Ekrem Murat Esmer

McDonnell Center for the Space Sciences Postdoctoral Fellow

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Research Statement

My research focuses on the dynamics and structure of exoplanetary and binary star systems, applying data-driven approaches to understand system architectures and their detectability. My publications can be found at ORCID, NASA ADS. I also maintain a well-rounded academic profile through ongoing teaching, mentoring, and outreach.

Research Interests

- Exoplanets
- Binary star systems
- Orbital dynamics and stability
- Time-domain astronomy
- Data-driven methods

Education

PhD in Astronomy and Space Sciences, Ankara University, Ankara, Turkey 2022
Thesis: *Orbital Stabilities of the Substellar Objects in Multibody Stellar Systems*
- Visiting PhD Student, University of Coimbra, Portugal 2018 – 2019

MSc in Astronomy and Space Sciences, Ankara University, Ankara, Turkey 2015
Thesis: *Timing Method to Discover Exoplanets in Multiple Star Systems*
Additional graduate coursework completed through Erasmus Mundus Program 2012 – 2014
- University of Innsbruck, Austria
- University of Padova, Italy
- University of Belgrade, Serbia

BSc in Astronomy and Space Sciences, Ankara University, Ankara, Turkey 2011

Employment

- Postdoctoral Research Associate, Washington University in St. Louis, MO, USA Since 2024
- Research Assistant, Ankara University, Ankara, Turkey 2015 – 2024

Scholarships, Awards and Grants

Fellowships

- McDonnell Center for the Space Sciences Postdoctoral Fellowship Since 2024
- National Postdoctoral Research Fellowship Program (TÜBİTAK 2218) 2022
  Awarded but not initiated
- International Research Fellowship Programme for PhD Students (TÜBİTAK 2214-A) 2018
  Funded by The Scientific and Technological Research Council of Turkey

Research Project Grants

- Co-I, *An Exoplanet Search Around Evolved Binary Star Systems* Since 2023
  Funded by: The Scientific and Technological Research Council of Turkey (TÜBİTAK)
  Program: 1001 Research Projects Project ID: 112F538
- Co-I, *Determining the Limits for Direct Imaging of Objects Around Binary Star Systems* Since 2023
  Funded by: Council of Higher Education (YÖK)
  Program: Research Universities Support Program Project ID: FBA-2023-2698
- Contributor, *Exoplanet Discovery via the Timing Method* 2018–2021

Funded by: The Scientific and Technological Research Council of Turkey (TÜBİTAK)
Program: 1001 Research Projects Project ID: 118F042
Contributed significantly to key results, including the most impactful scientific outcomes; formally affiliated as a TÜBİTAK doctoral fellow for part of the project.

Scientific Activity Support

- Grant Program for Participation in Scientific Meetings Abroad (TÜBİTAK 2224-A) 2023
  Funded by The Scientific and Technological Research Council of Turkey
- International Scientific Activity Support Program (UBED), Ankara University 2023
- International Scientific Activity Support Program (UBED), Ankara University 2018

Awards

- PhD Performance Award, Ankara University Graduate School of Natural and Applied Sciences 2024
- Best Oral Presentation Award, XXII National Astronomy Congress, Turkish Astronomical Society 2022

Teaching Experience

Lecturer

- Numerical Analysis in Astronomy I, Ankara University Fall 2023
- Numerical Analysis in Astronomy II, Ankara University Spring 2023, 2024

Guest Lecturer

- Ampersand: Gateway Expeditions Into Exoplanets, Washington University in St. Louis Fall 2024

Teaching Assistant 2015 – 2024 (excluding Fall 2018 and Spring 2019)

- Numerical Analysis in Astronomy I, Ankara University Fall 2016 – 2022
- Numerical Analysis in Astronomy II, Ankara University Spring 2015 – 2022
- Practical Astronomy, Ankara University Spring 2018 – 2024
- Observational Astronomy, Ankara University Spring 2015 – 2018, 2020

Observatory Instructor 2015 – 2022 (excluding Fall 2018 and Spring 2019)

- Weekly photometry/spectroscopy instruction at Ankara University Observatory

Professional Activities

- Member, Edwin Thompson Jaynes Fellowship Selection Committee, Washington University 2024
- Reviewer for Research Grant Proposal, National Science Centre Poland (OPUS-26) 2024
- Member, PLATO Working Group – Photometric Detection of Circumbinary Planets (WP 112510) Since 2023
- Reviewer for Journals: MNRAS, PASA and Ap&SS
- SOC Member, IOTA/ME 2nd Workshop on Photometric Study of Binary Systems and Exoplanet Transits, Çukurova University, Adana, Turkey 2020
- SOC & LOC Member, *IOTA/ME Photometric Observations of Exoplanet Transits Workshop*, Ankara University, Ankara, Turkey 2018
- Technical Team Member, Ankara University Observatory 2015–2022

Mentoring and Supervision

Contributed to the supervision and mentoring of the following graduate students through scientific guidance, data analysis support, and project development, in collaboration with their official supervisors.

