Gizem Şengör

Assistant Professor at Boğaziçi University
Physics Department
Istanbul, Turkey
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Education:

- Syracuse University, 2013-2018 Syracuse NY, USA
  PhD in Physics, 29/06/2018
  Advisor: Associate Professor G. Scott Watson
  Thesis title: "Cosmological Perturbations in the Early Universe"
- Boğaziçi University, 2011-2013 Istanbul, Turkey
  M.S. in Physics, 27/06/2013
  Advisor: Professor Metin Arık
  Thesis title: "From Five Dimensional Flat Spacetime to Our Four Dimensional Braneworld via Kaluza-Klein"
- Boğaziçi University, 2007-2011 Istanbul, Turkey
  B.S. in Physics, graduated with Honors

Postdoc and Fellowship Positions:

- October 2021-June 2022 postdoc within the CoGraDS project
  CEICO, FZU Czech Academy of Sciences
- October 2019-October 2021 Marie Curie Individual Fellowship Fellow at
  CEICO, FZU Czech Academy of Sciences
  with Marie Skłodowska-Curie grant agreement No 840709, project SymAcc
  project supervisor: Senior Researcher Constantinos Skordis
- February-October 2019 Postdoc at CEICO, FZU Czech Academy of Sciences
  under the IOP Researchers Mobility Grant$CZ.02.2.69/0.0/0.0/16_027/0008215$
- University of Amsterdam, Fall 2017 Amsterdam, Netherlands
  Delta Institute of Theoretical Physics Visiting Fellow, 21/09/2017-22/12/2017
  Supervisor: Associate Professor Jan Pieter van der Schaar

Projects

- "Quantum Field Theory in a de Sitter Universe: from particles to information"
  TÜBİTAK 2232-B International Fellowship for Early Stage Researchers Programmes
  Grant agreement No:121C138
  Host Institution: Boğaziçi University
  Role: Project Coordinator
  Start and end dates: 01/11/2022-01/11/2025

- "SymAcc: Symmetries and Degrees of Freedom in Cosmic Epochs of Accelerated Expansion"
  European Research Council Marie Skłodowska-Curie (MSCA) Individual Felloship
  Grant agreement No:840709 October 2019-October 2021 Host Institution: CEICO, FZU Czech Academy of Sciences
  Role: MSCA Individual Fellowship Fellow
  Project supervisor: Senior Researcher Constantinos Skordis
  Start and end dates: 1/10/2019-1/10/2021

Honors and Awards:

- 2020 MSCA Success Stories in Widening Countries
  My MSCA- IF project SymAcc has been chosen by the European Commission to be portrayed among the upcoming Europe-wide NET4Mobility handbook.

- 2017 Henry Levinstein Fellowship for Outstanding Senior Graduate Student
  Fall 2017 Syracuse University
  On the academic excellence in research

- WISE-FPP cohort (Future Professionals Programe)
  2015-2017 Syracuse University

- 2014 Henry Levinstein Fellowship Award
  Summer 2014 Syracuse University
  In recognition of excellent work in first year graduate courses and promise of excellence in research.

Publications:

1. "The de Sitter group and its presence at the late-time boundary"
   Gizem Şengör
   arXiv:2206.04719 [hep-th]

Prepered for Proceedings of Science, Corfu Summer Institute 2021 "School and Workshops on Elementary Particle Physics and Gravity" under the workshop on "Quantum Features in a de Sitter Universe"

2. "Principal and complementary series representations at the late-time boundary of de Sitter"
Gizem Şengör, Constantinos Skordis
arXiv:2205.11550 [hep-th]
Prepared as part of the proceedings of the 14th International Workshop on Lie Theory and Its Applications in Physics

3. "Scalar two-point functions at the late-time boundary of de Sitter"
Gizem Şengör, Constantinos Skordis
arXiv: 2110.01635 [hep-th]

