Research Training Group
Graduiertenkolleg
Models of Gravity

RTG Models of Gravity Colloquium	
Date:	05.02.2020
Time:	10:00 - 17:30
Location:	ZARM, Bremen Room 1730

Program

10:00 - 10:30	Students' Assembly
10:30 - 11:30	Students' Seminar: **Kai Flathmann** (Oldenburg, Germany) *"Post-Newtonian limit of general scalar-torsion theories of gravity"*
11:30 - 12:00	Discussion and Coffee
12:00- 12:30	Journals' Club: **Mourad Halla** (Bremen, Germany) *"Applications of the Gauss-Bonnet theorem to gravitational lensing"*
12:30 - 14:00	Lunch and *Board Meeting*
14:00 - 15:00	Talk 1: **Anna Ijjas** (Hannover, Germany) *"The virtues of slow contraction, and other perks of bouncing"*
15:00 - 15:30	Discussion and Coffee
15:30 - 16:30	Talk 2: **Yakov Shnir** (Dubna, Russia) *"Spinning black holes with synchronized hairs and soliton stars"*
16:30 - 17:30	Discussion and Coffee
16:45 - 17:30	Women's assembly
18:00	Dinner

Abstracts

Talk 1: **Anna Ijjas** (Hannover, Germany)

"The virtues of slow contraction, and other perks of bouncing"

It is a wide-spread view that our universe emerged from a quantum big bang while its large-scale features were generated during the following inflationary expansion. Another logical and empirically testable possibility is that space-time had no beginning at all but `bounced' to the current expanding phase from a contracting pre-phase. In this talk, I will discuss the robustness of such a slowly contracting pre-phase to initial conditions using the full power of numerical general relativity and review recent progress on studying the generation of primordial perturbations in bouncing scenarios, including the implications for ongoing experiments. I will also explain how a cyclically bouncing universe can be viewed as an on-average de-Sitter-like phase driven by dark energy.

Talk 2: **Yakov Shnir** (Dubna, Russia)

"Spinning black holes with synchronized hairs and soliton stars"

We study a new families of stationary rotating axially symmetric hairy black holes which represent solutions of the non-linear O(3) sigma model in the Kerr spacetime. We found that the spinning axially symmetric cloudy solutions of the model also exist in the regular asymptotically flat space-time without the event horizon. These configurations are similar to the usual rotating boson stars, which, in the at flat space limit are linked to the axially symmetric Q-balls, in both cases the solutions exist for some restricted range of values of the angular frequency and possess a quantized angular momentum. We show that, depending on the values of the parameters of the model and the Hawking temperature, the branch structure of the cloudy solutions varies from the usual inspiraling pattern, which is typical for the boson stars, to the two branch structure, similar to that of the black holes with Skyrme hairs. As another example of spinning black holes with synchronized hairs we consider families of parity-odd solutions of the Einstein-Klein-Gordon model. Finally, we discuss Dirac stars and compare their properties with the usual boson stars.

Student Seminar: **Kai Flathmann** (Oldenburg, Germany)

"Post-Newtonian limit of general scalar-torsion theories of gravity"

In this talk we derive the post-Newtonian limit of a general class of teleparallel theories of gravity, where the action is a free function of the Torsion scalar and several quantities derived from a dynamical scalar field. In order to use the parameterized post-Newtonian (PPN) formalism without modifications, such as introducing an effective gravitational constant, we restrict the analysis to a massless scalar field. This class of theories is fully conservative, with only two non-vanishing PPN parameters. For a particular choice of the free function, the theory is even indistinguishable from General Relativity in its post-Newtonian approximation.

Journals' Club: **Mourad Halla** (Bremen, Germany)

"Applications of the Gauss-Bonnet theorem to gravitational lensing"

In this talk we show that in the Schwarzschild the deflection angle of light in the equatorial plane is related to the Gauss curvature by the Gauss-Bonnet theorem.

G. W. Gibbons and M. C. Werner,
Class. Quant. Grav. 25, 235009 (2008),
arXiv:0807.0854