

# Large-Scale Numerical Investigations into the Dynamics of Nonlinear Classical Systems

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May 12, 2019

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# Outline

Introduction

Numerical simulations

Conclusions

# Acknowledgements

- I would like to thank A.I. Nicolin, and V. Băran for helping and motivating me.
- The author has been supported by PN-III-P4-ID-PCE-2016-0792.
- All numerical simulations were performed on the computing cluster of Department of Computational Physics and Information Technologies, “Horia Hulubei” National Institute for Physics and Nuclear Engineering.

# Introduction

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# The model

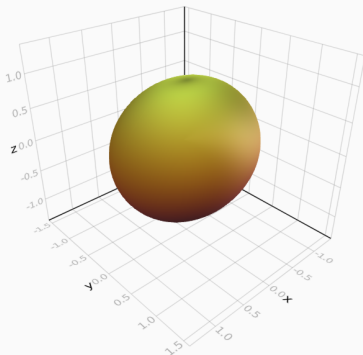
- The physical system that we model is the surface of heavy nuclei.
- The Hamiltonian describes the constrained motion of the vibrational quadrupole degrees of freedom of nuclear surface.

# The model

The Hamiltonian of the system

$$H = \frac{A}{2} (p_0^2 + p_2^2) + \frac{A}{2} (q_0^2 + q_2^2) + \frac{B}{\sqrt{2}} q_0 (3q_2^2 - q_0^2) + \frac{D}{4} (q_0^2 + q_2^2)^2$$

- Harmonic oscillator part
- Integrable part
- Non-integrable term

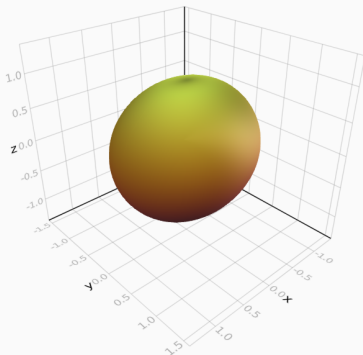


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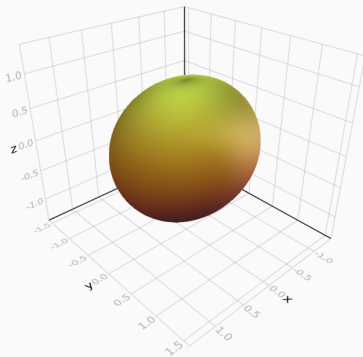


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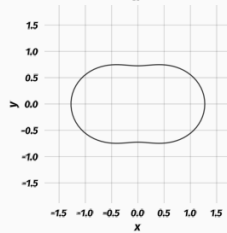
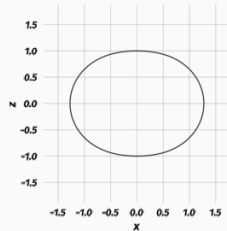
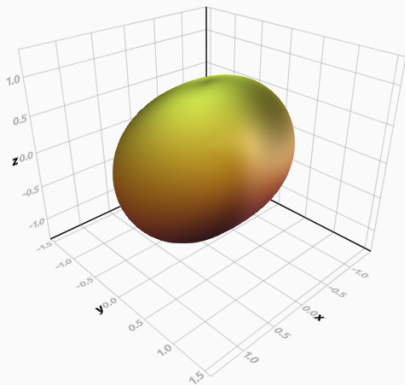
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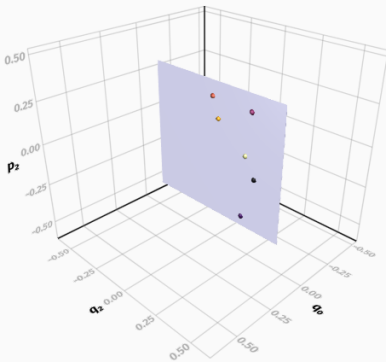
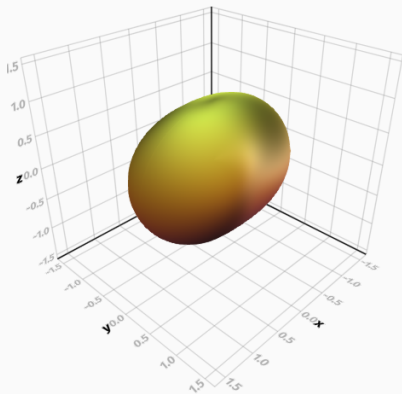
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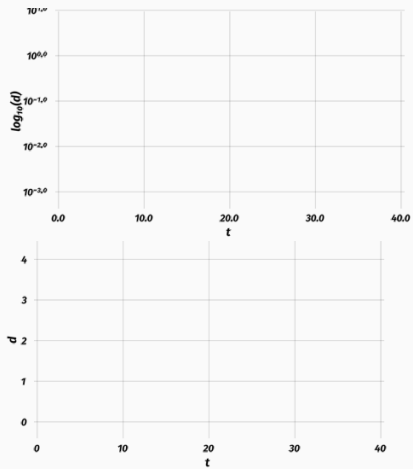
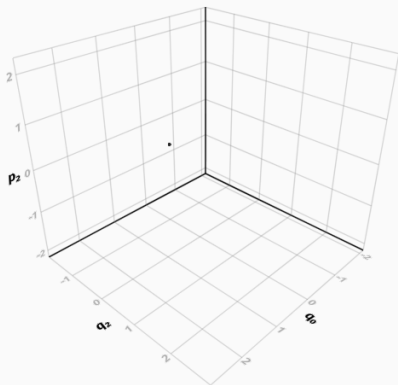




