Ekrem Seyfi Demirboğa

CONTACT INFORMATION

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RESEARCH INTERESTS

Gravity Theory: *General Relativity and physics of compact objects, alternative theories of gravity, quantum field theory on curved spacetime, quantum gravity, numerical relativity, black hole physics, gravitational-wave astrophysics, numerical relativity,high performance computing, parallel programming, computational methods and machine learning*

Quantum Information

EDUCATION

Koç University, Istanbul, Turkey   September 2017– June 2022

- B.Sc. in Physics, Department of Physics, GPA: **3.74/4** Magna Cum Laude

- Thesis: *Instabilities in Vector-Tensor Theories* Advisor: Assistant Prof. Fethi Mübin Ramazanoğlu.

RESEARCH EXPERIENCE

Koç University Department of Physics Gravity Group   2020-Present
Supervisor: Asst. Prof Fethi Mübin Ramazanoğlu

- **Instabilities in Vector-Tensor Theories**

  Studied the Vector Tensor theories, written a code to numerically compute Neutron Star structures. Used several numerical techniques such as finite differencing and numerical solutions for boundary value and eigenvalue problems. Mainly used C++/C and Python on Koç University High Performance Computing (HPC) cluster. This project resulted in publication where we showed that all the vectorized solutions in vector-tensor gravity has ghost instability.

- **Scalar-Tensor Theories and Spontaneous Scalarization**

  Investigated a class of alternative gravity theories called scalar-tensor theories and a phenomenon called spontenous scalarization that occurs in certain scalar-tensor theories under supervision of Asst. Prof Fethi Mübin Ramazanoğlu.

Internship: International Center for Theoretical Physics (ICTP)   2021 Summer
Supervisor: Prof. Angelo Bassi

- **Gravitationally Induced Entanglement**

  Studied the recently proposed experiments on testing the quantum nature of gravity under supervision of Prof. Angelo Bassi. Learned the necessary tools from Quantum Information to have rigorous understanding of the relevant papers. derived the calculations and proofs such as the "Local Operations and Classical Channel (LOCC) Constraint" theorem which is the backbone of the proposed experiments.

Internship: Sabancı University Physics Department   2020 Fall
Supervisor: Prof. Durmuş Ali Demir

- **Einstein-Proca Model**   2020 Fall

  Studied a Spherically-Symmetric Einstein-Geometric Proca Model which describes a spin-1 massive vector in General Relativity. Derived the field equations of our model using Mathematica packages and numerically calculated some of the results from the literature

Independent Study: Koç University Department of Physics   2020 Spring
Supervisor: Prof. Tekin Dereli

- **Relativity and Field Equations**   2020 Fall

  Studied the Classical Field Equations and relativistic wave equations under the supervision of Prof. Tekin Dereli.

Koç University Laser Research Laboratory   2018-2019 Supervisor: Prof. Alphan Sennaroğlu

- **Characterization ZnSe Laser**

  Assisted the experiments on characterization and instrumentation of ZnSe Laser. Learned optical alignment and preparing the experimental setup for lasers. Prepared a tutorial on how to use the Shimadzu UV spectrometer.

Other Research Experiences

- QFT in Curved Spacetime and Unruh Effect   2021 Spring

  As a term project of the course PHYS516:General Relativity and Cosmology, Quantum Field Theory in Curved Spacetime is studied. Then, the famous Unruh Effect is derived.

- Stars from Newton to Einstein, and Beyond   2019 Falls

  As a term project of the PHYS414: Computational Physics course, structures of various types of stars are studied both numerically and analytically starting from Newtonian Mechanics to General Relativity as well as some alternative models of gravity. An initial data solver is written in python for solving Lane-Emden Equation , Chandrasekhar White Dwarf Equation and TOV equations.

- Tübitak Project: Developing electrochemical battery using H_2S and Vanadium   2015-2017

  Developed a project on developing an electrochemical fuel cell using H_2S and Vanadium . Conducted experiments on characterizations of the fuel cell under the supervision of Dr.Elif Sanlı. We have earned several prizes among which are Genius Olympiad Honorable Mention, ICYS Encouragement.

note: add research visits ICTP and Durmus + teaching düzelt + talks düzelt üni ekle. +

- **Teaching Assistant, Koc University**   Fall 2021

  Held weekly Problem Sessions and Office Hours for the course PHYS102: General Physics II.

- **Tutor, Koc University**   2019 Fall, 2020 Spring, 2021 Spring

  Held weekly tutor office hours at Koc University Office of Learning and Teaching (KOLT) for students and gave review lectures before the exams for the course PHYS101: General Physics I.

- **Tutor, Koc University**   2020 Fall

  Held weekly tutor office hours at Koc University Office of Learning and Teaching (KOLT) for students and gave review lectures before the exams for the course PHYS102: General Physics II, Electromagnetism.

- **Teaching Assistant, Koc University Work Study Program**   2017 Fall

  Teaching Assistant for the PHYS101: General Physics I course. Written Homework assignments and solutions in Latex format.

TALKS

- Sifa University National Project Competition   2015

- National Solar and Hydrogen Energy Symposium   2014

- Doganata Education Science Energy Engineering Fair   2014

PUBLICATIONS

[1] **Ekrem S. Demirboğa**, Andrew Coates and Fethi M. Ramazanoğlu. Instability of vectorized stars, Phys. Rev. D, 105(2):024057, 2022, arXiv:2112.04269 [gr-qc].

SCHOLARSHIPS, HONORS AND AWARDS	KU Fellowship	2022
	Vehbi Koç Scholarship	2019,2020,2021
	Dean's Honor Roll	2018
	TUBITAK 2205 National Exam Based Scholarship Program ($20,000): January 2021 Scholarship for Exceptional Success in University Entrance Exam	September 2017 -
	Full-Merit Scholarship of Koc University ($80,000): Scholarship for Exceptional Success in University Entrance Exam	2017-2021
	TUBITAK National Research Project Competition top 202 among 13.775 projects	2015
	International Conference of Young Scientists Encouragement Award	2015
	Oswego University, GENIUS Olympiad honorable mention	2014

TECHNICAL SKILLS

Programming: Python, C/C++, Java, Github Account

Technical Softwares: MATLAB, LaTeX, Mathematica, COMSOL, ANSYS

EXTRACURRICULAR ACTIVITES

Koc University Science Society		2018-2020
President		
Koc University Rocket Club		2018-2019
Co-founder, President		
Koc University Orchestra		2021

I like to compose orchestral music: Soundcloud and YouTube
I like to play piano, ney, Sazbüş, harmonica and to try new instruments

LANGUAGES

- Turkish (native)
- English (Fluent)

REFERENCES

Fethi Mübin Ramazanoğlu
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  Koç University,
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