

# Ann-Marie Madigan

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## Research Interests

My research focuses on the gravitational dynamics of individually small, but collectively massive, groups of bodies. It spans both astrophysical and planetary sciences and includes the dynamics of stars and gas around supermassive black holes, the collective gravity of minor planets in the outer solar system and the dynamics of galactic dark matter.

## Employment

2022 - present	Associate Professor & JILA Fellow, CU Boulder
2016 - 2022	Assistant Professor & JILA Fellow, CU Boulder
2012 - 2016	NASA Einstein & Theoretical Astrophysics Center (TAC) Postdoctoral Fellow, UC Berkeley

## Education

2012	<i>Ph.D., Astronomy</i> Leiden University, The Netherlands
2007	<i>M.Sc., Astronomy</i> Leiden University, The Netherlands
2004	<i>B.Sc., Honors Physics &amp; Astronomy</i> National University of Ireland, Galway

## Awards & Grants

2021	<i>American Astronomical Society (AAS) Vera Rubin Early Career Prize</i> <i>Outstanding Faculty Mentor Award (CU Boulder)</i> <i>Increasing Diversity in STEM at CU Boulder, Packard Foundation</i> \$150k grant (co-PI)
2018	<i>Packard Fellowship for Science and Engineering</i> \$875k grant (PI)
2016	<i>NASA Astrophysics Theory Program</i> \$640k grant (PI)

	<i>NASA Solar System Workings</i> \$600k grant (PI)
2015	<i>NASA Pleiades</i> 7 million CPU hr supercomputing grant (PI)
2014	<i>NSF XSEDE</i> 2.5 million CPU hr supercomputing grant (co-PI)
2012	<i>NASA Einstein Postdoctoral Fellowship</i> (3 years) <i>TAC Postdoctoral Fellowship</i> (UC Berkeley, 1 year)
2010	<i>Martin &amp; Beate Block Award</i> Promising young physicist, Aspen Center for Physics
2011	<i>NWO TopTalent Fellowship</i> Independent Ph.D. research grant, The Netherlands (4 years)

### **Invited Colloquia\* & Seminars**

2024	*University of California, Santa-Cruz * Northwestern University
2023	*University of Wisconsin-Madison
2021	*University of Edinburgh *University of Washington *Pontificia Universidad Católica de Chile
2020	*Caltech *University of Chicago
2019	*Harvard University
2018	*McGill University *University of Michigan *Michigan State University *University of Kentucky *University of Florida Theoretical Astrophysics Seminar, University of California, Berkeley University of Colorado Center for Astrobiology Seminar
2017	*Pennsylvania State University Theoretical AstroPhysics inc. Relativity & Cosmology (TAPIR) seminar, Caltech
2016	*University of Amsterdam *Leiden University *Nijmegen University *University of Arizona *University of California, Berkeley *University of Colorado, Boulder Canadian Institute for Theoretical Astrophysics (CITA)

2015 \*Institute for Astronomy, Hawaii  
\*University of California, Los Angeles

2014 IMPS seminar, UC Santa Cruz  
\*University of California, Davis

2013 Nova Galactic Center day, Amsterdam, The Netherlands

2012 \*University of California, Santa Cruz  
\*University of Birmingham, UK

2011 Swinburne University of Technology, Australia

### Invited Conference Talks

2022 AAS Division on Dynamical Astronomy, Center for Computational Astrophysics, New York

2018 “Open questions in Astrophysics”, Niels Bohr Institute, Denmark

2017 “Tidal Disruption Events: Piercing the Sphere of Influence”, Cambridge, UK

2016 “Fellows at the Frontiers”, Northwestern University  
“Dynamics & Accretion at the Galactic Center”, Aspen Center for Physics

2015 AAS Division on Dynamical Astronomy, Caltech

2014 “Stellar  $N$ -body Dynamics”, Italy

2013 “Black Hole Fingerprints”, Snowpac conference, Utah

2012 Marcel-Grossman Meeting on General Relativity, Sweden

2009 Astronomical Science Group of Ireland Conference

### Public Outreach

2024 Invited Talk for Chautauqua Community House Space Series, Boulder CO  
“Supermassive Black Holes in our Backyard!”

2021 Invited Talk for Cork Astronomy Club, Ireland  
Outreach talk at Pretty Brainy, non-profit organization for girls  
Outreach talk at Eagle-Rock High School, Los Angeles

