

Publications

Edward Belbruno

Books

1. Title: *Fly Me to the Moon*
Subtitle: *An Insiders Guide to the New Science of Space Travel*
Author: Edward Belbruno
Publisher: Princeton University Press
Publication date: February, 2007
Pages: 150
Type of Book: General mathematics and science
2. Title: *Capture Dynamics and Chaotic Motions in Celestial Mechanics*
Subtitle: *With Applications to the Construction of Low Energy Transfers*
Author: Edward Belbruno
Publisher: Princeton University Press
Publication Date: February 2004
Pages: 211
(see www.pupress.princeton.edu/titles/7687.html)
Type of book: Graduate text in mathematics

Proceedings Volumes

- 1., 2. Special issues of journal *Celestial Mechanics and Dynamical Astronomy*
Guest Editor: Edward Belbruno, Regular Editor: Sylvio Ferraz-Mello
Publisher: Springer Verlag
Volume 114: Entitled *Weak Stability Boundaries, Manifolds and Low Thrust Transfers*; Sept. - Oct 2012
Volume 105: Entitled *New Trends in Astrodynamics*; December 2008
3. Title: *Astrodynamics*
Editors: P. Gurfil, Edward Belbruno
Publisher: Elsevier
COSPAR(ASR), Volume 42
Publication Date: October 2008
Pages: 131
4. Title: *New Trends in Astrodynamics and Applications III*
Editor: Edward Belbruno
Publisher: American Institute of Physics
AIP Conference Proceedings, Volume 886
Publication Date: 2007
Pages: 336
5. Title: *Astrodynamics and Applications*
Editor: Edward Belbruno

Publisher: New York Academy of Sciences (Annals Series)
Volume 1065
Publication Date: January 2006
Pages: 471

6. Title: *Astrodynamics, Space Missions and Chaos*
Editors: Edward Belbruno (chief editor), Pini Gurfil, David Folta
Publisher: New York Academy of Sciences (Annals Series)
Volume 1017
Publication Date: May 2004
Pages: 474

7. Title: *Nonlinear Astrodynamics*
Editor: Edward Belbruno
Publisher: The Geometry Center(Univ. of Minnesota)/National Science Foundation
Volume GCG65
Publication Date: April 1994
Pages: 324

Research Papers

Papers Submitted

"A Dynamical Mechanism for the Big Bang and Non-Regularizability for $w = 1$ "
Submitted to *Classical and Quantum Gravity* - November 2014.
ArXiv: 1411.4071 [gr-qc], November 14, 2014

Peer Reviewed Publications - Nonconference

"Earth-Mars Transfers With Ballistic Capture", *Celestial Mechanics and Dynamical Astronomy*, **121**, pp329-346, 2015 (co-author: Francesco Topputo) (posted on arXiv, number: 1410:88564v1 [astro-ph], October 27,2014)

"Regularization of the Big Bang Singularity with Time Varying Equation of State $w > 1$ ", *Classical and Quantum Gravity*, v 31, 165002, 2014.(co-author: BingKan Xue) (posted on arXiv, number:1403:2122 [gr-qc], March 10, 2014)

"On the Regularizability of the Big Bang Singularity", *Celestial Mechanics and Dynamical Astronomy*, **115**, pp 21-34, Jan. 2013 (posted on arXiv, number: 1205.1474v1 [math-ph], May 2,2012)

"Chaotic Exchange of Solid Material Between Planetary Systems: Implications for Lithopanspermia", *Astrobiology*,**12**, Number 8, pp 754-774, August 2012. (co-authors: Amaya Moro-Martin, Renu Malhotra, Dmitry Savransky) (posted on arXiv, number: 1205.1059v1 [astro-ph.EP], May 2, 2012)

"Optimization of Low Energy Transfers", in Modeling and Optimization in Space Engineering, G. Fasana; J, Pinter Editors, **73**, Series ISSN 1931-6828, Springer, New York, pp 389-404, 2013(co-author - Francesco