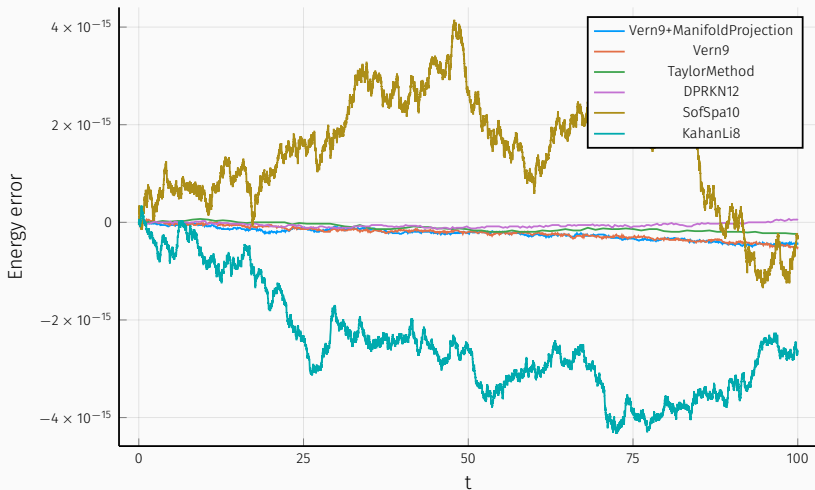


# Numerical simulations

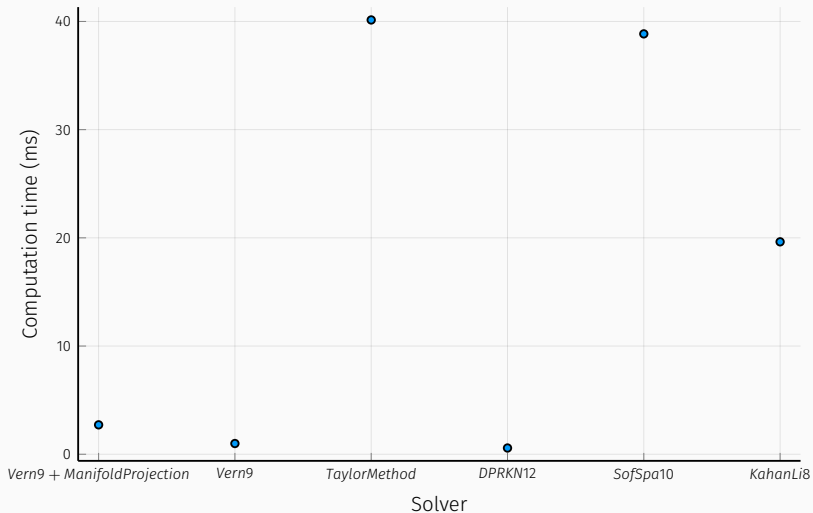
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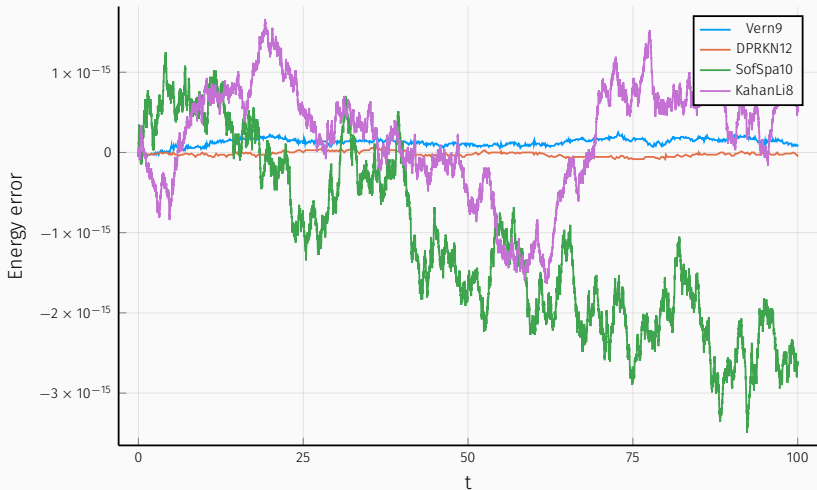