4. " Unitarity at the Late time Boundary of de Sitter"
Gizem Şengör, Constantinos Skordis
JHEP 06 (2020) 041, arXiv:1912.09885 [hep-th]

5. "Hidden regimes during preheating"
Gizem Şengör
Phys.Rev. D100 (2019) no.4, 043503, arXiv:1808.10602 [gr-qc]

6. "Toward an Effective Field Theory Approach to Reheating"
Ogan Özsoy, John T. Giblin, Eva Nesbit, **Gizem Şengör**, Scott Watson
Phys.Rev. D96 (2017) no.12, 123524, arxiv:1701.01455[hep-th]

7. "BRST Quantization for Cosmological Perturbations"
Cristian Armendariz-Picon, **Gizem Şengör**
JCAP 11 (2016) 016, arxiv:1606.03823 [hep-th]

8. "Non-thermal WIMPs and Primordial Black Holes"
Julian Georg, **Gizem Şengör**, Scott Watson
Phys.Rev.D 93, 123523 (2016), arXiv:1603.00023 [hep-ph]

9. "Is the Effective Field Theory of Dark Energy Effective?"
Eric Linder, **Gizem Şengör**, Scott Watson
JCAP 1605 (2016) 053, arXiv:1512.06180 [astro-ph]

10. "A Model Independent Approach to (p)Reheating"
Ogan Özsoy, **Gizem Şengör**, Kuver Sinha, Scott Watson
arXiv:1507.06651 [hep-th]

11. "A five dimensional model with a fifth dimension as fundamental as time in terms of a cosmological approach"
Gizem Şengör, Metin Arık
Mod. Phys. Lett., A28, (2013),arXiv:1302.0947 [gr-qc]

Invited Seminars:

- "Some clues from the late-time boundary of de Sitter"
  Battcock Coffee Seminars
  online 10/11/2021, Cambridge

- "Clues from the late-time boundary of de Sitter"
  Cosmology Lunch Seminars
  online 08/11/2021, Cambridge

- "The de Sitter Group"
  CORFU Summer Institute 2021, Workshop on Quantum Features of a de Sitter Universe
  in person 13-19/09/2021, Corfu

- "Cosmology as told by symmetries"
  Boğaziçi University, Istanbul, Physics department online seminars, 28/04/2021
  based on publications 4, 5, 6, 7, 8, 10 and ongoing work with Constantinos Skordis that led to 3.

- "Some of the unintuitive features of de Sitter"
  Kings College London, Theoretical Physics Virtual Journal Club, 13/11/2020
  based on publication 4 and ongoing work with Constantinos Skordis that led to 3

- "de Sitter'in Geç Zaman Sınırında Korelasyonlar"
  (Correlations at the Late time Boundary of de Sitter)
  Boğaziçi Üniversitesi Department of Physics Online Seminars, 28/05/2020
  based on publication 4 and ongoing work with Constantinos Skordis that led to 3.

- "Unitarity at the Late-time Boundary of de Sitter"
  Imperial College London, Claudia de Rham and Andrew Tolley group meetings, 10/02/2020
  based on publication 4.

- "Unitarity at the Late-time Boundary of de Sitter"
  Boğaziçi University, Physics Department
  High Energy Theory Group Seminars, 12/09/2019
  based on ongoing work with Constantinos Skordis that led to publication 4.

- "A Look at Cosmological Perturbations During Preheating with Effective Field Theory Methods"
  Istanbul Center for Mathematical Sciences (IMBM), Mathematical and Theoretical Physics Afternoons, 14/12/2018
  based on publications 5 and 6.

- "Cosmological Perturbations During Preheating"
  Istanbul Technical University, Physics Department Seminars, 28 September 2018
  based on publications 5 and 6.

- "An Effective Field Theory Approach to Preheating"
  University of Amsterdam, Cosmology Journal Club Seminar, 30 November 2017
  Utrecht University, Cosmology Seminar, 5 December 2017
  Leiden University, de Sitter Cosmology Group Journal Club, 19 December 2017
  based on work with Ogan Özsoy, John T. Giblin, Eva Nesbit, Scott Watson, of publication 6.

- "BRST Quantization for Cosmological Perturbations"
  Istanbul Technical University, Physics Department Seminars, 15 July 2016
  based on work with Cristian Armendariz-Picon, of publication 7.

Seminars at CEICO:

- " Scalar two-point functions at the late-time boundary of de Sitter"
  CEICO Strings Seminar, 18 October 2021
  based on publications 3 and 4.

- "Unitarity at the Late-time Boundary of de Sitter"
  CEICO Seminar, 19 September 2019
  based on ongoing work with Constantinos Skordis that led to publication 4.

- "A look at Cosmological Perturbations during Preheating with Effective Field Theory Methods"
  CEICO Seminar, 28 February 2019
  based on publications 5 and 6.

Seminars at Syracuse University:

- "A Promenade in de Sitter"
  10/04/2018 Syracuse University High Energy Theory Seminar
  Based on work with Jan Pieter van der Schaar and discussions with Dionysios Anninos.

- "BRST Quantization of Cosmological Perturbations"
  12/10/2016 and 19/10/2016 Syracuse University Cosmology Journal Club
  Based on work with Cristian Armendariz-Picon of publication 7.

- "Is the Effective Field Theory of Dark Energy Effective?"
  07/03/2016, Syracuse University High Energy Theory Seminar
  Based on work with Eric Linder and Scott Watson, of publication 9.

Talks at Workshops and Conferences:

- "de Sitter group"
  18 September 2021, Corfu (in person)
  The de Sitter Group and Euclidean Techniques
  discussion session leader together with Dr. Victor Gorbenko
  Workshop on Quantum Features of a de Sitter Universe
  13-19 September 2021 Corfu Summer Institute 2021

- "Principal and complementary series representations at the late-time boundary of the de Sitter group "
  14th International Workshop on Lie Theory and Applications in Physics
  held online 20-26/06/2021, Sofia Bulgaria

- "On some of the intrinsic aspects of de Sitter"
  HEPAC 2021 (High Energy Physics Astronomy and Cosmology Workshop),
  held online 1-2/02/2021, Istanbul

- "Unitary States at the Late Time Boundary of de Sitter"
  DESY Virtual Theory Forum,
  held online 22/09/2020-25/09/2020, Hamburg

- "Exploring Hidden Regimes during Preheating with Effective Field Theory Methods"
  String Theory and Cosmology Gordon Research Conference, 16/06/2019-21/06/2019, Castelldefels
  Hot Topics in Modern Cosmology:Spontaneous Workshop XIII, 05/05/2019-11/05/2019, Cargèse
  Gravity@Prague 2018, 10/09/2018-14/09/2018, Prague
  Poster based on publications 5 and 6.

- "An Effective Field Theory Approach to Preheating"
  Dark Matter 2018, 21/02/2018, UCLA (Poster)
  Based on work with Ogan Özsoy, John, T. Giblin, Eva Nesbit, Scott Watson of publication 4.

- "Is the Effective Field Theory of Dark Energy Effective?"
  ICTP-SAIFR, Sao Paulo, 03/03/2016,
  School on Effective Field Theory Across Length Scales
  Based on work with Eric Linder and Scott Watson of publication 9.

- "EFT Methods for Preheating"
  Rust Belt Meeting, University at Buffalo 07/11/2015,
  Based on work with Ogan Özsoy, Kuver Sinha, Scott Watson of publication 10.

- "Black Hole Constraints on Moduli Cosmology"
  Neighbourhood Workshop on Astrophysics and Cosmology, PennState 26-27/03/2015,
  Based on work with Julian Georg, Scott Watson of publication 8.
- "Black-hole Constraints on the post-Inflationary Epoch"
  COSMO 2014, 25-29/08/2014, University of Chicago, Chicago, USA
  Poster based on work that led to publication 8.
- "How far away is Proxima Centauri?"
  XXVth ICPS 17/08/2010, Graz International Conference for Physics Students
  Based on work done together with fellow students Medine Tuna Pesen, Yemliha Bilal Kalyoncu, on stellar spectra, absolute and apparent luminosity of stars and the effects of these in determining astronomic distances.

