

# CURRICULUM VITAE

## *Stepan Douplii*



### PERSONAL INFORMATION

Passport name: **Stepan Douplii**  
Pen/scientific name: **Steven Duplij**  
Cyrillic name: **Степан Анатольевич Дуплий**

#### **Address:**

Center of Information Technology (CIT)  
University of Münster  
48149 Münster  
Germany

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#### **Homepage:**

<https://www.uni-muenster.de/IT.StepanDouplii>

### PERSONAL INFORMATION

Date and place of birth: August 29, 1954, Chernyshevsk, Russia.  
Citizenship: Ukraine. Marital status: married, wife is EU citizen. Nonsmoking.

### DEGREES

- 2002** The academic status of Senior Research Fellow is given by Higher Certifying Commission, Kiev, Ukraine
- 1999** Habilitation Thesis: "*Semigroup Methods in Supersymmetric Theories of Elementary Particles*", Bogolyubov Institute of Theoretical Physics, Kiev, Ukraine,  
Doctor Habilitatus in Theoretical Physics  
(Doctor of Science in Physics and Mathematics)
- 1983** Ph.D. Thesis: "*Theoretical Investigation of Hard Processes in QCD*";
- 1978-1982** Post Graduate Course in Theoretical Physics, Kharkov State University;  
PhD (Candidate of Science in Physics and Mathematics); adviser M.P. Rekalov

### EDUCATION

- 1994-1995** Special German Language Course, Goethe Institute, Mannheim, Germany;  
Distinguished diploma
- 1974-1978** Department of Theoretical Physics, Kharkov State University;  
The Distinguished Diploma in Theoretical Nuclear Physics - M.Sc.
- 1973-1976** Special English Language Course, Kharkov State University;  
The Distinguished Diploma
- 1971-1973** Department of Theoretical Radiophysics, Kharkov State University

## WORK EXPERIENCE

- 2019-now** Scientific Researcher at the Center of Information Technology (CIT),  
Universität Münster, Münster, Germany
- 2016** Lecturer in Mathematics, Bochum University of Applied Sciences, Germany
- 2014-2016** Scientific Researcher at the Mathematisches Institut, Universität Münster,  
Münster, Germany
- 2012** Lecturer in Mathematics, Rutgers University, Piscataway, USA
- 2011-2012** Visiting Fulbright Scholar, Rutgers University, USA
- 2000-2014** Lead Senior Staff Researcher at the Nuclear Physics Laboratory,  
Kharkov National University, Kharkov, Ukraine
- 2000-now** CMS collaboration, CERN, Geneva
- 1997-2000** Senior Staff Researcher at the Nuclear Physics Laboratory,  
Kharkov National University, Kharkov, Ukraine
- 1983-1997** Staff Researcher at the Nuclear Physics Laboratory,  
Kharkov State University, Kharkov, Ukraine
- 1983-1992** Staff Researcher at the Nuclear Physics Laboratory,  
Kharkov State University, Kharkov, Ukraine
- 1978-1983** Half-time Researcher at the Radiophysics Laboratory,  
Kharkov State University, Kharkov, Ukraine

## FELLOWSHIPS & GRANTS

- 2015-2016** European Research Council Grant at University of Münster (Host: J. Cuntz)
- 2010** Alexander von Humboldt Fellowship at University of Münster (Host: J. Cuntz)
- 2011-2012** Fulbright Scholar Program at the Rutgers University,  
Piscataway, USA (Host: G. A. Goldin)
- 2010** Alexander von Humboldt Fellowship at University of Münster (Host: J. Cuntz)
- 2008** Alexander von Humboldt Fellowship at University of Köln (Host: M. Zirnbauer)
- 2007** American Physical Society Travel Grant at John Hopkins University  
(Host: J. Bagger)
- 2005-2006** Alexander von Humboldt Fellowship, University of Münster (Host: J. Cuntz)
- 2004** Simons Foundation Travel Grant (Stony Brook, USA)
- 2001** Alexander von Humboldt Fellowship at Max-Planck-Institute for Dynamics  
and Self-Organization, Göttingen (Host: F. Müller-Hoissen)
- 2001** National Natural Science Foundation of China Grant at Zhejiang University,  
Hangzhou (Host: Fang Li)
- 1994-1997** Alexander von Humboldt Fellowship at the Physics Department,  
University of Kaiserslautern, Kaiserslautern, Germany (Host: W. Rühl)

