Transilvania University of Brașov
INTERDISCIPLINARY DOCTORAL SCHOOL

ADMISSION TO DOCTORAL STUDIES **Session September 2024**

Field of doctoral studies: Mathematics

Doctoral supervisor: Assoc. Prof. Dr. Nicoleta VOICU

TOPICS FOR THE ADMISSION TO DOCTORAL STUDIES

TOPIC 1: *Finslerian geometric models of gravity*
Contents / Main aspects to be considered - Finsler and Lorentz-Finsler geometry. - Calculus of variations on manifolds. - Finslerian extensions of general relativity, comparisons with general relativity.
Recommended bibliography: 1. D. Bao, S. S. Chern, and Z. Shen, An Introduction to Riemann-Finsler Geometry, Springer, New York, 2000. 2. I. Bucataru, R. Miron, Finsler-Lagrange Geometry: Applications to Dynamical Systems, Ed. Acad. Romane, 2007. 3. J. Ehlers, General-Relativistc Kinetic Theory of Gases, Springer, Berlin, Heidelberg, 2011, pp. 301–388. 4. M. Hohmann, C. Pfeifer, N. Voicu, Relativistic kinetic gases as direct sources of gravity, Physical Review D 101, 024062 (2020).
Prerequisites / Remarks: *- Riemannian geometry;* *- Elements of Finsler geometry;* *- calculus of variations;* *- general relativity.*
X Scientific Doctorate (full-time only)
X without tuition fee (state budget funded) **X with tuition fee or with funding from other sources than the state budget**

TOPIC 2: *Conformal symmetries and isometries of Finsler spacetimes*

Contents / Main aspects to be considered

- Geometry of Finsler spacetimes, specific features of Lorentzian signature.
- Conformal and isometry groups.
- Cosmologically symmetric Finsler spacetimes and applications.

Recommended bibliography:

1. D. Bao, S. S. Chern, and Z. Shen, An Introduction to Riemann-Finsler Geometry, Springer, New York, 2000.
2. I. Bucataru, R. Miron, Finsler-Lagrange Geometry: Applications to Dynamical Systems, Ed. Acad. Romane, 2007.
3. A. Onishchuk, R. Sulanke, Projective and Cayley-Klein Geometries, Springer, Berlin/Heidelberg, Germany, 2006.
4. O. Piatella, Lecture Notes in Cosmology, Springer, 2018.
5. M. Hohmann, C. Pfeifer, N. Voicu, Cosmological Finsler spacetimes, Universe 6 (5), 65 (2020).

Prerequisites:

- Riemannian geometry;
- elements of Finsler geometry;
- general relativity.

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TOPIC 3: *Hamiltonian geometry with applications to extended gravity theories*

Contents / Main aspects to be considered

- dual Finsler and Hamilton geometries;
- Hamiltonian formalism in mechanics and field theory, associated geometric structures;
- applications of dual Finsler geometry in quantum gravity phenomenology.

Recommended bibliography:

1. I. Bucataru, R. Miron, Finsler-Lagrange Geometry: Applications to Dynamical Systems, Ed. Acad. Romane, 2007.
2. R. Miron, D. Hrimiuc, H. Shimada, S. Sabau, The Geometry of Hamilton and Lagrange Spaces, Springer, 2002.
3. M. de Gosson, Symplectic Geometry and Quantum Mechanics, Birkhäuser Verlag, Basel, 2006.
4. D. Raetzel, S. Rivera, F. P. Schuller, Geometry of physical dispersion relations, Physical Review D 83:044047 (2011).

Prerequisites:

- Riemannian geometry;
- elements of Finsler geometry;
- calculus of variations, Lagrangian and Hamiltonian mechanics.

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Doctoral supervisor,

Assoc. Prof. Dr. Nicoleta VOICU.

Signature

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Coordinator of the field of doctoral studies,

Prof. dr. Radu PĂLTÂNEA

Signature

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