**Figure 1:** Energy error benchmark for short integration time

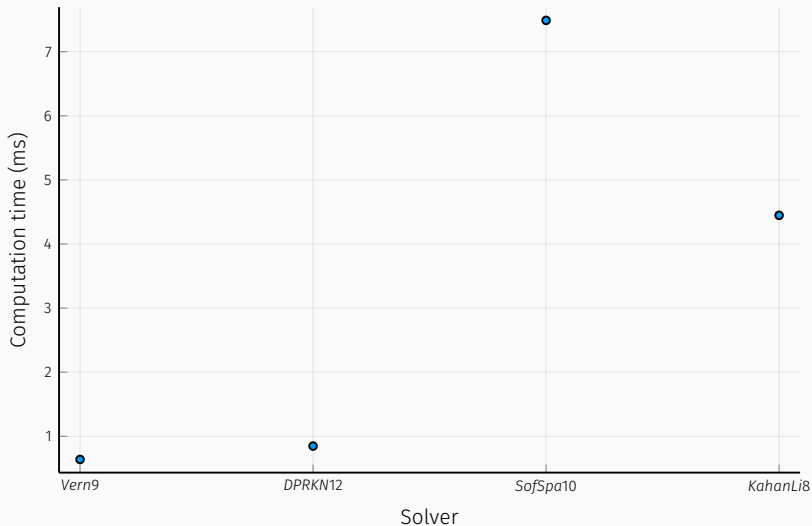


**Figure 2:** Computational time benchmark for short integration time

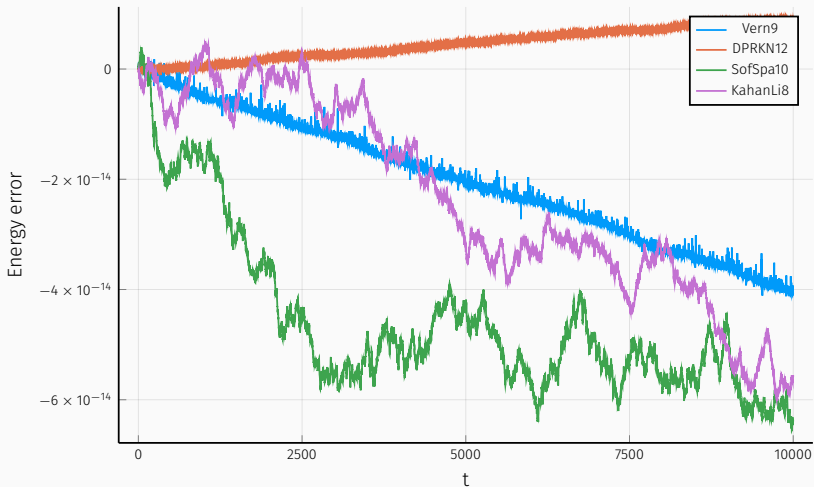


**Figure 3:** Energy error benchmark for short integration time with rescaling

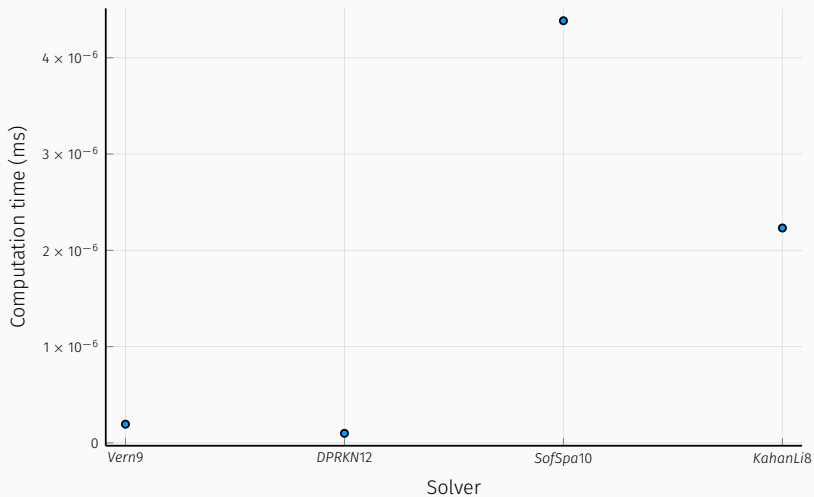




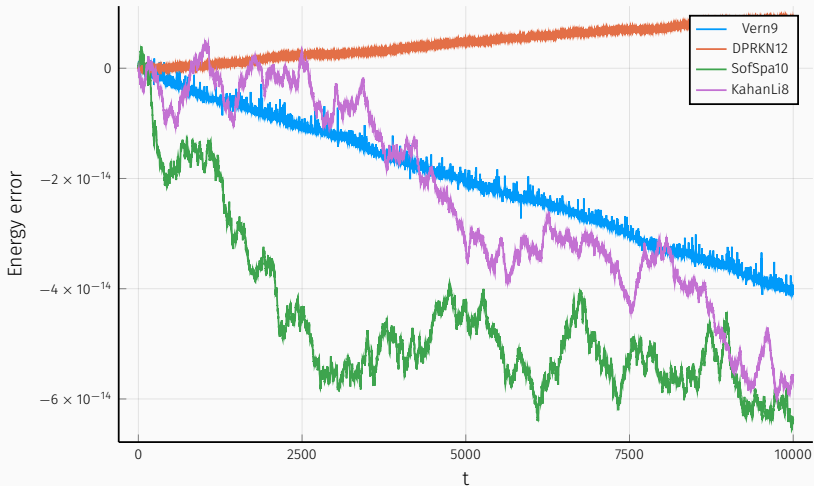