## SCIENTIFIC PUBLICATIONS

In total: **192** publications, among them 9 books and 183 articles in *Physical Review*, *Journal of Physics*, *Communications in Mathematical Physics*, *Journal of Mathematical Physics*, *Communications in Algebra*, *Semigroup Forum*, *Letters in Mathematical Physics*, *Theoretical and Mathematical Physics*; *Journal of Lie Theory*, *International Journal of Geometric Methods in Modern Physics*, *Linear Algebra and Applications*, etc. Full lists are on the homepage.

**Scientific Books** (available on Amazon, Barnes&Noble, etc.):

1. S. Duplij, R. Vogl, “*Innovative Quantum Computing*”, IOP Publ., Bristol-London, 2023, 178 pp.
2. S. Duplij, “*Polyadic Algebraic Structures*”, IOP Publ., Bristol-London, 2022, 461 pp.
3. S. Duplij and M.L. Walker, eds, “*Selected Topics in Gravity, Field Theory and Quantum Mechanics*”, MDPI Books, Basel, 2022, 348 pp.
4. S. Duplij, “*Exotic Algebraic and Geometric Structures in Theoretical Physics*”, Nova Publishers, New York, 2018, 410 pp.
5. S. Duplij, “*Supersymmetry, Quantum Groups, Multigravity and Singulaer Theories*”, Central West Publ., Australia, 2018, 254 pp.
6. S. Duplij, W. Siegel, and J. Bagger, eds., “*Concise Encyclopedia of Supersymmetry And Noncommutative Structures In Mathematics And Physics*”, Kluwer Academic Publishers, Dordrecht-Boston-London, 2004, 584 pp. (Second printing, Springer Science and Business Media, Berlin- New York-Heidelberg, 2005).
7. S. Duplij and J. Wess, eds., “*Noncommutative Structures in Mathematics and Physics*”, Kluwer, Dordrecht, 2001, 493 pp.
8. S. Duplij and V. G. Zima, eds., “*Supersymmetric Structures in Mathematics and Physics*”, UkrINTI, Kiev, 2000, 262 pp.
9. S. Duplij “*Semisupermanifolds and Semigroups*”, Kharkov: Krok, 2000, 220 pp. (Second Print by CreateSpace Publ.: Charleston, 2013).

## EDITOR EXPERIENCE

**1999-2013** Editor of *Kharkov National University Journal* (Vestnik KSU), ser. Nuclei, Particles and Fields

**2013-now** Editor of *East European Journal of Physics*

**2018** Invited Editor at *World Scientific Publishing Co*

Reviewing:

**1998-now** *Zentralblatt Mathematik*, Karlsruhe-Berlin, Germany

**2005-now** *Journal of Zhejiang University. Science*, Hangzhou, China

**2007-now** AIP, Melville, USA

**2010-now** *Reports of Mathematical Physics*, Warsaw, Poland  
**2012-now** *Advances in Mathematical Physics*, New York, USA  
**2016-now** *Modern Physics Letters A*, World Scientific, Singapore  
**2017-now** *International Journal of Modern Physics B*, World Scientific, Singapore  
**2014-now** *Advances in Applied Clifford Algebras*, Springer, Heidelberg, Germany  
**2015-now** *Hindawi Publishing Co.*, London, UK  
**2018-now** *Symmetry*, Basel, Switzerland

## LECTURE COURSES

Calculus  
Elementary Particle Physics  
Quantum chromodynamics  
Unified theories  
Supersymmetry and supergravity

## SUPERVISION

5 students received Distinguished M.Sc. Degree in Theoretical Physics  
4 PhD students

