

MATTHEW J. HOLMAN

Center for Astrophysics | Harvard & Smithsonian
Mail Stop #51
60 Garden Street
Cambridge, MA 02138

mholman@cfa.harvard.edu
ORCID: 0000-0002-1139-4880

Education and Training

Massachusetts Institute of Technology	Mathematics	SB, 1989
Massachusetts Institute of Technology	Planetary Sciences	PhD, 1994
National Astronomical Observatory of Japan	Solar System Dynamics	Postdoc, 1994–1995
Canadian Institute for Theoretical Astrophysics	Solar System Dynamics	Postdoc, 1995–1997
Harvard University	Comput. Sci. & Eng.	SM, 2018

Appointments

Smithsonian Astrophysical Observatory	<i>Senior Astrophysicist.</i> 2011–present
Harvard University	<i>Lecturer on Astronomy.</i>
Minor Planet Center	<i>Director.</i> 2015–2021
Smithsonian Astrophysical Observatory	<i>Associate Director.</i> 2004–2014
Smithsonian Astrophysical Observatory	<i>Astrophysicist.</i> 1997–2011

Honors and Awards

AAAS Newcomb Cleveland Prize, for the best paper published in *Science*, 2000
Asteroid 3666 Holman, 1999
Boris Garfinkel Lectureship, Yale University, 2018
Bok Center Excellence in Teaching Award, Harvard University, 2017
NCU–Delta Young Astronomer Lectureship Award, 2012
Cover article of *Science*, 1 October 2010
NASA Group Achievement Award, Kepler Launch and Commissioning Team, 2010
NASA Group Achievement Award, EPOXI Project Team, 2009
Editor’s Letter of Commendation for Excellent Reviewing, *Icarus*, 1998
Japan Society for the Promotion of Science Postdoctoral Fellowship, 1994
National Research Council Research Associateship (declined), 1994
National Science Foundation Graduate Fellowship, 1990–1993

Principal Research Contributions

- *N-body integrators.* With Jack Wisdom, introduced the symplectic n -body mapping now known as the Wisdom–Holman map, an order of magnitude faster than prior methods and since adopted as the standard technique for long-term integration of the solar system. Led the development of ASSIST, an ephemeris-quality test-particle integrator built for the precision that modern surveys require.
- *Transit timing variations.* With Norman Murray, proposed the use of deviations in transit times to detect planets far below the mass reachable from transit depth alone, and in 2010 led the discovery of Kepler-9, the first planetary system confirmed by that method. Transit timing is now a standard technique in exoplanet science.
- *Faint trans-Neptunian discovery from space.* The small end of the trans-Neptunian size distribution records the collisional history of the outer solar system. The bodies that carry that record are too faint for ground-based surveys. Beginning with the *Hubble Space Telescope* survey that first measured the small end and found fewer small bodies than collisional models predicted (Bernstein et al. 2004). Has pursued the same question through deeper searches of those *HST* data and a combined *JWST*

and *HST* program that in 2026 reached diameters near 10 km. Yet deeper searches with *JWST* are underway. Will use the *Nancy Grace Roman Space Telescope*, through a funded archival search (PI Napier) of the Galactic Bulge Time Domain Survey, to discover ~ 1000 faint TNOs.

- *Stability and the origin of chaos.* Mapped the stable and unstable regions among the giant planets, together with the dynamical pathway that supplies short-period comets, and established where planets can persist in binary systems — a criterion published before any such planet was known and later applied to the circumbinary planets found by Kepler. Then, with Norman Murray, identified the dynamical mechanism responsible for chaos in asteroid and planetary orbits — the overlap of high-order and three-body mean-motion resonances — in a series of papers running from the outer asteroid belt (*The Astronomical Journal*, 1996, 1997, 1998) to the outer solar system (*Science*, 1999) and the role of chaotic resonances generally (*Nature*, 2001).
- *Discovery at survey scale.* Developed HeliLinC, the linking algorithm that makes minor-planet discovery possible in sparse survey data without nightly pairs. A version of it, developed by Ari Heinze, now runs in the Vera C. Rubin Observatory’s solar system pipeline, where it is expected to account for the majority of the survey’s discoveries over its ten-year planned operations.

Discoveries

Credited with the discovery or co-discovery of one moon of Jupiter, one of Saturn, seven of Uranus, and five of Neptune. In the past year, discovered approximately 1,500 trans-Neptunian objects in Rubin Observatory data, all reported to the Minor Planet Center, against roughly 6,000 known previously – a one-quarter increase in the known population of the outer solar system.

Publications

244 refereed publications. 46,995 citations and $h = 91$ (NASA ADS, 4 October 2026). Twelve publications selected as most significant are listed separately.

Training and Mentoring

Mentored 14 postdoctoral researchers, 8 doctoral students, 3 master’s students, and 28 undergraduate researchers, and served on roughly 15 doctoral supervisory committees.

Former postdoctoral mentees include Konstantin Batygin (Caltech), B. Scott Gaudi (Ohio State), Joshua Winn (Princeton), Daniel Fabrycky (Chicago), Eric Ford (Penn State), Ruth Murray-Clay (UC Santa Cruz), Darin Ragozzine (Brigham Young), and Matthew Payne (Director, Minor Planet Center). Former undergraduate researchers include Shannon Curry (LASP, Colorado), Nikole Lewis (Cornell), Carolyn Ernst (JHU Applied Physics Laboratory), and Wesley Fraser (NRC Herzberg).

Selected Service

Users Committee for NSF’s NOIRLab, 2024–present

Rubin Observatory Users Committee: Chair 2022–2024, Member 2024–2025

Rubin Observatory Solar System Commissioning Team, 2021–present

Roman Early Definition Survey Assessment Committee, 2023–2024

American Association for the Advancement of Science, Astronomy Section, Member-at-large, 2023–2024

Director, Minor Planet Center, 2015–2021

Pan-STARRS-1 Science Consortium Board, 2008–2016

Kepler Science Council, elected member, 2009–2011

Division on Dynamical Astronomy, Brouwer Award Selection Committee, 2001–2003 (Chair, 2003)

Co-chair, CfA Colloquium Committee, 2026–present

Smithsonian Astrophysical Observatory, Professional Accomplishments Evaluation Committee, 2026

Referee for *Nature*, *Science*, *The Astronomical Journal*, *The Astrophysical Journal*, *Icarus*, *The Planetary Science Journal*, and *Celestial Mechanics and Dynamical Astronomy*; NASA and NSF grant review panels