

# Stephen John Kortenkamp

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## DEGREES

University of Florida, Astronomy, Ph.D. in 1996, M.S. in 1994

University of Wisconsin Eau Claire, Physics & Math, B.S. in 1990

## PROFESSIONAL APPOINTMENTS

Planetary Science Institute:

Senior Research Scientist (2007-present)  
Research Scientist (2001-06)

University of Arizona, Lunar and Planetary Lab:

Teaching Teams Instructional Coordinator (2013-present)  
Adjunct Instructor (2007-present)  
Research Associate (2001-03)

University of Maryland, Department of Astronomy:

Research Associate (2000-01)

Carnegie Institution of Washington, Department of Terrestrial Magnetism:

Research Associate with the late George Wetherill (1997-2001)

## TEACHING AND EDUCATIONAL ACTIVITIES

University of Arizona:

Adjunct Instructor, Lunar and Planetary Lab (2007-present)

- I teach a second-tier planetary science course for planetary/astronomy minors and non-science majors (PTY5/ASTR 206, typical enrollment 80-160).

Leader of the Teaching Teams Program, College of Science (2013-present)

- Teaching Teams is the campus-wide undergraduate peer-instruction program that originated in the Lunar and Planetary Lab.

Planetary Science Institute:

Continuing Education Workshops for Science Teachers (2010-2014)

- Responsible for developing and teaching state-certified workshops for local K-12 science teachers to earn their required continuing education credits.

Undergraduate Students

- Emily Joseph (Case Western Reserve University), 2007-2010.
- Scott LaPlante (University of Arizona), 2010.

Children's Science Books:

Author of 21 peer-reviewed non-fiction children's science books explicitly addressing national and state education standards in Earth and space sciences. At least six of my titles have been incorporated into the Accelerated Reader program used in elementary schools nation-wide. See below for listing.

## TEACHING AWARDS

University of Arizona:

Innovations in Teaching Award, College of Science, 2011.

Nominated for Distinguished Early Career Teaching Award, College of Science, 2009.

## PROFESSIONAL INTERESTS

Orbital and Collisional Evolution of Small Solar System Bodies:

Computer simulations of orbital evolution, with particular emphasis on resonant interactions between planets and small bodies, such as with Trojan asteroids, objects on Pluto-like orbits, and quasi-satellites of the terrestrial and giant planets.

Origin and Evolution of Earth-Like Planets:

Utilization of a unique computer code developed at the Planetary Science Institute for simulating the formation of rocky terrestrial planets within a protoplanetary disk initially composed of small km-sized bodies.

Innovative Visualization Techniques in Earth and Space Science Education:

Development of ray-tracing computer code for production of high-resolution computer simulations for science teachers and researchers. To date over 100 unique simulations have been produced to demonstrate concepts such as planet formation, planetary motion, seasons, phases, eclipses, and historical science experiments.

## GRANTS FOR RESEARCH, EDUCATION, AND EQUIPMENT

### Current Grants

NASA PG&G: Accretion of interplanetary dust through Earth's quasi-satellite resonance (PI: Kortenkamp; 2014-17)

NASA EPO Supplement: Out of this world: Bringing space rocks that hit Earth to children and families (PI: the late Betty Pierazzo; 2010-14)

### Recent Completed Grants

NASA PG&G: Investigation of a new resonant mechanism for accretion of interplanetary dust by Earth (PI: Kortenkamp)

NASA SMD EPOESS: Workshops in Science Education and Resources (WISER): Planetary Perspectives (PI: David Crown)

NASA Origins: Studying the origins of small bodies to aid theories of planet formation and early evolution (PI: Kortenkamp)

NASA Planetary Major Equipment: Origin and evolution of planetary systems (Co-PI: Kortenkamp)

NSF Planetary Astronomy: Investigation of a resonant mechanism for capture of irregular satellites (PI: Kortenkamp)

NSF Advanced Technologies and Instrumentation: Acquisition of equipment for an interdisciplinary research center at the Planetary Science Institute (PI: Kortenkamp)

## PROFESSIONAL ACTIVITIES

Chair of the dynamics review panel for NASA's PG&G program. Review panelist for NASA's Origins, PG&G, and Outer Planets research programs, external proposal reviewer for Exobiology, Origins, PMDAP, and PG&G.

Reviewer for Ap. J., *Icarus*, Univ. Arizona Press, and Kluwer Academic Publishers.