## PROFESSIONAL MEMBERSHIPS

**2014** RUSSIAN UNION OF WRITERS (Moscow, Russia)  
**2008** AMERICAN PHYSICAL SOCIETY (College Park, MD)  
**2002** ALEXANDER VON HUMBOLDT CLUB Ukraine  
**1995** AMERICAN MATHEMATICAL SOCIETY (Providence, RJ)  
**1994** INTERNATIONAL ASSOCIATION OF MATHEMATICAL PHYSICS  
(Cambridge, MA)  
**1993** ENGLISH INTERNATIONAL ASSOCIATION (Lund, Sweden)  
**1993** AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE  
(Washington, DC)  
**1992** EUROPEAN PHYSICAL SOCIETY (Geneva, Switzerland)  
**1999** INTERNATIONAL MATHEMATICAL UNION (IAS, Princeton)

## LISTED

World Directory Of Mathematicians  
Marques Who Is Who In America  
Encyclopedia of Modern Ukraine  
Mathematical Portal (Math-Net)  
MathSciNet (American Mathematical Society)  
Academic Genealogy of Theoretical Physicists

Mathematics Genealogy Project  
Wikipedia (UA)  
Google Scholar  
Microsoft Academics  
Scopus  
Semantic Scholar  
MathSciNet (Author)  
MathNet  
ZMath  
ORCID  
Scopus  
SciProfiles

## CONFERENCE ORGANIZING

**2017** December Workshop *Supergeometry And Applications* (Luxembourg),  
as a member of Advisory Board

**2005** June-International Workshop “*Pseudo-Hermitian Hamiltonians  
in Quantum Physics*”, as a member of Advisory Board

**2000** September-NATO Advanced Research Workshop “*Noncommutative Structures in  
Mathematics and Physics*”, as a Partner Country Co-Director  
(NATO Co-Director: Julius Wess)

## CONFERENCE PARTICIPATION

Participated at numerous international conferences, workshops, schools and seminars  
in USA, Germany, France, UK, Poland, Spain, Czech Republic, Russia, China, Ukraine.