Conferences, Schools and Workshops Attended

Workshop on Features of a Quantum de Sitter Universe
Corfu, Corfu Summer Institute, 29/08- 4/09/2022

School on Gravitation
12-16/09/2022, Istanbul Technical University, Istanbul, Turkey

Mimar Sinan School on Cosmology
1-5/08/2022, Mimar Sinan Fine Arts University, Istanbul, Turkey
∀ΛHolography@Prague (online)
CEICO, FZU, Prague, 4-8 October 2021

Quantum features in a de Sitter Universe
Corfu Summer Institute, Corfu, 13-19 September 2021

Lie Theory and Applications in Physics (LT14) (online)
Sofia, 20-26 June 2021

Beyond Standard Model: From Theory to Experiment (BSM-2021) (online)
Cairo, 29/03-2/04-2021

DESY Virtual Theory Forum (online)
Hamburg, 22-25 September 2020

Strings 2020 (online)
Cape Town, 29 June - 3 July

String Theory and Cosmology Gordon Research Conference
Castelldefels, 16-21 June 2019

Hot Topics in Modern Cosmology:Spontaneous Workshop XIII
Cargèse 5-11 May 2019

Gravity@Prague 2018

Prague, 10-14 September 2018

UCLA Dark Matter Conference
UCLA, Santa Barbara 21-23 February 2018

UCLA Dark Matter Advanced Training Institute
UCLA, Santa Barbara 18-20 February 2018

CERN Winter School on Supergravity, Strings and Gauge Theory 2018
CERN, Geneva 12-16 February 2018

School on Effective Field Theory Across Length Scales
ICTP-SAIFR, Sao Paulo 22 February - 4 March 2016

Rust Belt Meeting
University at Buffalo 7-8 November 2015

Neighbourhood Workshop on Astrophysics and Cosmology
PennState 26-27 March 2015 COSMO 2014
University of Chicago25-29 August 2014

Neighbourhood Workshop on Astrophysics and Cosmology
PennState 3-4 April 2014

Summer School on Cosmology
ICTP-Trieste 16-27 July 2012

International School on Strings and Fundamental Physics
DESY-Hamburg 1-12 July 2012

ULUYEF (Uludağ High Energy Physics Winter School)
Bursa, Turkey 5-11 February 2012

XXVIth ICPS (International Conference of Physics Students)
Budapest, Hungary 11-18 August 2011

XXVth ICPS
Graz, Austria 17-23 August 2010

IAPS2CERN (International Association of Physics Students trip to CERN)
Geneva, Switzerland 17-20 February 2010

XXIVth ICPS
Split, Croatia 10-18 August,2009

XXIIIth ICPS
Krakow, Poland 6-13 August 2009

Interdisciplinary Presentations:

"Transposition in Music via Linear Algebra"
XXVIth ICPS Budapest, 13/08/2011

This work, carried out together with fellow students Cem Eröncel and Medine Tuna Pesen, was about describing musical notes as basis vectors and defining a transposition matrix among different musical scales which can be used to transpose a piece of music in a given scale to another scale, keeping the piece's structure invariant.

"Dancing with Physics"
XXIVth ICPS Split, 14/08/2009

In ballet moves, the motion of arms effect the technical and artistic quality of a move due to energy and momentum transfer among limbs. In literature one can find studies that especially focus on jumps and turns. The subject of this work was to investigate the momentum transfer from one move to another in a sequence of ballet steps. It is intuitive for dancers that a jump is easier to perform when it is part of a sequence. Here we wanted to give the physical explanation behind the intuition and carry on a quantitative study on the jump pas de chat. This work was completed under the supervision of Prof. Ibrahim Semiz.