Book reviewer for the journal *Meteoritics & Planetary Science*.

Scientific consultant for Capstone Press on 12 children's science books about the solar system, including a book for each planet plus the sun, moon and the object formerly known as the planet Pluto.

#### EXTRACURRICULAR ACTIVITIES

Invited speaker at numerous local schools and organizations, including recently the La Palma Prison in Eloy, AZ (inmates in the academic program), Kartchner Caverns State Park (public evening presentation), Presidio Charter School (K-12 students); Jewish Community Center (pre-school and kindergarten); Twin Peaks Elementary School (K-6 classes and whole-school assemblies).

Volunteer third grade math tutor, Twin Peaks Elementary School, Tucson, AZ, 2007.

Grand Awards Judge, Intel International Science and Engineering Festival, 2005.

Long-course triathlete and distance runner, including half-ironman (PR 4:59), ironman (PR 11:09), 10K (PR 31:40) and marathon (PR 2:44).

#### FIRST-AUTHOR PEER-REVIEWED SCIENTIFIC PUBLICATIONS

Kortenkamp S.J., Trapping and dynamical evolution of interplanetary dust particles in Earth's quasi-satellite resonance. *Icarus* **226**, 1550–1558 (2013).

Kortenkamp S.J. and Joseph E.C.S., Transformation of Trojans into quasi-satellites during planetary migration and their subsequent close-encounters with the host planet. *Icarus* **215**, 669–681 (2011).

Kortenkamp S.J., An efficient, low-velocity, resonant mechanism for capture of satellites by a protoplanet. *Icarus* **175**, 409–418 (2005).

Kortenkamp S.J., Malhotra R., and Michtchenko T., Survival of Trojan-type companions of Neptune during primordial planet migration. *Icarus* **167**, 347–359 (2004).

Kortenkamp S.J., Wetherill G.W., Inaba S., Runaway growth of planetary embryos facilitated by massive bodies in a protoplanetary disk. *Science* **293**, 1127–1129 (2001).

Kortenkamp S.J., Dermott S.F., Fogle D., Grogan K., Sources and orbital evolution of interplanetary dust accreted by Earth. In *Accretion of extraterrestrial matter throughout Earth's history* (Peucker-Ehrenbrink & Schmitz, Eds.) 13–30, Kluwer, New York (2001).

Kortenkamp S.J., Kokubo E., Weidenschilling S., Formation of planetary embryos. In *Origin of the Earth and Moon* (Canup R. and Righter K., Eds.) pp. 85–100, Univ. of Ariz. Press, Tucson (2000).

Kortenkamp S.J. and Wetherill G.W., Terrestrial planet and asteroid formation in the presence of giant planets I. Relative velocities of planetesimals subject to Jupiter and Saturn perturbations. *Icarus* **143**, 60–73 (2000).

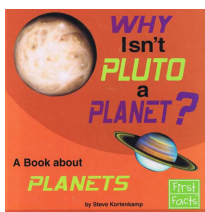
Kortenkamp S.J. and Dermott S.F., Accretion of interplanetary dust particles by the Earth. *Icarus* **135**, 469–495 (1998).

Kortenkamp S.J. and Dermott S.F., A 100,000 year periodicity in the accretion rate of interplanetary dust. *Science* **280**, 874–876 (1998).

Kortenkamp S.J., Dermott S.F., Liou J.C., Naturally occurring selection effects on the terrestrial accretion of interplanetary dust particles. In *Physics, Chemistry and Dynamics of Interplanetary Dust* (Gustafson B.Å.S. and Hanner M.S., Eds.), IAU Colloquium 150, ASP Conference Series **104**, pp. 167–170 (1996).

PEER-REVIEWED CHILDREN’S SCIENCE BOOKS (All published by Capstone Press, Mankato, MN)

In Capstone’s First Facts series *Why In The World?*, for struggling readers at the K-3 level:

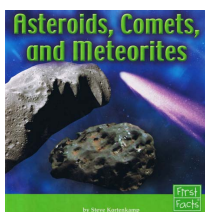


Kortenkamp S.J. (2007)  
*Why Isn't Pluto a Planet?*

What is a planet anyway? How come Pluto isn't one? Are there any more planets? Scientists are learning more about these questions every day. Look inside to discover more about the mysteries of the planets in our solar system, and beyond.