**2017** December Workshop *Supergeometry And Applications* (Luxembourg)

**2016** January Workshop *Banach Methods In Noncommutative Geometry* (Münster,  
Germany)

**2015** April Workshop *Structure And Classification Of  $C^*$ -Algebras* (Münster, Germany)

**2015** April Workshop *Structure And Classification Of  $C^*$ -Algebras* (Münster, Germany)

**2014** May Workshop *Quantum groups and operator algebras* (Münster, Germany)

**2011** August 3rd International Conference *Quantum Electrodynamics And Statistical  
Physics* (Kharkov, Ukraine)

**2010** June 26th Workshop *Foundations And Constructive Aspects Of QFT* (Münster,  
Germany)

**2010** May *Analytic And Algebraic Methods In Physics VI* (Prague, Czech Republic)

**2009** October *Algebra, Geometry, And Mathematical Physics* (Bedlewo, Poland)

**2009** September *The Fourth International Conference On  $p$ -Adic Mathematical Physics*  
(Hrodna, Belarus)

**2009** June *Symmetry In Nonlinear Mathematical Physics* (Kiev, Ukraine)

**2009** May *Analytic And Algebraic Methods V* (Prague, Czech Republic)

**2008** December 100th *Statistical Mechanics* Conference (Rutgers, USA)  
**2008** July Summer School And Conference On *Modern Mathematical Physics* (Belgrade, Serbia)  
**2007** May 97th Statistical Mechanics Conference (Rutgers, USA)  
**2004** July-August Simons Workshop In Mathematics And Physics (Stony Brook, USA)  
**2001** July XV Max Born Symposium *Schroedinger Operators, Random Potentials And Singular Perturbations* (Wroclaw, Poland)  
**2000** July International Conference On *Supersymmetry And Quantum Field Theory* 75th Birthday of D. V. Volkov (Kharkov, Ukraine)  
**1999** July International Conference On Supersymmetry And Quantum Symmetries in the memory of V. I. Ogievetsky (Dubna, Russia)  
**1999** July International Conference *Strings-99* (Potsdam, Germany)  
**1999** August International Conference On *Quantum Gravity And Superstrings* (Dubna, Russia)  
**1998** August *International Congress Of Mathematicians* (Berlin, Germany)  
**1997** January International Seminar On *Supersymmetry And Quantum Field Theory* in memory of D. V. Volkov (Kharkov, Ukraine)  
**1996** June *Supersymmetry-96* (College Park, MD, USA)  
**1996** June International Conference On *Higher Homotopy Structures In Mathematical Physics* (Poughkeepsie, NY)  
**1995** June Cracow *School Of Theoretical Physics* (Zakopane, Poland)  
**1995** July International Conference *On Gauge Theories, Applied Supersymmetry And Quantum Gravity* (Leuven, Belgium)  
**1995** July European School Of *Group Theory* (Valladolid, Spain)  
**1994** July International Congress On *Mathematical Physics* (Paris)  
**1993** June First Carribean Spring School Of *Mathematics And Theoretical Physics* (Saint-Francois, Guadeloupe)

## VISITS & TALKS (outside FSU)

**2018**

Tianjin, China (Chern Inst. Math.)-*Chi-Keung Ng*

Harbin, China (Harbin Eng. Univ.)-*Qiang Guo, Zheng Yu*

**2017**

Luxembourg (Math. Research Unit)-*N.Poncin*

**2016**

Jena, Germany (Inst. Math.)-*D.Lenz*

**2014**

Münster, Germany (Inst. Math.)-*J. Cuntz, W. Werner, R. Wulkenhaar*

Salerno, Italy (Univ. Salerno, Math. Dept.)-*C.Delizia*

**2012**

Davis, USA (UC, Math. Dept.)-*M. Mulase, A. Schwarz*

Riverside, USA (UC, Math. Dept.)-*M.Lapidus*

Honolulu, USA (Univ. Hawaii, Phys. Dept.)-*X. Tata*  
Syracuse, USA (Univ. Syracuse, Phys. Dept.)-*K. Wali*  
Medford, USA (Tufts Univ., Inst. Cosmology)-*A. Vilenkin*  
Boston, USA (Northeastern Univ., Math. Dept.)-*A. Martsinkovsky*  
Hangzhou, China (Zhejiang Univ., Math. Dept.)-*Fang Li*  
Nanchang, China (Nanchang Univ.)-*Jiejing Cheng*

**2011**

Chicago, USA (UIC, Math. Dept.)-*L. Kauffman*  
Minneapolis, USA (Univ. Minnesota, Phys. Dept.)-*M. Shifman*  
Philadelphia, USA (UPenn, Math. Dept.)-*J. Stasheff*  
Piscataway, USA (Rutgers, Math. Dept.)-*G.A. Goldin*  
Argonne, USA (ANL, HEP Division)-*C. Zachos*  
New York, USA (CUNY Graduate Center, Math. Dept.)-*A. Douglas*

**2010**

Münster, Germany (Inst. Math.)-*J. Cuntz, W. Werner,*  
Heidelberg, Germany (Inst. Theor. Phys.)-*G. Wolschin, J. Kupsch,*  
Wien, Austria (ESI, Univ.)-*H. Grosse,*  
Prague, Czech. Rep. (Inst. Nucl. Phys., Rez)-*M. Znojil,*  
Wien, Austria (Inst. Theor. Phys., TUW)-*D. Grumiller,*  
Padova, Italy (Inst. Nucl. Phys.)-*M. Tonin,*  
Naples, Italy (Inst. Phys.)-*G. Esposito,*  
Florence, Italy (Inst. Nucl. Phys.)-*R. Casalbuoni, L. Lusanna,*  
Rome, Italy (Inst. Theor. Phys.)-*M. Bianchi*