Teaching Experience:

PHYS 101 Physics I
Fall 2022, Boğaziçi University

"Asimtotik Simetriler"
School on Gravitation
12-16/09/2022, Istanbul Technical University, Istanbul, Turkey

"Erken Evrende Kozmik Tedirgenmeler"
Mimar Sinan School on Cosmology
1-5/08/2022, Mimar Sinan Fine Arts University, Istanbul, Turkey

Parçacıkları Poincare temsilleri olarak algılamak
(Understanding particles as Poincare representations)
ITFG - School on Quantum Field Theory,
28 September-2 October 2020 (online)
ITFG (Istanbul Theoretical Physics Days) is a week long school held once a semester on various special topics with the purpose of preparing undergraduate and Master level Physics students in Turkey towards active research. At the end of each school the lecturers are asked to prepare their notes as a book chapter.

Astronomy 101 Our Corner of the Universe
Fall 2013 & 2014, Summer 2014, Syracuse University,

Lab assistant

Astronomy 104 Stars, Galaxies & the Universe
Spring 2014, Syracuse University
Lab assistant

PHY 661 Graduate Quantum Mechanics
Spring 2016, 2017 & 2018, Syracuse University
Grading of weekly homeworks and exams, preparing solution manuals for the homeworks to be handed out and holding problem solving sessions on black board when needed.

PHY 731 Graduate Thermodynamics & Statistical Mechanics
Spring 2016, Syracuse University
Grading of weekly homeworks

PHY 567 Introduction to Quantum Mechanics I
Spring 2017, Syracuse University
grading of weekly homeworks

PHY 641 Advanced Electromagnetic Theory
Spring 2018, Syracuse University
Grading of weekly homeworks, exams and solving preassigned problems on black board during extra problem solving sessions when needed.

Clinic Hours
Fall 2013, Spring 2014, Fall 2014,Spring 2016, 2017,2018, Syracuse University
As part of my teaching assistant duties, I helped undergraduate students with any questions they had regarding their undergraduate physics courses for two hours a week, irrespective of the course I was the teaching assistant for at the time.

Participation in Organizations:

- $\forall\Lambda$Holography@Prague workshop organizer

I am among the organizers of this online workshop hosted by CEICO, FZU, between 4-8 October 2021. The focus of the workshop was on the relation of all three different signs of the cosmological constant, each of which corresponds to a maximally symmetric spacetime, to conformal filed theory. The aim was to bring together experts and young researchers on these three aspects of holography to discuss and exchange ideas towards a broader understanding of holography.

- Scientific secretary at BSM-2021

I was the scientific secretary of the Cosmology and Early Universe portion of BSM-2021 (Beyond Standard Model: From Theory to Experiment) conference held online between 29/03-2/04-2021

- CEICO Seminar Coorganizer

I was the coorganizer for the Fall 2020 - Spring 2021 term at CEICO. Due to the restrictions of the ongoing pandemic we were trying to continue our seminars in a hybrid setting with the speakers joining in via Zoom as well as screening the seminar at the lecture hall for the local participants who wish to participate in person. I was in charge of contacting speakers, and establishing the remote connections for the seminar together with the coorganizer Roberto Oliveri.

- Pazartesi Buluşmaları (Monday Gatherings) website creator

Pazartesi Buluşmaları is a weekly online meeting between Master, PhD students and Postdocs from any area of Physics, who have had at least a part of their education in Turkey. These meetings were initiated in April 2020 during the Pandemic so as to be able to keep connected with different areas of physics at a graduate level, with the hopes to establish interdisciplinary collaborations among each other. In these meetings each week one of the participants gives an online seminar about their work or some topic they wish to start working on. I created and continue to be in charge of the website, so as to build up an arxiv of our talks.