2020 Panelist for “Women of JILA - Speaker Series”

2018 TEDx Boulder talk “*Black Hole Sun*”  
Keynote speaker for Denver Astronomical Society  
Invited talk for Students for the Exploration and Development of Space  
Astronomy liaison for the Logan School for Creative Learning (- present)

2017 Astronomy on Tap speaker, Boulder  
University of Colorado astronomy club speaker

- 2016 Invited public talk at SETI institute  
*“The bizarre orbits of minor planets beyond Neptune”*
- 2014 Invited talk for seminar series *“What Physicists Do”*, Sonoma State University
- 2013 *Dinner with a scientist* outreach event for Oakland school district
- 2011 Invited outreach talks:  
Technical University Eindhoven, The Netherlands  
De Leidsche Flesch, Leiden, The Netherlands  
*Careers in science*, St. Louis High School, Ireland

### CU Boulder Teaching

- Spring 2024, 2022, 2021 ASTR-2030: Black Holes  
Undergraduate non-majors course, 3 credits
- Fall 2023, 2020, 2017 ASTR-3710: Formation & Dynamics of Planetary Systems  
Undergraduate majors course, 3 credits
- Spring 2019, 2018 ASTR-1030: Accelerated Introduction to Astronomy  
Undergraduate majors course, 4 credits
- Fall 2018, 2016 ASTR-5820: Origin & Evolution of Planetary Systems  
Graduate course, 3 credits
- Fall 2022 ASTR-5720: Galaxies  
Graduate course, 3 credits
- Fall 2020 ASTR-6000: Spiral Arm Formation and Dynamics  
Graduate seminar, 1 credit

### Students and postdocs advised at CU Boulder

Graduate Students	Constanza Echiburú	2024 - present
	Jane Bright	2023 - present
	Tatsuya Akiba	2020 - present
	Alexander Zderic	2017 - 2021
	Heather Wernke	2017 - 2021
Postdocs	Alexander Zderic	2022 - present
	Angela Collier	2019 - 2022
	Maria Tiongco	2019 - 2022
	Aleksey Generozov	2018 - 2021
Undergraduates	Lucy Walton	2023 - present
	Selah McIntyre	2022 - present
	Alexandra Gladkova	2021 - 2022
	Karin Roley	2021 - 2022
	Allie Christensen	2020 - 2022

Alexander Rodriguez	2019 - 2022
Emma Lieb	2020 - 2021
Gwendalynn Roebke	2018 - 2021
Hayden Foote	2018 - 2020
Jacob Moss	2018 - 2019
Jacob Fleisig	2017 - 2019
Sean Moss	2017 - 2018
Aidan Jared	2017 - 2018

## University Service at CU Boulder

2023	Undergraduate Associate Chair (- present) Member of JILA executive committee (- present) Member of APS executive committee (- present) Chair of Undergraduate Curriculum and Concerns committee (- present) Member of faculty search committee (- present) Chair of Promotion Committee Panelist for JILA postdoc panel on funding Developed and gave seminar on “How to get a Postdoc” for APS students
2022	Chair of FDAP Faculty Search Committee Member of JILA executive committee Member of APS Friday Lunch Seminar committee Member of APS Exams committee
2021	Member of College of Arts and Sciences Dean Search Advisory Committee Faculty representative to APS graduate student body Member of APS awards committee Reviewer of Undergraduate Research Opportunities Program (UROP) Co-organizer and host of JILA’s Richard Nelson Thomas Award celebration
2020	Member of APS Executive Committee Co-chair of Representation, Recruitment & Retention Department Action Team Panelist for Research and Innovation Office (RIO) Webinar
2019	Member of Packard Fellowship internal competition review committee (- present) Member of graduate admissions committee
2018	Member of faculty search committee for time-domain hire Chair of APS social committee Member of faculty search set-up committee Organizer of ‘Women in Astro’ lunches (- present) Organizer of ‘Under-Represented Minorities in Astro’ lunches (- present)
2017	Honors Thesis Representative for the APS department (- present) Member of faculty search committee for planetary science hire Member of graduate admissions committee Member of colloquium committee

