

# SUNYOUNG (SUNNY) PARK

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## EDUCATION

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**Harvard University**, Cambridge, MA

**Ph.D.**, Earth and Planetary Sciences (Geophysics/Seismology), May 2018

- Thesis: “Earth's Internal Processes and Structure Based on Novel Seismological Approaches”
- Committee: Miaki Ishii (principal advisor), James R. Rice, and Jerry X. Mitrovica

**Seoul National University**, Seoul, South Korea

**M.S.**, Energy System Engineering (Geophysics), Feb 2012

- Thesis: “Convergence of Full Waveform Inversion in the Complex-Frequency Domain”
- Advisors: Changsoo Shin and Maarten V. de Hoop
- Visiting Student, Geo-Mathematical Imaging Group (GMIG), Purdue University, West Lafayette, IN, Jan 2011–Jul 2012

**B.S.**, *summa cum laude*, Energy Resources Engineering, Feb 2010

**B.A.**, *summa cum laude*, Economics, Feb 2010

## RESEARCH INTERESTS

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- New Seismic Imaging Techniques
- Seismic Structure of the Earth
  - Near Surface, Mantle, and Core
- Earthquake Rupture Dynamics
- Earthquake Hazards
- Seismic Inverse Problems

## TEACHING INTERESTS

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- Geophysics
- Seismology
- Natural Hazards
- Applied Geophysics
- Inverse Problems
- Engineering Mathematics

## AWARDS AND HONORS

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- Student Presentation Award, Seismological Society of America, 2017
- Distinction in Teaching Award, Derek Bok Center for Teaching and Learning at Harvard University, 2017 & 2018
- Samsung Human Tech Paper Award, Samsung Electronics, 2005
- Gold Prize for Korean Earth Science Olympiad, The Korean Earth Science Society, 2004
- Special Prize for Earth Science Exhibition in Korean Science Fair, Korean Minister of Science and Technology, 2004

## FELLOWSHIPS AND GRANTS

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- Texaco Postdoctoral Fellowship at Caltech, Starting in Fall 2018
- Conference Grant, Graduate Student Council of Harvard University, Feb 2018

- NSF EAR program “Near-Surface Structure of the Continental United States Using Distant Earthquakes” (#1735960); Prepared the proposal and executed the work, Sep 2017–Aug 2018
- Merit Research Fellowship, