

# FUTURE RESEARCH

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## 1. INTRODUCTION

The problem of determining if a given Lie algebra admits a symplectic structure remains difficult in general and the picture seems far from complete. Only some classifications in low dimensions and some special cases in higher dimensions are known. (See [1] and references within). I want to advance the understanding of symplectic Lie algebras and to obtain more classification results. In particular we have the following problems.

## 2. FUTURE PROBLEMS

**2.1. Completing the classification of presymplectic structures on almost abelian Lie algebras.** In a paper in preparation, we obtained a classification for the presymplectic forms of maximal rank. Extend the result to presymplectic forms of any rank.

**2.2. Understanding the geometry of the moduli space of symplectic structures on almost abelian Lie algebras.** Our method for studying left-invariant symplectic forms is based on the study of the moduli space of nondegenerate 2-forms. This is the orbit space of certain action and is a pseudo-Riemannian symmetric space. We found a nice description of this space this space, but its geometry is still not clear. We want for example to investigate if symplectic forms correspond to distinguished orbits in this space.

**2.3. Classification of left-invariant symplectic structures in other other cases.** In low dimensions only the classification of the 4 dimensional case is complete. For six dimensional solvable Lie algebras only a partial classification is known. We would like to apply our method to complete this classification. Also we would like to explore other interesting higher dimensional cases.

## REFERENCES

- [1] Baues, O. and Cortés, V. : *Symplectic Lie groups*. Astérisque 379 (2016).
- [2] Castellanos Moscoso, L. P.: *Left-invariant symplectic structures on diagonal almost abelian Lie groups*. Hiroshima Math. J. 52 (3) 357–378 (2022).
- [3] Castellanos Moscoso, L. P. and Tamaru, H.: *A classification of left-invariant symplectic structures on some Lie groups*. Beitr Algebra Geom.(2022).  
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