2016 Founder of undergraduate research opportunities symposium (- present)  
Organizer of weekly APS journal club (- present)

## External Service

2023 SOC member for AAS Dynamical Division of Astronomy (DDA) conference

2021 Science advisor for Heising-Simons Foundation  
Mentor in AAS Dynamical Division of Astronomy (DDA) program (- present)

2020 NSF Astronomy and Astrophysics Research Grants (AAG) panel member

2019 SOC member, “New Horizons in Galactic Center Astronomy & Beyond”, Japan

2018 LOC member, AAS Dynamical Division of Astronomy (DDA) meeting, Boulder

2017 NASA Astrophysics Theory Program (ATP) panel member  
AAS Dynamical Division of Astronomy committee member (- 2019)  
Session chair at AAS Dynamical Division of Astronomy Conference, London  
Reviewer for The Israel Science Foundation (Joint NSFC-ISF Research Grant)

2015 Reviewer for NASA Earth and Space Science Fellowship (NESSF)

2014 Hubble Space Telescope allocation committee, Cycle 22 panel member

## CU Boulder Examination Committees

[Undergraduate Students](#) and [Graduate Students](#) I advised

2023	Daniel Sega	APS Dissertation
	Constanza Echiburú	APS Comprehensive Exam
2022	Noora Alsaeed	APS Dissertation
	Jennifer Davis	Geology Comprehensive Exam
	Alex Haughton	APS Comprehensive Exam
	Cole Tamborri	APS Comprehensive Exam
	Kirk Long	APS Comprehensive Exam
	Megan Kenny	APS Comprehensive Exam
	Sajal Gupta	APS Comprehensive Exam
	Tyler Bishop	APS Comprehensive Exam
	<a href="#">Karin Roley</a>	APS undergraduate honors thesis
	Adrienne Pickerel	APS undergraduate honors thesis
	Ben Johnston	APS undergraduate honors thesis
	Conrad Meyer-Reed	APS undergraduate honors thesis
	James Crowley	APS undergraduate honors thesis
	Junyu Chen	APS undergraduate honors thesis
	Patrick McCreery	APS undergraduate honors thesis
	Spencer Hurt	APS undergraduate honors thesis
	Samuel Rodgers	APS undergraduate honors thesis

2021	<a href="#">Alexander Zderic</a>	APS Dissertation
	<a href="#">Heather Wernke</a>	APS Dissertation
	Jessica Libby-Roberts	APS Dissertation
	Aaron Stemo	APS Dissertation
	<a href="#">Tatsuya Akiba</a>	APS Comprehensive Exam
	Hannalore Gerling-Dunsmore	APS Comprehensive Exam
	Joshua Hibbard	APS Comprehensive Exam
	Kya Sorli	APS Comprehensive Exam
	Aimee Schechter	APS Comprehensive Exam
	Amanda Hampton	Applied Math Comprehensive Exam
	<a href="#">Gwendalynn Roebke</a>	General honors thesis
	<a href="#">Alexander Rodriguez</a>	APS undergraduate honors thesis
	<a href="#">Allie Christensen</a>	APS undergraduate honors thesis
	Brenna Royersmith	APS undergraduate honors thesis
	Anna Estes	APS undergraduate honors thesis
	Ferris Bosworth	APS undergraduate honors thesis
Madeline Pettine	APS undergraduate honors thesis	
Zhiyu Yao	APS undergraduate honors thesis	
2020	Daniel Segal	APS Comprehensive Exam
	<a href="#">Hayden Foote</a>	APS undergraduate honors thesis
	Anna Pusack	APS undergraduate honors thesis
	Allyson Leffler	APS undergraduate honors thesis
	John Faulhaber	APS undergraduate honors thesis
	Ryder Strauss	APS undergraduate honors thesis
Jenna Kishinevsky	Physics undergraduate honors thesis	
2019	Zach Milby	APS undergraduate honors thesis
	Dylan Gatlin	APS undergraduate honors thesis
	Maya Yanez	APS undergraduate honors thesis
	Claire Lamman	APS undergraduate honors thesis
	Carlos Eytan Gary Bicas	APS undergraduate honors thesis
	Evan Tucker	Geology undergraduate honors thesis
2018	Erika Zetterlund	APS Dissertation
	<a href="#">Heather Wernke</a>	APS Comprehensive Exam
	<a href="#">Alexander Zderic</a>	APS Comprehensive Exam
	Ryan Diaz-Perez	APS Comprehensive Exam
	Hayley Roberts	APS Comprehensive Exam
	Daniel Brack	Aerospace Engineering Comprehensive Exam
	<a href="#">Jacob Fleisig</a>	APS undergraduate honors thesis
	Amanda Alexander	APS undergraduate honors thesis
	Cami Nasr	APS undergraduate honors thesis
	Ian Cadenhead	APS undergraduate honors thesis
	Odysseus Quarles	APS undergraduate honors thesis
	Parker Hinton	APS undergraduate honors thesis
	Rachel McClure	APS undergraduate honors thesis