**Figure 4:** Computational time benchmark for short integration time with rescaling



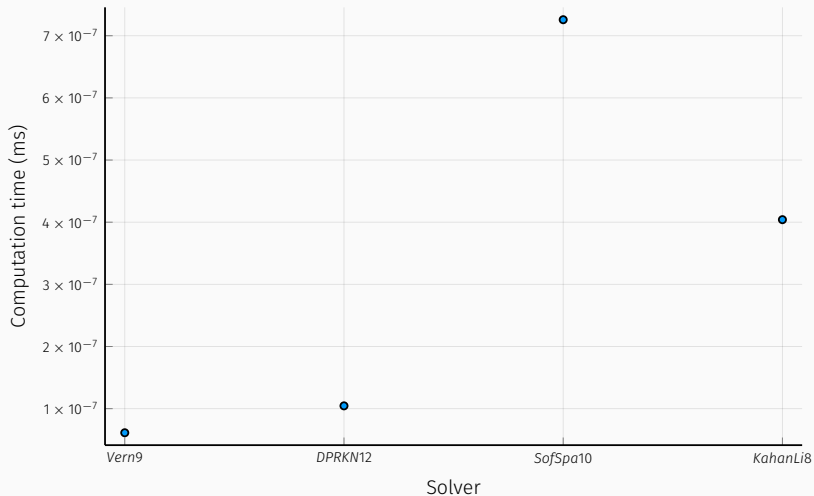
**Figure 5:** Energy error benchmark for long integration time



**Figure 6:** Computational time benchmark for long integration time



**Figure 7:** Energy error benchmark for long integration time with rescaling



**Figure 8:** Computational time benchmark for long integration time with rescaling

# Conclusions

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Thank you!