- CUWIP (Conference for Undergraduate Women in Physics)

This is an annual conference held by APS (American Physical Society). In 2015 it was hosted at Syracuse University. Together with fellow graduate students I prepared the content for workshops on how to apply for Graduate School, which were carried out by the rest of the volunteers.

- UFOK6 Istanbul (6th National Conference of Physics Students), Boğaziçi University 6-10 July 2010

UFOK is an annual national conference for and organized by Physics Students. UFOK6 was held in Boğaziçi University, Istanbul on 6-10 July 2010 , and I was one of the three leading organizers. I was in charge of arranging the invited speakers who were expert faculty on different research topics from various Physics Departments in Istanbul, an Astronomy Observation session, preparation of the conference booklet and some of the more practical issues.

Outreach Activities:

- The lesser known personality of Gravity

As the second major outreach component of my MSCA-IF project SymAcc, I created the short dance movie titled “The lesser known personality of Gravity", directed by Jat Dhillon, available to the public on Youtube. This movie discusses the relation of Gravity to the other three fundamental forces of nature, as if all four fundamental forces were siblings. The aim of the movie is to introduce the ideas that gravity is weak compared to other forces, and unintuitively in certain circumstances it acts repulsively. By focusing

on these two points, the objective of the movie is to highlight the nature of de Sitter spacetime as a universe that undergoes accelerated expansion, and to point out that this feature becomes important at very large scales.

- Public talk: “Zaman içinde Zaman’a bakış açımız nasıl değişti"
  (How our understanding of time evolved through time)

Upon invitation by Özgür Forum, I gave this talk as part of a weekly seminar series. Özgür Forum is a group of active and retired Electrical and Electronics engineers. The aim of the talk was to introduce the idea of coordinate transformations to the wider audience. I focused on how our notion of time evolved from being absolute, such as in Galilean transformations, to relative, as in Lorentz transformations. Following this emphasis on the story I introduced Galilean transformations, Lorentz transformations and diffeomorphisms and how they worked into our understanding of physical laws and gravity with stories from the lives of Galilei and Einstein.

- A glimpse into the daily thoughts of a physicist movie

Every year the institutes of the Czech Academy of Science open their doors to the public for a few days. During these days the public are welcome to visit the laboratories, offices, talk with scientists and watch demonstrations prepared for them. While this is a nice environment to build a connection between scientists and public, I noticed it doesn’t create an environment where the nature of theoretical work can be conveyed. Partly inspired by this observation, partly inspired by the impossibility of the circumstances for the institute to continue with its public events during the 2020 Pandemic, I created a movie that explains the basics of work in Theoretical Cosmology. To make sure it would be accessible for the general audience, I asked Jat Dhillon, the director of Giving Voice (an amateur theatre group at Prague) to direct me in making this movie. The movie “A glimpse into the daily thoughts of a physicist” is accessible via Youtube since 10 July 2020, and has been receiving positive feedbacks both from general public and scientists in my field since its screening.

- Czech Academy of Sciences Science Fair

On 06/06/2016, I participated at the annual Science Fair as a volunteer at the CEICO table for a four hour slot. During this period I tried to answer questions from the general public who visited our table.

- Demonstration session for 12 year olds, Syracuse University 26/05/2017

On 26/05/2017 a group of 80 sixth Grade students from the local West Gennessee Middle School came to visit the Physics Department at Syracuse University for a science trip with their teacher. Together with another Physics Graduate Student we organized and presented a 20 minute demonstration session, on light and its use in gaining information on the quantum nature of elements and in astronomy. We delivered this together in four sessions during the day.

- Undergraduate Audience Presentation: “Extra Dimensions:What are they? Where are they?”

The Istanbul Technical University Physics Students Club organizes a one week school, tittled “ Physic’s Week”, at the end of each fall and spring semester every year. This one week school involves introductory lectures on Master level subjects taught by Postdocs and some invited student presentations. For the Physic’s Week of 4-8 February 2013, I was invited to give a half an hour talk based on my master’s thesis at the time which also led to publication 8.