2017

Keri Hoadley  
Morgan Rehnberg  
Aaron Stemo  
Nicole Arulanantham

APS Dissertation  
APS Dissertation  
APS Comprehensive Exam  
APS Comprehensive Exam



[Undergraduate Students](#), [Graduate Students](#) and [Postdocs](#) I advised at CU Boulder.

28. *Anisotropic Star Clusters around Recoiling Supermassive Black Holes*  
[Akiba](#) & **Madigan**, *2023ApJ*, 958, 137A (2023)
27. *How to Flip a Bar*  
[Collier](#) & **Madigan**, *arXiv:2305.06383* (2023)
26. *Steeper Scattered Disks Buckle Faster*  
[Zderic](#) & **Madigan**, *2023ApJ*, 948L, 1Z (2023)
25. *Forming young and hypervelocity stars in the Galactic Centre via tidal disruption of a molecular cloud*  
[Generozov](#), [Nayakshin](#), & **Madigan**, *MNRAS*, 512:4100G (2022)
24. *Bar-driven Leading Spiral Arms in a Counter-Rotating Dark Matter Halo*  
[Lieb](#), [Collier](#), & **Madigan**, *MNRAS*, 509:685L (2022)
23. *On the Formation of an Eccentric Nuclear Disk following the Gravitational Recoil Kick of a Supermassive Black Hole*  
[Akiba](#) & **Madigan**, *ApJL*, 921:L12 (2021)
22. *A Lopsided Outer Solar System?*  
[Zderic](#), [Tiongco](#), [Collier](#), [Wernke](#), [Generozov](#), & **Madigan**, *AJ*, 162:278Z (2021)
21. *Photometry and Kinematics of Self-Gravitating Eccentric Nuclear Disks*  
[Wernke](#) & **Madigan**, *ApJ*, 920:149 (2021)
20. *The Coupling of Galactic Dark Matter Halos with Stellar Bars*  
[Collier](#) & **Madigan**, *ApJ* 915:1 (2021)
19. *Galactic merger implications for eccentric nuclear disks: a mechanism for disk alignment*  
[Rodriguez](#), [Generozov](#), & **Madigan**, *MNRAS* 503:2713 (2021)
18. *Giant-planet Influence on the Collective Gravity of a Primordial Scattered Disk*  
[Zderic](#) & **Madigan**, *AJ* 160:50Z (2020)
17. *The Hills Mechanism and the Galactic Center S-stars*  
[Generozov](#) & **Madigan**, *ApJ* 896:137G (2020)