PhD students: Fatemeh Davoudi (later University of Liège); Arif Solmaz (Çukurova University); Seda Kaptan (Istanbul University); Selçuk Yalçınkaya (MSc and PhD, Ankara University).

Master's students: Yasemin Aladağ (Çukurova University); Furkan Akar, Ezgi Sertkan, Barış Güler, Anıl Temelci, Eylül Demir, Burak Keten (all Ankara University).

Selected Scientific Presentations

• *Circumbinary Planet Occurrence via Eclipse Timing Variations*, **245th Meeting of the American Astronomical Society, National Harbor, MD, USA**, January 12–16, 2025

• *Circumbinary Planet Occurrence via Eclipse Timing Variations*, **Mid-American Regional Astrophysics Conference, KU, Lawrence, KS, USA**, December 5–6, 2024

• *Circumbinary Planet Occurrence via Eclipse Timing Variations*, **Washington University Physics Research Symposium, St. Louis, MO, USA**, November 20, 2024

• *The TESS Spotlight on Detached Binary Systems via Eclipse Timings*, **TESS Science Conference III, MIT, Cambridge, MA, USA**, July 29–August 2, 2024

• *Detecting Eclipse Timing Variation Planets with Other Methods*, **2024 Sagan Summer Workshop: Advances in Direct Imaging: From Young Jupiters to Habitable Earths, Caltech, Pasadena, CA, USA**, July 22–26, 2024

• *The TESS Spotlight on Detached Binary Systems via Eclipse Timings*, **Emerging Researchers in Exoplanet Science Symposium IX, Cornell University, Ithaca, NY, USA**, July 10–12, 2024

• *Eclipse Timing Variations of Evolved Eclipsing Binaries: Potential Targets for Meter-sized Telescopes in the Light of TESS Observations*, **Observing techniques, instrumentation and science for metre-class telescopes III, Tatranská Lomnica, Slovakia**, September 11–15, 2023

• *Utilizing the Rømer Delay: Determining Mass Ratios of HW Vir-like Eclipsing Binaries through TESS Observations*, **11th International Conference on Hot Subdwarf Stars and Related Objects, Armagh, Northern Ireland**, September 11–15, 2023

• *Orbital Stability of Exoplanetary Systems Discovered via the Eclipse Timing Variation Method*, **22nd National Astronomy Congress, İzmir, Turkey**, September 6–8, 2022

• *Eclipse Timing Variations*, **IOTA/ME 2nd Workshop on Photometric Study of Binary Systems and Exoplanet Transits, Çukurova University, Adana, Turkey**, February 4–7, 2020

• *The NY Vir System Revisited in the Light of New Data*, **9th Meeting on Hot Subdwarfs and Related Objects, Hendaye, France**, June 23–28 2019

• *Stability of NY Virginis System in the Light of New Eclipse Timing Data*, **Planetary Dynamics Conference, Max Planck Institute of Astronomy, Heidelberg, Germany**, June 3–7, 2019

• *Data Reduction of a Photometric Transit Observation*, **IOTA/ME Photometric Observations of Exoplanet Transits Workshop, Ankara University, Ankara, Turkey**, October 15–18, 2018

• *Preliminary ETV Analysis of HW Vir: Bayesian Approach*, **Summer School on Astronomical Data Analysis (ADAIX), Valencia, Spain**, May 20–25, 2018

• *Re-Investigating the Eclipse Timing Variation of 2M1938+4603*, **8th International Workshop on Occultation and Eclipse, Istanbul, Turkey**, March 1–2, 2018

• *Timing Sensitivity in Exoplanet Research*, **20th National Astronomy Congress, Erzurum, Turkey**, September 5–9, 2016

• *Kepler Light Curves with Different Morphologies*, **18th National Astronomy Congress, Malatya, Turkey**, August 27–September 1, 2012

Invited Talks and Seminars

• *Finding Circumbinary Planets Using Binary Star Eclipses*, **WUCAP Seminar Series, Washington University in St. Louis, MO, USA**, November 22, 2024

• *Discovery of New Worlds*, **Space Week, Physics Research Society, Ankara University, Ankara, Turkey**, May 24, 2024

• *Sun and the Solar System*, **AESS Space and Aerospace Summit, Abdullah Gül University, Kayseri, Turkey**, December 15, 2022

• *Sun and the Solar System*, **Teacher Training Astronomy Seminar Series, Ankara Provincial Directorate of National Education, Ankara, Turkey**, December 13, 2022

