XI School on Geometry and Physics

27 June — 1 July 2022

1. **Daniel BELTIŢĂ** — *Institute of Mathematics "Simion Stoilow" of the Romanian Academy, Romania*

   Quantization and enveloping algebras of Lie groups

   We discuss associative algebras whose representations can be used for parameterizing the representations of a given Lie group, with emphasis on the algebra of invariant differential operators and on the group C^*-algebra. Special attention is paid to the question of whether certain Lie groups can be recovered from their corresponding associative algebras. We also consider the way these associative algebras are related to the canonical Poisson structures on the dual spaces of the Lie algebras under consideration, which bears on the construction of Lie group representations by the method of geometric quantization.

2. **David FERNÁNDEZ** — *CINVESTAV, Mexico*

   Supersymmetric quantum mechanics and Painlevé equations

   In the first lecture we will make a brief overview of supersymmetric quantum mechanics (SUSY QM), as a tool for generating new exactly solvable potentials departing from a given initial one. We will illustrate the technique with the harmonic and radial oscillators. In the second lecture we will address the polynomial Heisenberg algebras (PHA), and the way the SUSY partners of the harmonic and radial oscillators realize the even and odd degree PHA respectively. We will explore as well the most general systems ruled by the second and third degree PHA, and the way these systems connect with the Painlevé IV (PIV) and V (PV) equations respectively. Finally, in the third lecture we will discuss and algorithm for generating solutions of the PIV and PV equations departing from the harmonic and radial oscillators respectively.

   References

   [1] J.M. Carballo, D.J. Fernandez, J. Negro, L.M. Nieto, Polynomial Heisenberg algebras, J. Phys. A: Math. Gen. 37 (2004) 10349-10362

   [2] D. Bermudez, D.J. Fernandez, Supersymmetric quantum mechanics and Painlevé IV equation, SIGMA 7 (2011) 025

   [3] D. Bermudez, D.J. Fernandez, Supersymmetric quantum mechanics and Painlevé equations, AIP Conf. Proc. 1575 (2014) 50-88

   [4] D. Bermudez, D.J. Fernandez, J. Negro, Solutions to the Painlevé V equation through supersymmetric quantum mechanics, J. Phys. A: Math. Theor. 49 (2016) 335203

3. **Mikołaj ROTKIEWICZ** — *Uniwersytet Warszawski, Poland*

   On some concepts in the theory of Lie algebroids

   Talk 1:

   1. Examples of Lie groupoids and Lie algebroids

2. Lie functor: groupoid — algebroid correspondence

Talk 2:

3. de Rham differential and supergeometry (Vaintrob's theorem)

4. Lie bialgebroids (D. Roytenberg's approach) and double Lie algebroids (T. Voronov's approach)

Talk 3:

5. Higher order analogues of Lie algebroids — comorphism approach to Lie algebroids

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Monday, June 27

LECTURES 09:30–12:40

09:30–10:20 *Supersymmetric quantum mechanics and Painlevé equations*
David FERNÁNDEZ, CINVESTAV, Mexico

10:20–10:50 Coffee break

10:50–11:40 *Quantization and enveloping algebras of Lie groups*
Daniel BELTIŢĂ, Institute of Mathematics "Simion Stoilow" of the Romanian Academy, Romania

11:50–12:40 *Quantization and enveloping algebras of Lie groups*
Daniel BELTIŢĂ, Institute of Mathematics "Simion Stoilow" of the Romanian Academy, Romania

Tuesday, June 28

LECTURES 09:30–12:40

09:30–10:20 *Quantization and enveloping algebras of Lie groups*
Daniel BELTIŢĂ, Institute of Mathematics "Simion Stoilow" of the Romanian Academy, Romania

10:20–10:50 Coffee break

10:50–11:40 *On some concepts in the theory of Lie algebroids*
Mikołaj ROTKIEWICZ, Uniwersytet Warszawski, Poland

11:50–12:40 *Supersymmetric quantum mechanics and Painlevé equations*
David FERNÁNDEZ, CINVESTAV, Mexico

Wednesday, June 29

LECTURES 09:30–12:40

09:30–10:20 *On some concepts in the theory of Lie algebroids*
Mikołaj ROTKIEWICZ, Uniwersytet Warszawski, Poland

10:20–10:50 Coffee break

10:50–11:40 *Quantization and enveloping algebras of Lie groups*
Daniel BELTIŢĂ, Institute of Mathematics "Simion Stoilow" of the Romanian Academy, Romania

11:50–12:40 *Supersymmetric quantum mechanics and Painlevé equations*
David FERNÁNDEZ, CINVESTAV, Mexico

Thursday: Excursion

Friday, July 1

LECTURES 09:30–11:40

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David FERNÁNDEZ, CINVESTAV, Mexico

10:20–10:50 Coffee break

10:50–11:40 *On some concepts in the theory of Lie algebroids*
Mikołaj ROTKIEWICZ, Uniwersytet Warszawski, Poland