**2009**

Warsaw, Poland (Inst. Math.)-*S. Woronowicz, P. Urbanski,*  
Lodz, Poland (Univ.)-*B. Broda,*  
Wroclaw, Poland (Inst. Theor. Phys., IFT)-*J. Lukierski,*  
Zielona Gora, Poland (Inst. Phys., IF)-*M. Dudek,*  
Szczecin, Poland (Inst. Phys., IF)-*M. Dabrowski,*  
Krakow, Poland (Inst. Phys., IF)-*H. Arodz,*  
Prague, Czech. Rep. (Inst. Math.)-*B. Burgstaller*  
Potsdam, Germany (AEI)  
Dresden, Germany (Forschungszentrum Dresden-Rossendorf)-*U. Günther*

**2008**

Piscataway, USA (Rutgers Univ.)-*G. Goldin,*  
Medford, USA (Tufts Univ.)-*A. Vilenkin,*  
Cambridge, USA (MIT)-*E. Lomon,*  
New York, USA (CUNY)-*S. Catto,*  
Köln, Germany (Inst. Theor. Phys.)-*M. Zirnbauer,*  
Belgrade, Serbia (Inst. Phys., IF)-*B. Dragovich,*  
Nic, Serbia (Inst. Phys.)-*M. Ciric,*  
Trieste, Italy (SISSA)-*L. Bonora,* Bielefeld, Germany (Univ.)-*C. Ringel,*  
Bonn, Germany (Phys. Inst.)-*V. Rittenberg*

**2007**

Princeton, USA (Inst.Adv.Study)-*S. Adler*,  
Chicago, USA (Univ.Illinois,UIC)-*L. Kauffman*,  
Medford, USA (Tufts Univ.)-*A. Vilenkin*,  
Cambridge, USA (MIT)-*E. Lomon*,  
Baltimore, USA (John Hopkins Univ.)-*J. Bagger*,  
Philadelphia, USA (Univ. Penn.)-*J. Stasheff*

**2006**

Münster, Germany (Inst. Math.)-*J. Cuntz*,  
Bielefeld, Germany (Univ.)-*C. Ringel* **2004**  
Princeton, USA (Inst. Adv. Study)-*S. Adler*,  
Baltimore, USA (John Hopkins Univ.)-*J. Bagger*,  
Stony Brook, USA (SUNY, YITP)-*W. Siegel*,  
Minneapolis, USA (Inst. Theor. Phys.,FTPI-UMN)-*M. Shifman*,  
Krakow, Poland (Jagellonian Univ.)

**2003**

Wroclaw, Poland (Inst. Theor. Phys.,IFT)-*W. Marcinek, J. Lukierski*

**2001**

Göttingen, Germany (ISF)-*F.Müller-Hoissen*,  
Hangzhou, China (Zhejiang Univ.)-*F. Li*,  
Shanghai, China (Inst. Phys.)-*Y.-L. Xu*,  
Wroclaw, Poland (Inst. Theor. Phys., IFT)-*W. Marcinek, , J. Lukierski*  
Prague, Czech. Rep. (CTU)-*C. Burdik*  
Rez, Czech. Rep. (Inst. Nucl. Phys.,NPI)-*M. Znojil*,  
Mannheim, Germany (Univ.)-*M.Schlichenmaier*

**2000**

Warsaw, Poland (Inst. Math.)-*J. Okninski*,  
Wroclaw, Poland (Inst. Theor. Phys., IFT) -*W. Marcinek, J. Lukierski*

**1999** Potsdam, Germany (AI)

**1998** Berlin, Germany (HMI)-*W. Von Oertzen*,

Berlin, Germany (Tech. Univ.),

Krakow, Poland (Inst. Nucl. Phys.)

**1994-1996**

Kaiserslautern, Germany (Univ.)-*W.Rühl*

**1994**

St.Andrews, UK (Univ.)-*J. Howie*

Orsay, France (Inst. Nucl. Phys.)-*A. Comtet*

**1993**

München, Germany (Max-Planck-Inst. für Physik)-*J.Wess*,

Lyon, France (Inst. Phys.)

Kaiserslautern, Germany (Univ.)-*W.Rühl*



## RESEARCH INTERESTS

**Supersymmetry** and semigroups; supermatrix models; superconformal symmetry; super Riemann surfaces; exotic supermanifolds; supersymmetric quantum mechanics.