16. *Apsidal Clustering following the Inclination Instability*  
[Zderic](#), [Collier](#), [Tiongco](#), & **Madigan**, *ApJL* 895L:27Z (2020)
  15. *Mass Segregation in Eccentric Nuclear Disks: Enhanced Tidal Disruption Event Rates for High Mass Stars*  
[Foote](#), [Generozov](#), & **Madigan**, *ApJ* 890:175F (2020)
  14. *Secular Eccentricity Oscillations in Axisymmetric Disks of Eccentric Orbits*  
[Fleisig](#), [Zderic](#), & **Madigan**, *AJ* 159:20F (2020)
  13. *The Effect of General Relativistic Precession on Tidal Disruption Events from Eccentric Nuclear Disks*  
[Wernke](#) & **Madigan**, *ApJ* 880:42W (2019)
  12. *On the Dynamics of the Inclination Instability*  
**Madigan**, [Zderic](#), [McCourt](#), & [Fleisig](#), *AJ* 156:141M (2018)
  11. *Dynamical Properties of Eccentric Nuclear Disks: Stability, Longevity, and Implications for Tidal Disruption Rates in Post-Merger Galaxies*  
**Madigan**, [Halle](#), [Moody](#), [McCourt](#), [Nixon](#), & [Wernke](#), *ApJ* 853:141M (2018)
  10. *A Characteristic Scale for Cold Gas*  
[McCourt](#), [Oh](#), [O'Leary](#), & **Madigan**, *MNRAS* 473:5047 (2018)
  9. *Using gas clouds to probe the accretion flow around SgrA\*: G2's delayed pericenter passage*  
**Madigan**, [McCourt](#), & [O'Leary](#), *MNRAS* 465:2310 (2017)
- [Arrival at CU]
8. *A new inclination instability reshapes Keplerian disks into cones: application to the outer Solar System*  
**Madigan** & [McCourt](#), *MNRAS* 457:89 (2016)
  7. *Going with the flow: using gas clouds to probe the accretion flow feeding SgrA\**  
[McCourt](#) & **Madigan**, *MNRAS* 455:2187 (2016)
  6. [McCourt](#), [O'Leary](#), **Madigan**, & [Quataert](#), *MNRAS* 449:1 (2015)  
*Magnetized Gas Clouds can Survive Acceleration by a Hot Wind*
  5. *The Galactic Center cloud G2 and its gas streamer*  
[Pfuhl](#) and 12 co-authors including **Madigan**, *ApJ* 798:111 (2015)

4. *On the Origin of the B-stars in the Galactic Center*  
**Madigan**, Pfuhl, Levin, Gillessen, Genzel, & Perets, *ApJ* 784:23M (2014)
3. *Secular Dynamical Anti-friction*  
**Madigan**, & Levin, *ApJ* 754:42M (2012)
2. *Secular Stellar Dynamics near Massive Black Holes*  
**Madigan**, Hopman, & Levin, *ApJ* 738:99M (2011)
1. *A New Secular Instability of Eccentric Stellar Disks around Supermassive Black Holes, with Application to the Galactic Center*  
**Madigan**, Levin, & Hopman, *ApJ* 697:L44 (2009)

## White Papers and Conference Proceedings

4. *Training the Future Generation of Computational Researchers*  
Besla and 108 co-authors including **Madigan**,  
Submitted to Astro2020 Decadal Survey, *BAAS*, 51g:11B (2019)
3. *On the origin of young stars at the Galactic center*  
**Madigan**, Pfuhl, Levin, Gillessen, Genzel, & Perets, *IAUS* 303:238M (2014)
2. *The Eccentric Disc Instability: Dependency on Background Stellar Cluster*  
**Madigan**, *ASPC* 439:153 (2011)
1. *Mass Segregation in the Galactic Centre*  
Hopman & **Madigan**, *ASPC* 439:180H (2011)

## Journal Abbreviations

AJ	The Astronomical Journal
ApJ(L)	The Astrophysical Journal (Letters)
MNRAS	Monthly Notices of the Royal Astronomical Society
BAAS	Bulletin of the American Astronomical Society
ASPC	Astronomical Society of the Pacific
IAUS	International Astronomical Union Symposia

January 30, 2024