

Julia D. Plummer

Assistant Professor of Science Education

Arcadia University
Education Department
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Glenside, PA 19038

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EDUCATION

- UNIVERSITY OF MICHIGAN, ANN ARBOR 2006
Ph.D. in Astronomy and Education (Student initiated, combined degree program)
Dissertation: *Students' Development of Astronomy Concepts across Time*
Committee: Joseph Krajcik (co-chair), Mario Mateo (co-chair), Scott Paris, Matthew Linke
NARST Outstanding Doctoral Dissertation Award for 2007
- UNIVERSITY OF MICHIGAN, ANN ARBOR 1999
M.S. in Astronomy
- WASHINGTON STATE UNIVERSITY, PULLMAN 1997
B.S. in Physics (magna cum laude)
Minors: Math and Philosophy

PROFESSIONAL EXPERIENCE

- ARCADIA UNIVERSITY 2006 TO PRESENT
Coordinator of Science Education
Assistant Professor of Science Education
Responsibilities include teaching elementary science methods courses, graduate seminars in science education, and undergraduate astronomy; conducting research on conceptual development in astronomy, learning in the planetarium, and beliefs and knowledge of astronomy teachers; advising candidates in state science certification programs; coordinating/hiring adjunct faculty in science education, environmental education; and supervise Masters student projects in science and environmental education.
- UNIVERSITY OF MICHIGAN 1997-2003, 2006
Graduate Student Instructor
COURSES: Elementary science methods for masters/certification students (2006). Introductory astronomy courses, astronomy discussion sections, and labs (1997-2003). Trained new astronomy graduate students (1998-2003).
- UNIVERSITY OF MICHIGAN 2003-2006
Curriculum developer, Center for Curriculum Materials in Science.
Lead developer for a 6th grade astronomy unit and member of a team that developed an 8th grade unit on energy for a comprehensive middle school science curriculum, adapted for publication by *It's About Time*.
- UNIVERSITY OF MICHIGAN 1997-2006
Planetarium Operator at the Exhibit Museum of Natural History.
- UNIVERSITY OF MICHIGAN 2002-2003
Research assistant, ROLE project – Observations of middle school science curriculum implementation

UNIVERSITY OF MICHIGAN Research assistant, GIsML project (Guided Inquiry supporting Multiple Literacies); PI: Anne Marie Palinscar	2000-2001
UNIVERSITY OF MICHIGAN Instructor, Michigan Math and Science Scholars program. Developed and co-taught summer astronomy program for high school students (<i>2 week programs</i>).	2001-2003
JACKSON COUNTY MATHEMATICS & SCIENCE CENTER Astronomy summer camp instructor - Guided middle and high school students in observations.	2000-2002
NASA GODDARD SPACE FLIGHT CENTER Research Associate, NASA Academy internship program	1997
WASHINGTON STATE UNIVERSITY Planetarium Operator and Undergraduate Teaching Assistant, Program in Astronomy (Dept. of Mathematics)	1994-1997
HARVARD-SMITHSONIAN CENTER FOR ASTROPHYSICS Undergraduate researcher, NSF REU, with Christine Jones and Bill Forman	1996
LOWELL OBSERVATORY Undergraduate researcher, NSF REU, with Deidre Hunter	1995

PUBLICATIONS

(*Graduate student collaborators labeled with an asterisk; **K-12 teacher collaborators labeled with a double asterisk)

REFEREED JOURNAL ARTICLES

Plummer, J.D., *Wasko, K., and **Slagle, C. (2011). Children Learning to Explain Daily Celestial Motion: Understanding Astronomy across Moving Frames of Reference. *International Journal of Science Education*. Online ahead of publication, DOI: 10.1080/09500693.2010.537707

Plummer, J.D. and Krajcik, J.S. (2010). Building a Learning Progression for Celestial Motion: Elementary Levels from an Earth-Based Perspective. *Journal of Research in Science Teaching*, 47(7): 768-787.

Small, K.J. and **Plummer, J.D. (2010). Survey of the goals and beliefs of planetarium professionals regarding program design. *Astronomy Education Review*, 9(1).