Topputo)

"Geometry of Weak Stability Boundaries", *Qualitative Theory of Dynamical Systems*, DOI 10.1007/s12346-012-0069-x, 2012 (co-authors: Marian Gidea, Francesco Topputo) (posted on arXiv, number: 1204.1502v1 [math.DS], April 6, 2012)

"Dynamical Systems Approach to Schwarzschild Null Geodesics", *Classical and Quantum Gravity*, v 28, 195007, 2011.(co-author: Frans Pretorius) (posted on arXiv, number: 1103.0585v1 [gr-qc])

"Weak Stability Boundary and Invariant Manifolds", *SIAM J. Appl. Dyn. Systems*, Volume 9, No. 3, pp 1061-1089, December 2010.

"A Survey of Recent Results on Weak Stability Boundaries and Applications", in *Space Manifold Dynamics*(subtitle: Novel Spaceways for Science and Exploration), edited by E. Perrozi, S. Ferraz-Mello, Springer-Verlag, 2010.

"Computation of Weak Stability Boundaries: Sun-Jupiter", *Celestial Mechanics and Dynamical Astronomy*, Volume 105, pp 3-17, 2009 (co-author, Francesco Topputo)

"Random Walk in Celestial Mechanics", *Regular and Chaotic Dynamics*, (Jürgen Moser-80), Volume 14, number 1, pp 7-17, February 2009.

"Recollections of Jürgen Moser", *Regular and Chaotic Dynamics*, (Jürgen Moser-80), Volume 14, number 1, pp 3-4, February 2009.

"Random Walk in the Three-Body Problem", *Discrete and Continuous Dynamical Systems-S*, Volume 1, number 4, pp 519-540, Dec. 2008.

"Resonance Transitions Associated to Weak Capture in the Restricted Three-Body Problem", *Advances in Space Research*, Volume 42, number 8, Elsevier, pp 1330-1352, 2008.

"Resonant Motion, Ballistic Escape and their Applications in Astrodynamics", *Advances in Space Research*, Volume 42, number 8, pp 1318-1330, Elsevier, 2008.

"Where Did The Moon Come From?", *Astronomical Journal*, V 129, No 3, pp 1724-1745, March 2005. (co-author: J. R. Gott III)

"Construction of Periodic Orbits in Hill's Problem for $C \gtrsim 3^{\frac{4}{3}}$ ", in *New Advances in Celestial Mechanics and Hamiltonian Systems*, pp 37-63, Kluwer Academic/Plenum Publishers, 2004.

"Analytic Estimation of Weak Stability Boundaries and Low Energy Transfers", *Contemporary Mathematics*, AMS, V 292, Feb. 2002, pp 17-45

"Resonance Hopping in Comets", *The Astronomical Journal*, V113, pp 1433-1444, April 1997. (co-author: Brian Marsden)

"On the Families of Periodic Orbits which Bifurcate from the Circular Sitnikov Motions", *Cel. Mech. and Dyn. Ast.*, V.60, 1994, pp 99-129. (co-authors: J. Llibre, M. Olle)

"Ballistic Lunar Capture Transfers Using the Fuzzy Boundary and Solar Perturbations: A Survey", *Journal of the British Interplanetary Society*, v. 47, Jan. 1994, pp 73-80.

"Sun-Perturbed Earth-to-Moon Transfers with Ballistic Capture", *Journal of Guidance, Control, and Dynamics*, V.16, No.4, July- August 1993. pp 770-775. (co-author: J. Miller)

"Through the Fuzzy Boundary: A New Route to the Moon", *Planetary Report*, V.7, No. 3, May/June 1992, pp 8-10.

"On Simultaneous Double Collision in the Collinear Four-Body Problem", *Journal of Differential Equations*, V.52, 1984, pp 415-431.

"A New Family of Periodic Orbits for the Restricted Problem", *Celestial Mechanics*, V.25, 1981, pp 195-217.