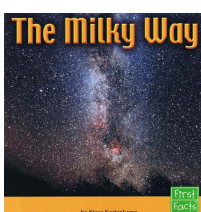
Note: Although this book was in preparation for more than a year, due to persistent nagging by the author and eventual fast-tracking by the editors at Capstone it was available just a couple of months after the IAU's August 2006 "demotion" of Pluto. In January 2008 it achieved a best-seller #6 ranking on Amazon.com among all children's astronomy & space related books.

In Capstone’s First Facts series *The Solar System*, for struggling readers at the K-3 level:



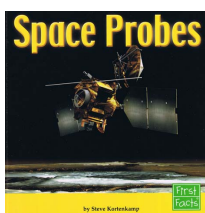
Kortenkamp S.J. (2007)  
*Asteroids, Comets, Meteorites*

Did you know that asteroids are leftovers from when the planets formed? Or that comets grow new tails every time they get near the Sun? Explore asteroids, comets, and meteorites, and their place in the solar system.



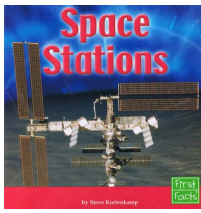
Kortenkamp S.J. (2007)  
*The Milky Way*

Did you know that the Milky Way is only one of billions of galaxies in the universe? Or that the planets in our solar system aren't the only planets in the Milky Way? Explore the Milky Way and our solar system's place in the galaxy.



Kortenkamp S.J. (2007)  
*Space Probes*

Did you know that space probes have been to every planet in our solar system? Or that probes are sent to explore asteroids and comets? Discover space probes and how they help us explore our solar system.



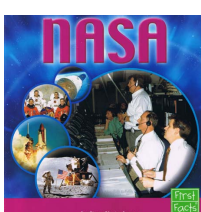
Kortenkamp S.J. (2007)  
*Space Stations*

Did you know that people have been living on space stations for more than 30 years? Or that scientists hope to build a space station on a faraway planet? Explore space stations and how they are helping us prepare to go farther out into our solar system.



Kortenkamp S.J. (2007)  
*The First Moon Landing*

Did you know that it took three days for the first astronauts to reach the moon? Or that the first men on the moon left experiments that scientists still use today? Explore the first moon landing and what it taught us about our solar system.



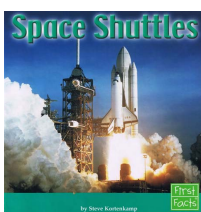
Kortenkamp S.J. (2007)  
*NASA*

Did you know that we use inventions made by NASA scientists every day? Or that NASA's robots have visited every planet in our solar system? Discover NASA and how this agency explores our solar system.



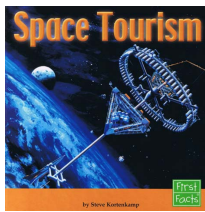
Kortenkamp S.J. (2008)  
*Space Junk*

Did you know that millions of pieces of space junk orbit Earth? Or that space junk travels fast enough to punch a hole in a spacecraft? Discover how space junk gets into Earth's orbit and why scientists study ways to clean it up.



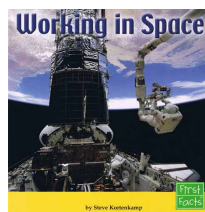
Kortenkamp S.J. (2008)  
*Space Shuttles*

Did you know the space shuttle was the first reusable spacecraft? Or that astronauts use the space shuttle to build the International Space Station? Explore space shuttles and how astronauts use them while working in space.



Kortenkamp S.J. (2008)  
*Space Tourism*

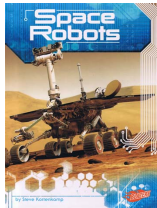
Did you know space tourists have already visited the International Space Station? Or that companies are building space hotels that will someday orbit Earth? Explore space tourism and learn how people will visit space in the future.



Kortenkamp S.J. (2008)  
*Working in Space*

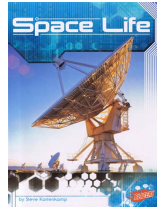
Did you know that astronauts train for up to 10 years before going into space? Or that their work involves fixing satellites and building space stations? Explore the ways astronauts work and play as they do their jobs in space.

In Capstone's Blazers series *Incredible Space*, for severely struggling readers at the K-3 level:



Kortenkamp S.J. (2009)  
*Space Robots*

Robots can be small enough to explore inside comets or big enough to look just like astronauts. Learn what robots do and how they'll help astronauts explore space in the future.