• *Discovery of Two Exoplanets in the Kepler-451 Binary System*, **AESS Space Seminar, Abdullah Gül University, Kayseri, Turkey**, July 18, 2022

• *Discovery of Two Exoplanets in the Kepler-451 Binary System*, **ATLAS Space and Aerospace Society, Atatürk University, Erzurum, Turkey**, March 26, 2022

• *Discovery of Two Exoplanets in the Kepler-451 Binary System*, **GUHEM – Gökmen Space and Aviation Training Center, Bursa, Turkey**, March 19, 2022

• *Eclipse Timing Variations of HW Vir-type binaries*, **Gr@v Seminar, University of Aveiro, Portugal** May 30 2018

• *Searching for Circumbinary Planets in Eclipse Timing Variations*, **9th Advanced Astrophysics Workshop of Maragha, Iran**, August 13–17, 2017

Affiliations

• American Astronomical Society Since 2024
• International Astronomical Union Since 2022
• Turkish Astronomical Society Since 2022
• Centre for Physics of the University of Coimbra (CFisUC), Portugal 2018–2022

Public Outreach

• Featured in multiple radio and YouTube interviews on astronomy and exoplanet research
• Delivered numerous public outreach talks on astronomy, engaging tens of thousands of participants
• Organizer, Astronomy on Tap – St. Louis Since 2024
• Social Media Editor, Ankara University Observatory (AUO) 2018–2024
• Organizer & Instructor, Periodic Public Events of AUO 2007–2024
• Organizer & Instructor, Public Events on Special Celestial Events, AUO 2007–2024
• Moderator, Online Astronomy Outreach Events, AUO 2019–2022
• Author, "Kepler-451 Çift Yıldızı Etrafında İki Yeni Gezegen Keşfi," *Bilim ve Teknik* magazine 2019
  Popular science article on the discovery of two planets in the Kepler-451 binary system
• Author of three popular science articles in TÜBİTAK Bilim Genç 2018–2019
  "TRAPPIST-1 Gezegenlerinde Su Bulunuyor Olabilir" — on habitability of exoplanets
  "Beta Pictoris Sistemini Gözleyen Nanouydu: PicSat" — on exoplanet monitoring with nanosatellites
  "Ötegezegen Avcısı: TESS Uzay Teleskobu" — on the NASA TESS mission
• Instructor, AUO Summer Schools 2015–2019
• Task Coordinator, Public Outreach Events, AUO 2015–2018
• Instructor, Astronomy Festivals in Turunc, ITAP, Funded by: The Scientific and Technological Research Council of Turkey (TÜBİTAK) Science in Society Projects (Project ID: 111B124) 2011
• Founding Member, Astrobiology Journal Club, Ankara, Turkey 2010
• Organizer, International Year of Astronomy 2009 Events, AUO 2009
• Member, Ankara University Astronomical Research Society 2007–2009

Publications

Full list available at: ORCID, NASA ADS

First Author

1. Esmer et al. 2025, *Eclipse Timing Variations of Circumbinary Substellar Objects in TESS Data*
In revision after peer review at AJ, doi:10.48550/arXiv.2503.20900

2. Esmer et al. 2024, *Eclipse timing variations of evolved eclipsing binaries: potential targets for meter-sized telescopes in the light of TESS observations*
CoSka, 54, 2, 228-233, doi:10.31577/caosp.2024.54.2.228

3. Esmer et al. 2023, *Tutulma Zamanlaması Değişimi Yöntemi ile Keşfedilen Ötegezegen Sistemlerinin Yörünge Kararlılıkları (Eng: Orbital Stability of Exoplanet Systems Discovered via the Eclipse Timing Variation Method)*
TJAA, 4, 102-107, doi:10.55064/tjaa.1199403

4. Esmer et al. 2023, *Testing the planetary hypothesis of NY Virginis: anticipated change in the eclipse timing trend within the next five years*
MNRAS, 525, 4, 6050-6063, doi:10.1093/mnras/stad2648

5. Esmer et al. 2022, *Detection of two additional circumbinary planets around Kepler-451*
MNRAS, 511, 4, 5207-5216, doi:10.1093/mnras/stac357

6. Esmer et al. 2021, *Revisiting the analysis of HW Virginis eclipse timing data. I. A frequentist data modeling approach and a dynamical stability analysis*
A&A, 648, A85, doi:10.1051/0004-6361/202038640

Co-Author

7. Sertkan et al. 2025, *A catalog of exoplanets around post-common envelope eclipsing binaries: CuPS-ETV*
CoSka, 55, 3, 301-306, doi:10.31577/caosp.2025.55.3.301

8. Akar et al. 2025, *Orbital analysis of additional bodies around eclipsing binaries HT Vir and MR Del*
CoSka, 55, 3, 286-294, doi:10.31577/caosp.2025.55.3.286