**Quantum groups** and supergroups; weak Hopf algebras and Yang-Baxter equation; representations of quantized algebras, new actions of quantum algebras on quantum spaces.

**Quantum computing and quantum information.**

**Polyadic algebraic structures**, algebras, groups, fields, and their representations.

**Nonlinear methods** in (super)electrodynamics, Yang-Mills, gravity and multigravity.

**Constrained systems and gauge theories**, quantum chromodynamics and gravity.

**Exactly solvable quantum field theory models**, matrix models, numerical methods.

Secondary:

Symmetries of genetic code and visualization of DNA sequences;

Helicity formalism in quantum chromodynamics;

Polarization phenomena in low energy nuclear physics;

Rutherford backscattering method in ion implantation;

Nonstationary radio noise.

## SCIENTIFIC RESULTS AND INNOVATIVE IDEAS

with direct links to articles

- A new direction in **supersymmetric models** of elementary particles, based on the inclusion of semigroups is proposed ([book](#), [thesis](#)). The concept of [semisupermanifold](#) having noninvertible transition functions (satisfying higher von Neumann regularity) is introduced, and its deviation from being an ordinary manifold is given by a newly defined variable, *obstructedness*. Based on this idea, the novel notions of *category regularization*, [regular topos](#), [regular functor](#), [higher regular braiding](#), [regular Yang-Baxter equation and regular module](#), [regular algebra and coalgebra](#), [regular graded algebras](#) are presented, and their [role in topological quantum field theory](#) is outlined. Even- and odd-reduced supermatrices are introduced and considered on a par, being complementary in terms of the newly obtained [Berezinian addition formula](#), and are unified into a kind of ["sandwich" semigroup](#). A special subset of odd-reduced supermatrices represent [higher order rectangular bands](#) for which new generalized ["fine" Green's relations and egg-box diagrams](#) are constructed. [One-parameter semigroups of idempotent odd-reduced supermatrices](#) and corresponding superoperator semigroups are introduced and studied by the new *semigroup  $\times$  semigroup method*. The linear idempotent superoperators and exponential superoperators are mutually dual in some sense, and the first gives rise to an additional noninvertible [non-exponential solutions to the initial Cauchy problem](#). A novel [permanent-determinant symmetry](#) is found for even complex superplane. It is shown that the corresponding counterparts (*per analogs*) of the cross ratio, distance and harmonic set are invariant under the introduced

per mapping, a special noninvertible subset of the fractional linear transformation. The per analogs of the Laguerre formula for distance and Schwarzian derivative are presented. An additional superextension of complex structure is uncovered, which is noninvertible and can correspond to another (odd) superanalog of Riemann surfaces and to the counterpart of superconformal-like transformations which twist the parity of tangent space and their nonlinear realization, which together with the ordinary ones form the superconformal semigroup having special unusual properties. A unique formula connecting berezinian, permanent and determinant is obtained. From a physical viewpoint, the above conceptions can lead to semistatistics, being von Neumann regular analog of the ordinary statistics.

- **Quantum groups:** a generalization of the Hopf algebra is introduced by relaxing the requirement for inverses of the generators of the Cartan subalgebra, which leads to a regular quasi-R-matrix structure. The classification of 6-vertex constant solutions to Yang-Baxter equation over Grassmann algebra is presented, including noninvertible ones which correspond to *von Neumann regular R-matrix*. The actions of universal enveloping quantum algebras on quantum planes (also of arbitrary dimension) are found. A novel double-graded quantum superplane and corresponding double-graded Hopf algebra are presented.
- **Singular theories** with degenerate Lagrangians are formulated without involving constraints using Clairaut equation theory and the corresponding generalized Clairaut duality. A new *antisymmetric bracket* (an analogue of the Poisson bracket) describing the time evolution of singular systems is built. A novel partial Hamiltonian formalism is constructed. It is shown that a singular theory can be interpreted as the multi-time dynamics.
- **Nonlinear gauge theories:** a generalized approach to nonlinear classical electrodynamics and supersymmetric electrodynamics is suggested, which takes into account all possible types of media and nonlocal effects, and is described in both Lagrangian and non-Lagrangian theories. First steps in the formulation of a general nonlinear conformal-invariant electrodynamics based on nonlinear constitutive equations and conformal compactification were made.
- **Gravity:** constitutive equations for nonlinear gravito-electromagnetism and an exact form of the Maxwell gravitational field equations are obtained. A general approach to describing the interaction of multi-gravity models in space-times of arbitrary dimension is formulated. The gauge gravity vacuum is investigated in the constraintless Clairaut-type formalism (as in QCD). A special fermionic lineal gravity model which differs from standard supersymmetry is presented.
- **Quantum computing** (book IOP, FrontMatter): a new conception of quantum computing which incorporates an additional kind of uncertainty, vagueness/fuzziness, by introducing a new "obscure" class of qudits/qubits, is announced. A superqubit theory in super-Hilbert space is reconsidered, and a new kind of superqubit carrying odd parity is introduced. A new kind of quantum gates, namely higher braiding gates, is suggested,

