established for the complex projective n-space $CP^n (n \geq 2)$, and hence, $E((CP^n)^{\bigwedge m})$ contains a subgroup isomorphic to $\{\pm 1\}^m Sm$. Sufficient conditions for Ψ to be injective are obtained for the Eilenberg-MacLane complex $K(A^r, n)$ where A is a subring of Q or a ring Z/k $(k \geq 2)$ and A^r is the free A-module of rank r. From this result, we

see that $E(K(A^r, n)^{\bigwedge m})$ contains a subgroup isomorphic to $GLr(A)^m Sm$ in many cases.

[m-honma-101-074-01:2016] E. Ganioğlu, H. Fujita, B. Rubio, Y. Fujita, T. Adachi, A. Algora, M. Csatlós, J. M. Deaven, E. Estevez-Aguado, C. J. Guess, J. Gulyás, K. Hatanaka, K. Hirota, M. Honma, D. Ishikawa, A. Krasznahorkay, H. Matsubara, R. Meharchand, F. Molina, H. Okamura, H. J. Ong, T. Otsuka, G. Perdikakis, C. Scholl, Y. Shimbara, G. Susoy, T. Suzuki, A. Tamii, J. H. Thies, R. G. T. Zegers, and J. Zenihiro. High-resolution study of Gamow-Teller transitions in the ^{48}Ti (^{3}He, t) ^{48}V reaction. *Phys. Rev. C*, 93:064326/1–10, 2016.

In this work we have studied $T_z = +2 \rightarrow +1$, Gamow-Teller (GT) transitions in the ^{48}Ti (^{3}He, t) ^{48}V charge-exchange reaction at 140 MeV/nucleon and 0° at the Research Center for Nuclear Physics, Osaka. From the high-resolution facility, consisting of a high-dispersion beamline and the Grand Raiden spectrometer, the spectrum had an energy resolution of 21 keV, among the best achieved. Individual GT transitions were observed and GT strength was derived for each state populated up to an excitation energy of 12 MeV. The total sum of the B(GT) strength observed in discrete states was 4.0, which is 33% of the sum-rule-limit value of 12. The results were compared with the results of shell-model calculations carried out with the GXPF1J interaction. The measured B(GT) distribution was also compared with that obtained in the (^{3}He ,t) charge-exchange reaction on ^{47}Ti. On the assumption of isospin symmetry the β spectrum of the $Tz = -2$ nucleus ^{48}Fe was deduced from the observed spectrum in the ^{48}Ti (^{3}He, t) ^{48}V reaction and this predicted spectrum was compared with the measured one.

[m-honma-101-074-02:2016] C. Loelius, H. Iwasaki, B. A. Brown, M. Honma, V. M. Bader, T. Baugher, D. Bazin, J. S. Berryman, T. Braunroth, C. M. Campbell, A. Dewald, A. Gade, N. Kobayashi, C. Langer, I. Y. Lee, A. Lemasson, E. Lunderberg, C. Morse, F. Recchia, D. Smalley, S. R. Stroberg, R. Wadsworth, C. Walz, D. Weisshaar, A. Westerberg, K. Whitmore, and K. Wimmer. Lifetime measurement of the 4_1^+ state of ^{58}Ni with the recoil distance method. *Phys. Rev. C*, 94:024340/1–7, 2016.

The quadrupole transition rate for the $4_1^+ \rightarrow 2_1^+$ transition of ^{58}Ni was determined from an application of the recoil distance method with the Gamma-Ray Energy Tracking In-beam Nuclear Array (GRETINA). The present result of

the $B(E2; 4_1^+ \to 2_1^+)$ was found to be 50^{+11}_{-6} e^2fm^4, which is about three times smaller than the literature value, indicating substantially less collectivity than previously believed. Shell model calculations performed with the GXPF1A effective interaction agree with the present data and the validity of the standard effective charges in understanding collectivity in the nickel isotopes is discussed.

[m-honma-101-074-03:2016] Kanji Mori1, Michael A. Famiano, Toshitaka Kajino, Toshio Suzuki, Jun Hidaka, Michio Honma, Koichi Iwamoto, Ken'ichi Nomoto, and Takaharu Otsuka. IMPACT OF NEW GAMOWTELLER STRENGTHS ON EXPLOSIVE TYPE IA SUPERNOVA NUCLEOSYNTHESIS. *The Astrophysical Journal*, 833:179–190, 2016.