9. Güler et al. 2025, *ObserPy: A tool for efficient observation planning in astronomy*
CoSka, 55, 3, 466-469, doi:10.31577/caosp.2025.55.3.466

10. Hinse et al. 2024, *Absolute dimensions of solar-type eclipsing binaries. NY Hya: A test for magnetic stellar evolution models*
A&A, 687, A116, doi:10.1051/0004-6361/202244066

11. Yalçınkaya et al. 2024, *Looking for timing variations in the transits of 16 exoplanets*
MNRAS, 530, 3, 2475-2495, doi:10.1093/mnras/stae854

12. Yalçınkaya et al. 2024, *ObsMap: Preparing observing maps with the best comparison stars for photometry*
CoSka, 54, 2, 22-28, doi:10.31577/caosp.2024.54.2.22

13. Demir et al. 2023, *Kataklizmik Değişen DW UMa'nın Gezegen Barındırma Potansiyeli (Eng: The Planet-Hosting Potential of the Cataclysmic Variable DW UMa)*
TJAA, 4, 401-405, doi:10.55064/tjaa.1203526

14. Yörükoğlu et al. 2023, *T80 Prof. Dr. Berahitdin Albayrak Teleskobu ve Odak Düzlemi Aletleri (Eng: The T80 Prof. Dr. Berahitdin Albayrak Telescope and Its Focal Plane Instruments)*

TJAA, 4, 294-299, doi:10.55064/tjaa.1203477

15. Baştürk et al. 2023, *Zamanlama Yöntemiyle Ötegezegen Keşfi (Eng: Exoplanet Discovery via the Timing Method)*
TJAA, 4, 83-89, doi:10.55064/tjaa.1202812

16. Baştürk et al. 2023, *Transit timing variation analysis of the low-mass brown dwarf KELT-1 b*
MNRAS, 521, 1, 1200-1209, doi:10.1093/mnras/stad248

17. Baştürk et al. 2023, *Eclipse Timing Variations Observed in PCEB Systems*
BSRSL, 92, 2, 11197, doi:10.25518/0037-9565.11197

18. Şenavcı et al. 2022, *RR Draconis: An Algol-Type Eclipsing Binary with a Possible Massive Tertiary Companion*
AcA, 72, 1, 31-53, doi:10.32023/0001-5237/72.1.3

19. Baştürk et al. 2022, *Homogeneous transit timing analyses of 10 exoplanet systems*
MNRAS, 512, 2, 2062-2081, doi:10.1093/mnras/stac592

20. Yalçınkaya et al. 2021, *Analysis of the Most Precise Light Curves of HAT-P-36 Detrended from Spot Signals*
AcA, 71, 3, 223-242, doi:10.32023/0001-5237/71.3.3

21. Davoudi et al. 2021, *Investigation of Orbital Decay and Global Modeling of the Planet WASP-43 b*
AJ, 162, 5, 210, doi:10.3847/1538-3881/ac1baf

22. Aladağ et al. 2021, *Analysis of HAT-P-16b and TrES-3b Exoplanets by the Transit Timing Variations Method*
TJAA, 2, 28-37, doi:10.48550/arXiv.2109.06108

23. Poro et al. 2021, *The First Light Curve Solutions and Period Study of BQ Ari*
AstL, 47, 6, 402-410, doi:10.1134/S1063773721060050

24. Kane et al. 2020, *Transits of Known Planets Orbiting a Naked-eye Star*
AJ, 160, 3, 129, doi:10.3847/1538-3881/aba835

25. Baştürk et al. 2020, *A holistic and probabilistic approach to the ground-based and spaceborne data of HAT-P-19 system*
MNRAS, 496, 4, 4174-4190, doi:10.1093/mnras/staa1758

26. Baştürk et al. 2019, *Transit timing variations of five transiting planets*
AIPC, 2178, 1, 030019, doi:10.1063/1.5135417

27. Baştürk et al. 2018, *Orbital Period Variations in the NY Vir System, Revisited in the Light of New Data*
OAst, 27, 1, 14-18, doi:10.1515/astro-2018-0009

28. Selam et al. 2018, *A simultaneous spectroscopic and photometric study of two eclipsing binaries: V566 Oph and V972 Her*
Ap&SS, 363, 2, 34, doi:10.1007/s10509-018-3252-y

29. Bahar et al. 2017, *Times of Minima of Some Eclipsing Binaries*
IBVS, 6209, 1, doi:10.22444/IBVS.6209

30. Pribulla et al. 2012, *The Dwarf project: Eclipsing binaries - precise clocks to discover exoplanets*
AN, 333, 8, 754, doi:10.1002/asna.201211722