which lead to a special type of multiqubit entanglement that can speed up key distribution and accelerate various algorithms. A novel visualization of quantum walks in terms of newly defined objects, [polyanders](#), is also proposed.

- **Polyadic structures** ([book IOP](#), [FrontMatter](#)): [polyadization](#), i.e. exchanging binary operations with higher arity ones, is proposed as a general new approach to the algebraic structures used in physics. A new form of the Hosszu-Gluskin theorem (giving the general shape of  $n$ -ary multiplication by the chain formula) in terms of polyadic powers is given, and its ["q-deformed" generalization](#) is found using the newly introduced [quasi-endomorphism](#). A polyadic analog of homomorphism, or [heteromorphism](#), a mapping between algebraic structures of different arities, is introduced, which leads to the definition of a new kind of  $n$ -ary group representation, [multiplace representations, as well as multiactions](#) and a [polyadic direct product](#).

The [arity invariance principle](#), a manifest expression of algebraic structure in terms of operations independent of their arities, is claimed. The relations of the von Neumann regular semigroups and the Artin braid group were found, and a higher arity generalization gave the [polyadic-binary correspondence](#), which allowed the definition of the following new structures: [higher braid groups](#), [higher degree analogs of Coxeter group and Artin braid group](#). The following were also uncovered: unusual [polyadic rings and fields](#) (which can, remarkably, be zeroless and nonunital) having addition and multiplication of different arities, [polyadic integer numbers](#) and [p-adic integers](#), [polyadic convolution products](#) having multiplication and comultiplication of different arities and their corresponding [polyadic Hopf algebra](#) and  $n$ -ary  $R$ -matrix, [polyadic multistar adjoints](#) and [polyadic operator  \$C^\*\$ -algebras and Cuntz algebras](#). The [polyadic analogs of the Lander–Parkin–Selfridge conjecture and Fermat's Last Theorem](#) were formulated.

It is proposed that mediality as a principle is more natural, unique and universal than commutativity in generalizing the latter to  $n$ -ary algebras (in the binary case commutativity directly follows from mediality). This is called the [commutativity-to-mediality ansatz](#), which is [applied](#) to obtain [almost medial  \$n\$ -ary graded algebras](#), a new kind of tensor categories, [polyadic nonunital "groupal" categories with "quertors"](#) (analog of querelements in  $n$ -ary groups), ["medial" tensor categories and querfunctors](#). A principally new mechanism of additional ["continuous noncommutativity"](#), governed by a special ["membership deformation" of commutativity](#) for algebras with the underlying set as obscure/fuzzy set, is introduced. Using the membership deformation factor together with the ordinary graded commutation factor, the almost commutative graded ( $n$ -ary) algebras and Lie algebras with [double commutativity](#) are obtained, and their projective representations are studied.

As a first step towards a the [polyadic algebraic  \$K\$ -theory](#), the [Grothendieck construction](#) of the completion group for a monoid is generalized to the case, where both are of different, higher arities. As opposed to the binary case, an identity is not necessary for the initial  $m$ -ary semigroup to obtain a class  $n$ -ary group, which in turn need not contain an identity.