"A New Regularization of the Restricted Three-Body Problem and an Application", *Celestial Mechanics*, V. 25, 1981, pp398-415.

"Regularizations and Geodesic Flows", *Classical Mechanics and Dynamical Systems*, Lecture Notes in Pure and Applied Mathematics, (R. Devaney; Z. Nitecki, ed.), Volume 80, pp 1-11, 1981.

"Two-Body Motion Under the Inverse Square Central Force and Equivalent Geodesic Flows", *Celestial Mechanics*, V.15, 1977, pp 467-476.

Peer Reviewed Publications - Conference Proceedings

"Ballistic Capture Transfers from the Earth to Mars", In Proceedings AAS/AIAA Spaceflight Mechanics Conference, Paper AAS 15-342, Williamsburg Virginia, January 2015. (co-author Francesco Topputo)

"Efficient Cis-Lunar Trajectories", in Proceedings of Global Exploration Conference 2012, Paper GLEX-2012.02.3.6x12248, Washington, D.C., May 22-24, 2012. (co-authors: Kevin Post, Francesco Topputo)

"A New Class of Low Energy Orbits and Mission Applications", AIP Conference Proceedings, **886**, *New Trends in Astrodynamics and Applications III*, (Belbruno, ed.), pp 3-20, American Institute of Physics, 2007.

"Weak Capture, Chaos, and Applications", in *Annals of the New York Academy of Sciences, Astrodynamics and Applications*, **1065**, (Belbruno, ed.), pp 1-14, New York Academy of Sciences, Annals, V. 1065, 2006.

"Reduction of Lunar Landing Fuel Requirements by Utilizing Ballistic Lunar Capture", in *Annals of the New York Academy of Sciences, Astrodynamics and Applications*, **1065**, (E. Belbruno, ed.), pp 139-151, New York Academy of Sciences, Annals, V. 1065, 2006.(co-author: M. Johnson (main author))

"A Low Energy Lunar Transportation System Using Chaotic Dynamics", In Proceedings AAS/AIAA Astrodynamics Specialists Conference, Paper AAS 05-382, Lake Tahoe, August 2005.

"Existence of Chaos Associated with Weak Capture and Applications", In *Annals of the New York Academy of Sciences, Astrodynamics, Chaos and Space Missions*, **1017**, (E. Belbruno, P. Gurfil, D. Folta, ed.), pp 1-10, New York Academy of Sciences, May 2004.

"Low Energy Transfers, Weak Capture and Chaos", Paper IAC-02-A.6.03, Proceedings of the 53rd International Astronautical Congress, October 10-19, 2002, Houston, Texas.

"Quasi-Stationary Motion", Paper IAC-02-A.7.01, Proceedings of the 53rd International Astronautical Congress, October 10-19, 2002, Houston, Texas.

"Biological Analogs and Emergent Intelligence for Control of Stratospheric Balloon Constellations", in *Lecture Notes in Computer Science*, V 2564, Springer, (Proceedings of First Inter. Workshop on Radical Agent Concepts WRAC), 2003, pp 393-407. (co-authors: N. Leonard (main author), P. Bhatta, M. Heun, R. Schlaifer, K. Aaron, K. Nock)

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"A Note On Reducing Cost of Lunar Base Construction Using the Ballistic Lunar Capture Transfer", in Proceedings of the Annual Lunar Development Conference", July 2000, Las Vegas, Published by SSI/Princeton, October 2000.

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"Significance of the 2:3 Resonance and Hopping in the Kuiper Belt", in *The Dynamics of Small Bodies in the Solar System*; Kluwer Press, Mathematical Sciences Series, (B. Steves; A. Roy, ed.), 1999.