Plummer, J.D. and *Zahm, V. (2010). Covering the Standards: Astronomy Teachers' Preparation and Beliefs. *Astronomy Education Review*, 9(1).

Plummer, J.D., *Zahm, V. and *Rice, R. (2010). Inquiry and Astronomy: Preservice Teachers' Investigations in Celestial Motion. *Journal of Science Teacher Education*. 21 (4), 471-493.

Plummer, J.D. (2009). Early Elementary Students' Development of Astronomy Concepts in the Planetarium. *Journal of Research in Science Teaching*, 46(2): 192-209.

Plummer, J.D. (2009). A Cross-Age Study of Children's Knowledge of Apparent Celestial Motion. *International Journal of Science Education*, 31(12): 1571-1606.

Secker, J., Harris, W.E., and **Plummer, J.D.** (1997). Dwarf Galaxies in the Coma Cluster. II. Photometry and Analysis. *Publications of the Astronomical Society of the Pacific*, 109, 1377-1393.

Hunter, D. and **Plummer, J.D.** (1996). Sextans A: A Case Study of Star Formation and Gas Densities in Irregular Galaxies, *Astrophysical Journal*, 462,732.

REFEREED BOOK CHAPTERS AND CONFERENCE PROCEEDINGS

Plummer, J.D. (accepted). Challenges in developing and validating an astronomy learning progression. Chapter accepted for publication in *Learning Progressions in Science*, Sense Publishers: Rotterdam, The Netherlands.

Plummer, J.D. and **Agan, L. (2010). Reasoning about the Seasons: Middle School Students' Use of Evidence in Explanations. *Proceedings of the Eighth International Conference of the Learning Sciences: Learning in the Disciplines*, Chicago, IL, Mahwah, NJ: Erlbaum.

CURRICULA

Plummer, J.D., Holt, L.S., Krajcik, J. Starr, M.L., and Linke, M. P. (2009). How do you know when objects in the solar system will collide? In *Project-Based Inquiry Science* (J. Kolodner, J. Krajcik, D. Edelson, B. Reiser, and M. Starr, Eds.). It's About Time: Armonk, NY.

Fortus, D., Nordine, J., **Plummer, J.**, Rogat, A., & Switzer, A. (2009). How can you use energy to turn out the lights? In *Project-Based Inquiry Science* (J. Kolodner, J. Krajcik, D. Edelson, B. Reiser, and M. Starr, Eds.). It's About Time: Armonk, NY.

OTHER PAPERS

Plummer, J.D. (2008). Students' Development of Astronomy Concepts across Time, *Astronomy Education Review*, 7(1): 143-152. [Extended thesis abstract.]

Plummer, J.D. (2008). Astronomy at Arcadia University, *Constellation*, 23(3): 5-6.

Price, A., et al. (**J. Plummer** included in list of 18 authors) (2007). Astronomy Education Research Charter and Symposium Report, *Astronomy Education Review*, 6(2).

Plummer, J.D., (2006). *Students' Development of Astronomy Concepts across Time*, Unpublished doctoral dissertation, University of Michigan, Ann Arbor, MI.

MANUSCRIPTS IN PREPARATION

Plummer, J.D. and **Agan, L. (in review). Building a learning progression for celestial motion: Towards the reason for the seasons

Plummer, J.D. and **Small, K. (in preparation). Informal Science Educators' Pedagogical Choices and Goals for Learners: The Case of Planetarium Professionals

CONFERENCE PAPERS AND PRESENTATIONS

Plummer, J.D., *Kocareli, A., & **Slagle, C. (2011). Children developing an ability to move between frames of reference in astronomy: Towards a learning progression in celestial motion. Paper to be presented at the Annual Meeting of the *Jean Piaget Society*, Berkeley, CA.

Plummer, J.D. and **Small, K. (2011). Informal Science Educators' Pedagogical Choices and Goals for Learners: The Case of Planetarium Professionals. Paper to be presented as part of a symposium at the *American Educational Research Association* annual conference, New Orleans, LA.

Plummer, J.D. (Presider), Krajcik, J., Bell, P., Duncan, R., Kenyon, L., & Songer, N. (2011). Examining learning progressions beyond content: Strands of scientific proficiency. Symposium to be presented at the *National Association for Research in Science Teaching* annual conference, Orlando, FL.