Recent experimental results have confirmed a possible reduction in the GamowTeller (GT+) strengths of pf-shell nuclei. These proton-rich nuclei are of relevance in the deflagration and explosive burning phases of SNe Ia. While prior GT strengths result in nucleosynthesis predictions with a lower-than-expected electron fraction, a reduction in the GT+ strength can result in a slightly increased electron fraction compared to previous shell model predictions, though the enhancement is not as large as previous enhancements in going from rates computed by Fuller, Fowler, and Newman based on an independent particle model. A shell model parametrization has been developed that more closely matches experimental GT strengths. The resultant electron-capture rates are used in nucleosynthesis calculations for carbon deflagration and explosion phases of SNe Ia, and the final mass fractions are compared to those obtained using more commonly used rates.

[shimizu-101-074-01:2016] Katsutaro SHIMIZU. Proposal for the proper gravitational energy momentum tensor. *Modern physcs Letters A*, A 31, 2016.

We propose a gravitational energy momentum tensor which has been misunderstood for a handred tears.

[sigeru-w-101-074-01:2016] "N. Dobashi, E. Suzuki, and S. Watanabe". "Some polynomials defined by generating functions and differential equations",. *"Cogent Mathematics",*, 2017,.

"The classical special functions have various interesting properties and applications. Some generalizations for them are also considered. For example, the sequence of the Humbert polynomials is a generalization of the sequence of the Legendre polynomials. In this paper, the authors focus on the Humbert

polynomials and the generalized Hermite polynomials, and show that they have deep relations with the generalized hypergeometric functions.",

[tsuchiya-101-074-01:2016] Hiroya Hashimoto and Takahiro Tsuchiya. Stability problems for Cantor stochastic differential equations. *Stochastic Processes and their Applications*, 128(1):211–232, 2018.

Accepted at 4 Apr. 2017. Stochastic Processes and their Applications isknown as a Quality one journal by SJR indicator.

[yamagami-101-074-01:2016] M. Yamagami and K. Matsuyanagi. Soft negative-parity excitations of rotating super- and hyperdeformed states around 40Ca studied by Skyrme-RPA calculations. *RIKEN Accel. Prog. Rep. 49*, 2016.

We investigate low-frequency octupole vibrations of rotating superdeformed (SD) and hyperdeformed (HD) states in 36Ar, 40Ca, and 44Ti. We performed cranked RPA (random phase approximation) calculation using Skyrme energy density functional. We emphasized the role of Nilsson orbits originated from high-j orbits for lowering octupole vibrational excitations at high-spin states. This may indicate instability from vibration to static reflection-asymmetric shape in SD and HD states.

[yamagami-101-074-02:2016] M. Yamagami and K. Matsuyanagi. QRPA calculations with Skyrme energy density functional for rotating unstable nuclei. *RIKEN Accel. Prog. Rep. 50*, 2017.

We have developed a new computer code for the quasiparticle random phase approximation (QRPA) calculations with Skyrme energy density functional. By using this code, we emphasized the role of pairing and collective rotation for K= 0 quadrupole excitations in 34Mg and 36Mg. This is a unique phenomenon that can emerge only in atomic nuclei as finite quantum systems.

Unrefeered proceedings of an academic conference

[kihara-101-074-04:2016] Hiroshi Kihara. Model categories of smooth spaces I. In *Algebraic and Geometric Models of Spaces, Shinshuu University*, 2016.

[kihara-101-074-05:2016] Hiroshi Kihara. Model categories of smooth spaces II. In *Algebraic and Geometric Models of Spaces, Shinshuu University*, 2016.

[tsuchiya-101-074-02:2016] Takahiro Tsuchiya. Stability problems for Cantor stochastic differential equations. In *Seminar of Probability in Fukuoka Univ.*, 2 November 2017.

[tsuchiya-101-074-03:2016] Takahiro Tsuchiya. Cantor diffusion SDEs and its applications. In *The Probability Symposium 2017*, 12 December 2017.

[tsuchiya-101-074-04:2016] Takahiro Tsuchiya. A SDE with locally Holder continuous diffusion coefficients. In *Colloqum at Ritusmeikan University*, 30 December 2017.

Academic society activities

[sigeru-w-101-074-02:2016] "Shigeru Watanabe", 2016-2017,.

"Reviewer : Mathematical Reviews published by the American Mathematical Society",

Advisor for undergraduate research and graduate research

[m-honma-101-074-04:2016] Yuto Hasegawa. Graduation Thesis: A computational study on the Kirkwood gaps, University of Aizu, September 2016.

Thesis Advisor: M. Honma

[m-honma-101-074-05:2016] Taro Susa. Graduation Thesis: A computational analysis of classical scattering problems, University of Aizu, March 2017.

Thesis Advisor: M. Honma

[m-honma-101-074-06:2016] Yuki Tamai. Graduation Thesis: Chaos in a billiard model of the stadium type, University of Aizu, March 2017.