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"Ballistic Lunar Capture Transfer Determination for the US Air Force Academy Blue Moon Mission", Paper no. AAS 97-171, Proceedings of the AAS/AIAA Space Flight Mechanics Meeting, Huntsville, Alabama, February 1997. (co-authors: R. Humble; J. Coil)

"Low Energy Comet Rendezvous Using Resonance Transitions", First IAA Symposium on Missions to the Outer Solar System and Beyond, Politecnico di Torino, Torino, Italy, June 1996. (co-author: G. Genta)

"An Investigation Into Critical Aspects of a New Form of Low Energy Transfer, The Belbruno-Miller Transfer", AIAA Paper No. 92-4581, August 1992. (co-authors: V.J. Krish (main author), W.M. Hollister)

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"To the Moon from a B52: Robotic Lunar Exploration Using the Pegasus Winged Rocket and Ballistic Lunar Capture", in Proceedings of 5th Annual AIAA/USU Conf. on Small Satellites, Utah State Univ., Logan, UT, August 24, 1991.(co-author: R. Ridenoure(main author)

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"Low Launch-Energy Trajectories to the Outer Solar System Via Venus and Earth Gravity-Assist Fly-bys", in Proceedings of AAS/AIAA Astrodynamics Specialists Conference, Kalispell, Montana, August 10-13, 1987. (co-authors: R. Diehl(main author), D. Bender, M. Meyers, D. Stetson).

"Lunar Capture Orbits, A Method of Constructing Earth-Moon Trajectories And The LunarGAS Mission", AIAA Paper no. 87- 1054, in Proceedings of AIAA/DGLR/JSASS Inter. Elec. Propl. Conf., May 1987.

Key Technical Reports, Book Chapters, and Preprints

"Weak Stability boundary and Invariant Manifolds", NASA AISRP Annual Report (Period: May 30 2009 - May 30, 2010), Report No. NASA-1-ARPT-09-10, Science Mission Directorate, March 31, 2010.

"Structure of the Weak Stability Boundary III", NASA AISRP Annual Report (Period: March 10, 2008-April 1, 2009), Report No. NASA-4-ARPT-08-09, Science Mission Directorate, April 5, 2009.

"Minimal Energy Transfer of Solid Material Between Planetary Systems", arXiv:0808.3268v2(astro-ph), (co-authors: Amaya Moro-Martin, Renu Malhotra), September 3, 2008.

"Structure of the Weak Stability Boundary II", NASA AISRP Annual Report (Period: January 10, 2007-March 10, 2008), Report No. NASA-3-ARPT-07-08, Science Mission Directorate, March 10, 2008.

"Structure of the Weak Stability Boundary", NASA AISRP Annual Report (Period: April 1, 2006- January 10, 2007), Report No. NASA-2-ARPT-06-07, Science Mission Directorate, January 10, 2007.

"Low Energy Transfers and Applications", Book chapter in *Advances in Astrodynamics* (P. Gurfil, ed.), Elsevier, September 2006.

"Mission Extension Using Sensitive Trajectories and Autonomous Control", NASA AISRP Annual Report (Period: March 2005-March 2006), Report No. NASA-1-ARPT-06, Science Mission Directorate, February 22, 2006.

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General Audience Science Articles

"Aided by Art, A Theory of Life's Extra-Solar Origins, space.com, Op-Ed, Feb. 26, 2015

"Painting Our Way to the Moon", space.com, Op-Ed section, Jan. 14, 2015

"The Angel that Flew to the Moon", New Scientist, Turning Point column, pp51, Feb. 2007

"Through the Fuzzy Boundary: A New Route to the Moon", Planetary Report, May 1992

Noted Articles by Other Authors on my Work

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Kluger, J., "Aliens Among Us", *Time Magazine*, (cover mention) pp44-47, October 22, 2012.

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Editorial Staff, "Interstellar 'Slowball' Could Have Carried Seeds of Life", *New Scientist*, Volume 272, page 21, September 4, 2008.

Casselmann, R., "Chaos in the Weak Stability Boundary", Cover of the *Notices*, American Mathematical Society, Volume 55, number 4, April 2008. (see www.ams.org/notices/200804/)

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Elfman, L., "Canvas of Reality: Ed Belbruno's Parallel Lives", *Space Life Style Magazine*, Fall 2007

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