Kortenkamp S.J. (2009)  
*Space Life*

As long as there has been human life on Earth, people have wondered if life could exist on other planets. Find out what scientist know about life on other planets and what astronauts may discover in the future.



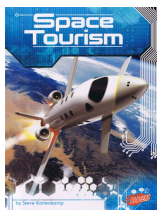
Kortenkamp S.J. (2009)  
*Spacecraft*

Spacecraft have traveled to places astronauts have never been. Learn how spacecraft will help astronauts explore space in the future.



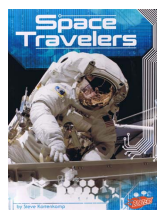
Kortenkamp S.J. (2009)  
*Space Stations*

A space station is a home away from home for astronauts. Learn more about space stations and how they'll be used in the future.



Kortenkamp S.J. (2009)  
*Space Tourism*

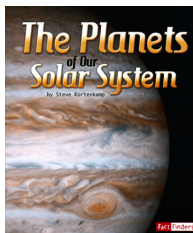
Imagine taking a vacation that's out of this world. Discover what scientists already know about space tourism and how long it will be before people can live in space.



Kortenkamp S.J. (2009)  
*Space Travelers*

Astronauts have been to the moon and back, but where do they want to go in the future? Find out where these space travelers have been and which planet they will visit next.

In Capstone's Fact Finders series *The Solar System and Beyond*, for readers in grades 3-5:



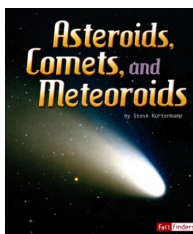
Kortenkamp S.J. (2011)  
*Planets of Our Solar System*

Venus is a sweltering, spinning rock. Jupiter is a huge ball of gas. But they are both planets. Get up close to the eight planets that orbit around our sun.



Kortenkamp S.J. (2011)  
*Dwarf Planets*

They're round and orbit around our sun. But they're not planets. What makes a dwarf planet different? Get up close to the five dwarf planets that call our solar system home.



Kortenkamp S.J. (2011)  
*Asteroids, Comets, Meteoroids*

They're leftover rocks from when the planets formed. And they hold clues to how the solar system began. Get up close to asteroids, comets, and meteoroids that orbit in our solar system.

## OTHER MISCELLANEOUS PUBLICATIONS

- Kortenkamp S.J., Book Review - The Solar System Beyond Neptune (Univ. Arizona Press). *Meteoritics and Planetary Science* **44**, 463–464 (2009).
- Buie M.W. and 16 others including Kortenkamp S.J., Minor Planet Observations [695 Kitt Peak], *Minor Planet Circular* 54354, 3 (2005).
- Yeung W.K.Y. and 23 others including Kortenkamp S.J., 2005 HA8, *Minor Planet Electronic Circular* 2005-J34 (2005).
- Gilmore A.C. and 11 others including Kortenkamp S.J., 2005 JS1, *Minor Planet Electronic Circular* 2005-J16 (2005).
- Kortenkamp S.J., Impact at Cumberland Gap: Where natural and national history collide. *Planetary Sci. Inst. Newsletter* **5(2)**, 1–2 (2004).
- Kortenkamp S.J., Amid the swirl of interplanetary dust. *Mercury* **27(6)**, 7–11 (1998).

## COLLOQUIA OR INVITED TALKS

- The Nearest of the Near-Earth Asteroids (invited), International Space Development Conference, San Diego, CA (2013).
- Survival of Trojan-type companions of Neptune during primordial planet migration, Lunar and Planetary Lab, Tucson, AZ (2003).
- Terrestrial planet formation (invited), Gordon Research Conference on Origins of Solar Systems, New England College, Henniker, NH (1999).
- Accretion of interplanetary dust particles by Earth: Sources of dust and variability in accretion rates (invited), Fall AGU Meeting, San Francisco, CA (1998).
- Terrestrial planet formation in the presence of giant planets, Department of Terrestrial Magnetism, Carnegie Institution of Washington, Washington, DC (1998).
- Accretion of interplanetary dust particles by Earth (invited), Astronomy Department “Lunch Time” Seminar, University of Maryland, College Park, MD (1998).
- Sources and orbital evolution of interplanetary dust (invited), Department of Terrestrial Magnetism, Carnegie Institution of Washington, Washington, DC (1997).