Plummer, J.D. and *Kocareli, A. (2011). Exploring pedagogical content knowledge in astronomy: Impact of professional development on elementary teachers. Paper to be presented at the *Association for Science Teacher Education* annual conference, Minneapolis, MN.

Plummer, J.D. and **Slagle, C. (2010). The influence of an observational-focused planetarium program on elementary students' mental models of celestial motion. Presented at the *Association for Science Teacher Education, North-East Region Meeting*, Dingmans Ferry, PA.

Plummer, J.D. and **Agan, L. (2010). Reasoning about the Seasons: Middle School Students' Use of Evidence in Explanations. Paper presented at the *Eighth International Conference of the Learning Sciences: Learning in the Disciplines*, Chicago, IL, Mahwah, NJ: Erlbaum.

Small, K.J. and **Plummer, J.D. (2010). Motivating a new genre for the fulldome era: Perspective from planetarium professionals. Paper presented at the *Annual Meeting of the Middle Atlantic Planetarium Association*, May 19-22, Portland, ME.

Plummer, J.D. and **Agan, L. (2010). Towards a Learning Progression Addressing the Seasons: A Comparison of Two Learning Trajectories with Middle School Students. Paper presented at the *Annual Meeting of the National Association for Research in Science Teaching*, March 21-24, Philadelphia, PA.

Plummer, J.D. and **Slagle, C. (2009). A Learning Progression Approach to Teacher Professional Development in Astronomy. Paper presented at the *Learning Progressions in Science* conference, June 24-26, Iowa City, IA.

Small, K. and **Plummer, J.D. (2009). Seeking Field Support for Fulldome Research Project. Presented at the *Annual Meeting of the South Eastern Planetarium Association*, June 16-18, Nashville, TN and at the *Annual Meeting of the Middle Atlantic Planetarium Association*, May 13-16, Seabrook, MD.

Plummer, J.D. and **Slagle, C. (2009). Children Explaining Celestial Motion: Development of a Learning Progression. Paper presented at the annual meeting of the National Association for Research in Science Teaching, April 20, Garden Grove, CA.

Plummer, J.D. (2008). Astronomy in Middle and High Schools in the Greater Philadelphia Region, Presented at the *3rd Annual Conference of the Math and Science Partnership of Greater Philadelphia*, November 15, West Chester, Pennsylvania.

Howard, L., **Plummer, J.D.**, and Moore, G. (2008). Connecting Science to the "Real" World: General Education for Non-Science Majors. Presented at *Engaging Science, Advancing Learning: General Education, Majors, and the New Global Century*, November 6-8, Providence, Rhode Island.

Plummer, J.D., *Rice, R. and *Zahm, V. (2008). Inquiry and Astronomy: Investigations in Celestial Motion. Paper presented at the *Annual Meeting of the National Association for Research in Science Teaching*, March 30-April 2, Baltimore, Maryland.

Plummer, J.D. and Krajcik, J.S. (2008). A Learning Progression for Celestial Motion. Paper presented at the *Annual Meeting of the National Association for Research in Science Teaching*, March 30-April 2, Baltimore, Maryland.

Plummer, J.D. (July, 2007). A Learning Progression for Astronomy: Assessing the Current State of Research. Paper presented at the *Center for Curriculum Materials in Science: Knowledge Sharing Institute*, July 22-25, Washington, D.C.

Plummer, J.D. (2007). Developing Students' Understanding of Astronomy in the Planetarium. Paper presented at the *Annual Meeting of the National Association for Research in Science Teaching*, April 15-18, New Orleans, Louisiana.

Plummer, J.D. (2006). Kinesthetic Learning Techniques in the Planetarium. Presented at the *Annual Meeting of the Association for Science and Technology Centers*, October 28-30, Louisville, Kentucky.

Plummer, J.D. (2006). Kinesthetic Learning with Celestial Motion in the Planetarium. Presented at the *Annual Meeting of the Philadelphia Area Planetarium Association*, October 27, Upper Dublin, Pennsylvania.

Plummer, J.D. (2005). Kinesthetic Learning with Elementary Students in the Planetarium. Presented at the 40th *Annual Meeting of the Great Lakes Planetarium Association*, October 19-22, Grand Rapids, Michigan.