Thesis Advisor: M. Honma

[sigeru-w-101-074-03:2016] "Shota Saito". "Graduation Thesis: Trying to find new functions related to Hermite polynomials",, "University of Aizu",, 2017,.

"Thesis Advisor: S. Watanabe",

[sigeru-w-101-074-04:2016] “Yu Sekimoto”. “Graduation Thesis: New special functions associated with Hermite polynomials”,, “University of Aizu”,, 2017,.

“Thesis Advisor: S. Watanabe”,

[sigeru-w-101-074-05:2016] “Sayuri Tanaka”. “Graduation Thesis: New system of functions related to Hermite polynomials”,, “University of Aizu”,, “Thesis Advisor: S. Watanabe”,.

[sigeru-w-101-074-06:2016] “Fuma Dobashi”. “Graduation Thesis: New special functions related to Legendre polynomials”,, “University of Aizu”,, 2017,.

[sigeru-w-101-074-07:2016] “Yukihiro Matsumoto”. “Master Thesis: Analysis of local and maximum signal based orthogonal polynomials and their applications to image compression”,, “University of Aizu”,, 2017,.

“Thesis Advisor: S. Watanabe”,

[sigeru-w-101-074-08:2016] “Yuya Fujioka”. “Master Thesis: Some differential equations whose general solutions are given by 2F2-type and kFk-1-type hypergeometric functions”,, “University of Aizu”,, 2017,.

“Thesis Advisor: S. Watanabe”,

[yamagami-101-074-03:2016] Kenta Ikeda. Research for population of insect using Logistic map, School of Computer Science and Engineering, March 2017.

Thesis Advisor: M. Yamagami

[yamagami-101-074-04:2016] Tsubasa Watanabe. Theory of charge density measurement using Fourier analysis, School of Computer Science and Engineering, March 2017.

Thesis Advisor: M. Yamagami

Others

[k-asai-101-074-01:2016] Kazuto Asai. Bipartite Chebyshev polynomials and elliptic integrals expressible by elementary functions, 2016.

The article is concerned with polynomials $g(x)$ whose graphs are

Summary of Achievement

Contributions related to syllabus preparation

[k-asai-101-074-02:2016] Preparate syllabi for the following classes: CSC07 Advanced Graph Theory (Graduate School) CSA13 Algebraic Systems and Combinatorics (Graduate School) M06 Complex Analysis F03 Discrete Systems (partial contribution) M01 Linear Algebra I (partial contribution) M08 Applied Algebra (partial contribution)

[kihara-101-074-06:2016] Differential Calculus I

[kihara-101-074-07:2016] Differntial Calculus II

[kihara-101-074-08:2016] Probability and Statistics

[shimizu-101-074-02:2016] I wrote syllabuses of mechanics , electro magnetism and quantum mechanics.

Preparation of course examination to measure comprehension

[k-asai-101-074-03:2016] Preparation for the examinations for the following classes: Complex Analysis, Discrete Systems, Linear Algebra, Applied Algebra.

[yamagami-101-074-05:2016] General admission test and Admission test based on recommendation [Math], Creation of exam problems

[yamagami-101-074-06:2016] General admission test and Admission test based on recommendation [Math], Selection of exam problems

[yamagami-101-074-07:2016] General admission test and Admission test based on recommendation [Math], Scoring

[yamagami-101-074-08:2016] Transfer admission test [Physics], Creation of exam problems

[yamagami-101-074-09:2016] Transfer admission test [Physics], Scoring

Contribution related to the creation of the annual schedule

[k-asai-101-074-04:2016] A contribution to the preparation of the annual schedule of the committees concerning the entrance examinations.

Contribution related to the selection of library or textbook materials

[k-asai-101-074-05:2016] A contribution to the selection of the textbooks or reference books for the following classes: Complex Analysis, Discrete Systems, Linear Algebra, Applied Algebra.

Advisor of a student club or circle

[k-asai-101-074-06:2016] Keion (music circle)

[shimizu-101-074-03:2016] I am a surperviser of a comic club

Other significant contribution toward university planning, management, or administration

[k-asai-101-074-07:2016] Providing great amount of problems to the entrance examination in mathematics. (Approx. 40% of the general entrance examination for 2017) Participate in the committees for the creation and selection of the entrance examination, and also participate in marking of examination papers of the entrance examination.

[t-maeda-101-074-01:2016] A memeber of the steering comittee of PC Koshien, Personal Computer Concurs for High School Students, organized by Fukushima Prefectural Board of Education, Fukushima Prefecture and the University of Aizu.

Contributions related to regional education

[t-maeda-101-074-02:2016] Advisor of SSH (super science highschool) of Aizu Gakuho highschool