- A new (infinite) class of division algebras, the [\*hyperpolyadic algebras\*](#), which correspond to the (only 4) binary division algebras R, C, H, O (reals, complex numbers, quaternions, octonions) are defined. A [\*polyadic analog of the Cayley-Dickson construction\*](#) is proposed, and a novel iterative process gives "*half-quaternions*" and "*half-octonions*". [\*New polyadic algebras with higher brackets\*](#) which have (as opposed to *n*-ary Lie algebras) different arity from the initial *n*-ary algebra multiplication, are introduced. The *sigma matrices and the Pauli group* are [\*generalized to higher arities\*](#). Using them, a toy model of one-dimensional supersymmetric quantum mechanics was constructed, as a first example of [\*polyadic supersymmetry\*](#), which is specially extended in a way different from the [\*new multigraded SQM\*](#) previously proposed.
- **DNA theory:** a new characteristic of nucleotides, the [\*determinative degree\*](#), which is proportional to the dipole moment and the weight of hydration site, is unveiled. The physical characteristics of nucleotides such as [\*dipole moment, heat of formation and energy of the most stable formation\*](#) are newly computed by advanced methods. The concept of a [\*triander\*](#) is set up, which leads to a new method of visual sequence analysis and identification using [\*DNA walk diagrams\*](#).

## SPECIAL SKILLS

**Languages:** English (perfect), German (speaking), Russian (native), Ukrainian (native), Italian (basic).

**Programming:** Perl, Mathematica, Maple, LaTeX, BibTeX, HTML.

**PC platforms:** MS-DOS, Windows, Unix, Linux.

**PC software:** Scientific Work Place, dBase, Adobe products, Microsoft Excel, Word, Photoshop, Dreamweaver, PowerPoint.

## MASS MEDIA & SOCIAL LIFE

TV programs and interviews at the Kharkov TV studios.

Scientific program "Logos" (interviews at the Central Kharkov radio station).

Articles about S. Duplij: in USA (SCOOP USA, Gazette, Library of Congress); in Germany, in Ukrainian press.

Alexander von Humboldt Fellows meetings/workshops.

## LITERARY & MUSICAL ACTIVITY

Writing poetry and short stories

More than 200 publications in USA/UK professional literary magazines in English, German, French, Spanish, etc. (the full list is on homepage).

**Literary books** (available on Amazon, Barnes&Noble, etc.):

1. S. Duplij, "*Poephysics of Spirit*" (prose, bilingual English/Russian), 2023 Lysestrah Press, USA, 372 pp.
2. S. Duplij, "*Poephysik der Seele*" (prose in German), 2023 Woodbridge Press, Toronto, 268 pp.
3. S. Duplij, "*Symmetry of Passion*" (U.S. Edition, full collection of poems and translations, in Russian) 2022, Cross-Cultural Communications, New York, 500 pp.
4. S. Duplij, "*Poetification of the Soul*" (poems in English), 2020 Lysestrah Press, USA, 168 pp.
5. S. Duplij, "*Bosonization of Feelings*" (poems and prose in Russian), 2019 Central West Publ., Australia, 232 pp.
6. S. Duplij, "*Supermanifold of Life*" (poems and prose in 9 languages), 2014 Trilingual Press, Cambridge, USA, 222 pp.
7. S. Duplij, "*Dash-Dotted*" (poems, bilingual English/Russian), 2014 Trilingual Press, Cambridge, USA, 356 pp.
8. S. Duplij, "*In Cry*" (poems, bilingual English/Russian), 1999 Mitez, Kharkov, Ukraine, 72 pp.
9. S. Duplij, "*Angel*" (poems in English), 1997 JVC Books, Arcadia FL, USA, 125 pp.

Playing guitar and composing songs

CD audio albums of songs (for mp3's see homepage old):

"*Blitz*" (Heidelberg, 1995)

"*Motifs of years*" (Heidelberg, 1996)

"*Supermanifold of life*" (Houston, 2007)

MC audio album of songs:

"*Blitz*" (GEMA, Berlin, 1996)