Plummer, J.D., Jones, C., Forman, W., Donnelly, R. H. and Rines, K.J. (1997). Cosmological Implications of ROSAT Observations of Distant Galaxy Clusters, *Bulletin of the American Astronomical Society*, 28, 1317

Plummer, J.D. and Hunter, D. (1996). Star Formation and Gas Densities in the Dwarf Irregular Galaxy Sextans A, *Bulletin of the American Astronomical Society*, 27, 1296

INVITED TALKS

Plummer, J.D. (September, 2010). Challenges in obtaining empirical support for a learning progression: Exploring connections in observational astronomy. Pennsylvania State University, State College, PA.

Plummer, J.D. (May, 2010). A Research-Based Approach to Teaching and Learning Astronomy in the Planetarium. Rittenhouse Astronomical Society, Franklin Institute, Philadelphia, PA.

Plummer, J.D. & *Zahm, V. (December, 2009). Covering the Standards: Astronomy Teachers Preparation and Beliefs. 21st Century Partnership for STEM Education, Conshohocken, PA.

Plummer, J.D. (August, 2009). Students' Preconceptions in Astronomy. Philadelphia Chapter of Project Astro, West Chester University, West Chester, PA.

Plummer, J.D. (January, 2008). Understanding Astronomy: Challenges in Teaching through Observation of the Sky. Association of Women in Science, Philadelphia Chapter.

Plummer, J.D. (October, 2007). The road from novice to expert: Application of the learning progression framework to astronomy education. Astronomy Department, University of Pennsylvania, Philadelphia, PA.

WORKSHOPS

Plummer, J.D. (2011, May). *Developing learning progressions for astronomy education researchers*. Workshop to be presented at the Center for Astronomy & Physics Education Research (CAPER) retreat, Denver, CO.

Duncan, R. G., Krajcik, J., Fortus, D., McNeill, K.L., & **Plummer, J.D.** (2011, April). *Developing and assessing learning progressions in science*. Workshop to be presented at the annual meeting of the National Association for Research in Science Teaching, Orlando, FL.

Plummer, J.D. and ****Slagle, C.** (2010). *Using Children's Observations to Guide Explanations in Astronomy*. Presented at the *Annual Meeting of the National Science Teachers Association*, March 18-20, Philadelphia, PA.

GRANTS

ASSESSMENT OF LEARNING PROGRESSIONS MINI-GRANT 2011
NSF-funded project (R. Duncan and J. Krajcik, PIs), *A workshop on developing learning progressions for astronomy education researchers*, \$2500

STEVE GOLDBERG AWARD 2010
Arcadia University, *Scientific Reasoning and Attitudes towards Science: Girls Participating in an Aerospace and Technology Program*, \$1300

FACULTY DEVELOPMENT FUND 2009
Arcadia University, *Supporting Students and Teachers in Elementary Astronomy Instruction: Learning to Explain Celestial Motion*, \$1200

ELLINGTON BEAVERS FACULTY AWARD FOR INTELLECTUAL INQUIRY 2007-2009
Arcadia University, *Elementary Students' Development of Apparent and Actual Celestial Motion Concepts*, \$3000

MATH AND SCIENCE PARTNERSHIP OF GREATER PHILADELPHIA 2007-2008
Co-PI; National Science Foundation – Sub-award, *Astronomy in the Greater Philadelphia Area: Teacher Preparation and the State Standards*, \$18,636

FACULTY DEVELOPMENT FUND 2007
Arcadia University, *Elementary Teachers' Understanding of the Connections between Apparent and Actual Celestial Motion*, \$1200

DISSERTATION FINISHING GRANT 2006
School of Education, University of Michigan (Tuition waiver)

SPENCER MINI-GRANT 2004
School of Education, University of Michigan, *Kinesthetic Learning Techniques in the Planetarium*, \$1140

SIGMA XI GRANTS-IN-AID OF RESEARCH 1996
Observing run to Apache Point Observatory to study tidal stripping in interacting galaxies, \$1000

HONORS

NSTA SUMMER READING LIST FOR TEACHERS 2010
Plummer (2009). *Early elementary students' development of astronomy concepts in the planetarium*.