## CONTRIBUTED TALKS

- Kortenkamp S.J., Trapping of quasi-satellites and their possible transition to irregular satellites during the late stages of planetary migration, abstract 2520, 39<sup>th</sup> LPSC, Houston, TX (2008).
- Kortenkamp S.J., Redistribution of Trojan asteroids between L4 and L5 induced by planetary migration. Is it symmetrical?, abstract 60.07, 39<sup>th</sup> DPS Meeting, Orlando, FL (2007).
- Kortenkamp S.J., Weidenschilling S.J., Marzari F., Modeling planetesimal accretion in protoplanetary disks perturbed by massive companions, abstract 2283, 38<sup>th</sup> LPSC, Houston, TX (2007).

- Kortenkamp S.J., Weidenschilling S.J., Marzari F., A new code for modeling planetesimal accretion in protoplanetary disks perturbed by massive companions, abstract 63.03, 38<sup>th</sup> DPS Meeting, Pasadena, CA (2006).
- Kortenkamp S.J., The fate of Neptune's primordial Trojan-type companions that were lost during planetary migration, 36<sup>th</sup> LPSC, Houston, TX (2005).
- Kortenkamp S.J., Resonant capture of irregular satellites by a protoplanet, 35<sup>th</sup> LPSC, Houston, TX (2004).
- Kortenkamp S.J., An efficient, low-velocity, resonant mechanism for capture of planetesimals by a protoplanet, 34<sup>th</sup> DPS Meeting, Birmingham, AL (2002).
- Kortenkamp S.J. and Hamilton, Capture of Trojan asteroids in the early solar nebula, 33<sup>rd</sup> DPS Meeting, New Orleans, LA (2001).
- Kortenkamp S.J., Wetherill G.W., Inaba S., and Trilling D.E., Asteroid formation with a pre-existing Jupiter, 32<sup>nd</sup> LPSC, Houston, TX (2001).
- Kortenkamp S.J. and Hamilton D.P., Asteroid formation: Origin of the Trojans, 32<sup>nd</sup> DPS Meeting, Pasadena, CA (2000).
- Kortenkamp S.J. and Wetherill G.W., Formation of the asteroid belt, 31<sup>st</sup> LPSC, Houston, TX (1999).
- Kortenkamp S.J. and Wetherill G.W., Planetesimal dynamics in a protoplanetary disk perturbed by massive companions, 30<sup>th</sup> DDA Meeting, Estes Park, CO (1999).
- Kortenkamp S.J. and Wetherill G.W., Formation of Earth in the presence of Jupiter and Saturn, Origin of the Earth and Moon Conf., Monterey, CA (1998).
- Kortenkamp S.J. and Wetherill G.W., Migrating giant planets and the formation of the asteroid belt, 30<sup>th</sup> DPS Meeting, Madison, WI (1998).
- Kortenkamp S.J. and Wetherill G.W., Terrestrial planet and asteroid formation in the presence of migrating giant planets, 61<sup>st</sup> Met. Soc. Meeting, Dublin, Ireland (1998).
- Kortenkamp S.J. and Wetherill G.W., Terrestrial planet and asteroid formation in the presence of giant planets, 29<sup>th</sup> LPSC, Houston, TX (1998).
- Kortenkamp S.J. and Wetherill G.W., Gas drag effects on planetesimals evolving under the influence of Jupiter and Saturn, 29<sup>th</sup> DPS Meeting, Cambridge, MA (1997).
- Kortenkamp S.J. and Dermott S.F., The origin of IDPs and variations in their rates of accretion, Asteroids, Comets, and Meteors Conf., Versailles, France (1996).
- Kortenkamp S.J. and Dermott S.F., The origin of interplanetary dust particles, 27<sup>th</sup> DPS Meeting, Kona, HI (1995).
- Kortenkamp S.J. and Dermott S.F., The origin of interplanetary dust particles, IAU Colloquium 150 – Physics, Chemistry and Dynamics of Interplanetary Dust, Gainesville, FL (1995).
- Kortenkamp S.J. and Dermott S.F., Capture probabilities of asteroidal dust particles, 26<sup>th</sup> DPS Meeting, Bethesda, MD (1994).
- Kortenkamp S.J., An unusual approach to matrix inversion, 60<sup>th</sup> Meeting of the Mathematicians Association of America – Wisconsin Chapter, Whitewater, WI (1992).