One of three articles from the Journal of Research in Science Teaching (from 2009) selected to be promoted by the National Science Teacher Association (NSTA); nominated by the National Association for Research in Science Teaching (NARST)

EARLY CAREER RESEARCHER CONSORTIUM 2010
Participant, NSF-funded competitive workshop, International Conference of the Learning Sciences (ICLS)

OUTSTANDING DOCTORAL DISSERTATION AWARD 2007
National Association for Research in Science Teaching (NARST)

DISTINGUISHED STUDENT AWARD 1997
College of Science, Washington State University

PARTICIPATION IN PROFESSIONAL ORGANIZATIONS

PROFESSIONAL SERVICE

Publications Advisory Committee member (2011-2014)
National Association for Research in Science Teaching

Annual EPO Conference Planning Committee (2011)
Astronomical Society of the Pacific

Co-Strand Coordinator: Science Learning, Understanding and Conceptual Change (2009-2011)
National Association for Research in Science Teaching

Advisory Board member - Math and Science Partnership: Earth & Space Science Partnership (2010-2015)
Pennsylvania State University

Advisory panel member – Weather & Climate (2010)
American Association for the Advancement of Science (AAAS) – Project 2061

Revision Panel for the MA Science and Technology/Engineering Curriculum Framework – Research consultant
Massachusetts Department of Elementary & Secondary Education (2010)

Arcadia University's Shared Futures project - Member (2006-present)
Association of American Colleges and University's (AAC&U)

Astronomy Education Research Charter – Member (2007)
Symposium held at Tufts University

Pedagogical Content Knowledge Science Retreat -- Consultant (2006)
Merck Institute for Science Education

Board of Directors - Docent Representative (2002-2006)
The Exhibit Museum of Natural History, University of Michigan

Introductory Astronomy Course Committee - Member (2003)
Department of Astronomy, University of Michigan

Strategic Planning Committee - Member (2003)
The Exhibit Museum of Natural History, University of Michigan

REVIEWING

Journal of Research in Science Teaching, Editorial Board (2010-2013)
 Science Education (2010-present)
 Journal of Science Teacher Education (2010-present)
 International Conference on the Learning Sciences (2009-present)
 National Association for Research in Science Teaching (Strand 1 & 2) (2005-present)
 Astronomy Education Review (2007-present)
 Cognition and Instruction (2006)
 Sage Publishers (2007-2009)

PROFESSIONAL AFFILIATIONS

Association of Women in Science (2008 – present)
 Astronomical Society of the Pacific (1992-present)
 National Association for Research in Science Teaching (2006-present)
 National Science Teachers Association (2006-present)

COMMUNITY SERVICE

Advisory Board	2009-present
Philadelphia Chapter of the Astronomical Society of the Pacific's Project Astro (West Chester University)	
Presentation to St. Peter's Nursery School, Lafayette, PA	2011
Presentation to the Upper Dublin High School Astronomy Club	2010
<i>The Search for Life: Habitability in the Solar System</i> , Upper Dublin HS, Upper Dublin, PA.	
Workshop Facilitator, Preparing to Teach/Tutor for Community Education Experience	2010
Drexel University Medical School, Philadelphia, PA	
Guest Speaker, Habitability in the solar system: Where should we look for life and why?	2010
Stella Della Valley Star Party, Ottsville, PA	
Guest Speaker, Stargazing	2010
Great American Backyard Campout, Schuylkill Center for Environmental Education	
Event Organizer	2009
Arcadia University, Astronomy Lecture Series and Observing Nights	
Keynote Speaker	2009
PAGES (Philadelphia Area Girls Enjoying Science) annual event for 6 th grade girls.	
Event Organizer	2009
Arcadia University Astronomy Night for Families. Organized students to run activities and the telescopes for the event. Advertized to local schools and community groups.	
Science Fair project advisor	2007-present
Advising Robyn Smith, High School student at Christopher Dock HS, on her astronomy research projects: <i>The evolution of galaxies</i> (2008), <i>Using irregular galaxy satellites to test the Holmberg effect</i> (2009), and <i>SDSS Red</i>	

Peas: Extending the spectrum of active galaxies (2010). Robyn has received numerous awards including a full-tuition college scholarship.

Earth Day Celebration 2007, 2008
Wissahickon Charter School, students in my graduate elementary science methods course planned and taught lessons at the Earth Day event.

Presentation to the Upper Dublin High School Astronomy Club 2006
The Status of the Planet Pluto, Upper Dublin HS, Upper Dublin, PA.

CONFERENCES AND WORKSHOPS – INVITED/FUNDED PARTICIPANT

Moving beyond conceptual models: Developing assessments to test and study learning progressions 2009
NSF-funded workshop; Invited participant (out of 30 total invited)
University of Michigan, August 3-7, 2009, Ann Arbor, MI

First Annual Birding Workshop for Educators 2008
John James Audubon Center, May 17 & 18, 2008, Mill Grove, PA.

Astronomy Education Research Symposium 2007
Tufts University, September 24, 2007, Medford, MA.

Shared Futures meeting, Arcadia team member 2007
Sonoma State University, July 16-20, 2007, California,

Shared Futures meeting, Arcadia team member 2007
American Association of Colleges & Universities conference, March 1-3, Miami, Florida

CONTRIBUTIONS TO THE UNIVERSITY

ADVISOR FOR MASTERS DEGREE CULMINATING PROJECTS

Robin Albright (2007), Jeff Deussing (2006), Judy Elinow (2007), Doug Faulkner (2007), Amber Geller (2008), Karen J. Johnston (2007), Joanne Long (2007), Victoria Meder (2007), Cindy Dale Miller (2008), Marie Duke Murphy (2008), Andrew Plunkett (2008), Dennis Robertson (2006), Dave Vinci (2008), Sophia Wang (2008), Emily Wash (2008), Kristin Kelly (2009), Michael Aviles (2009), Jessica Sonis (2009), Chris Bennett (2009), Chris Scheid (2010), Bill Harvey (2010), Brian Dooner (2010), Chris Ferry (2010),

PRESENTATIONS TO THE CAMPUS COMMUNITY

Plummer, J.D. (March, 2010). *The Night Skies of Pennsylvania*. Arcadia University Alumni Events, Glenside, PA.

Plummer, J.D. (December, 2008). *Elementary Students Explaining Astronomical Observations*. Faculty Spotlight Series, Arcadia University, Glenside, PA.

Plummer, J.D. (November, 2006). *The demotion of Pluto: A new definition for planets*, Arcadia University Alumni Association Meeting, Arcadia University, Glenside, PA.

Plummer, J.D. (October, 2006). *The demotion of Pluto: A new definition for planets*, Graduate Colloquium series, Arcadia University, Glenside, PA.

COURSES TAUGHT AT ARCADIA (2006-2011)

One section per semester listed, unless otherwise indicated.

*Indicates new courses I developed for the Arcadia curriculum

Undergraduate Education Courses:

*ED 324 – Elementary Science Methods

Fall 2008 (2 sections), Spring 2009, Spring 2010, Spring 2011 (2 sections)

ED 341 – The Processes of Learning in the Classroom

Fall 2006 (2 sections)

ED 343 – Refining and Integrating Curricular Practices

Fall 2007 (2 sections)

Graduate Education Courses:

ED 552 – Science Methods for Elementary Teachers

Spring 2007, Spring 2008, Spring 2009, Fall 2009, Fall 2010, Spring 2011

ED 553 – Science Methods for Secondary Teachers

Spring 2007

ED 555 – Instructional Materials for Teaching Science

Spring 2007, Spring 2009, Spring 2011

ED 558 – Special Seminar for Science Educators

Spring 2008, Spring 2010

*ED 561 – Summer Institute for Astronomy Educators

Summer 2007

*ED 561 – Project Based Learning in Math and Science

Spring 2010

Undergraduate Science Courses

PH 224 – Frontiers in Astronomy

Fall 2007 (1 section + 2 labs)

*HN 309/US 213 – Astrobiology: Life in the Universe

Fall 2007, Fall 2009, Fall 2010

*FY 103 – The Night Skies of Pennsylvania

Fall 2008, Fall 2009, Fall 2010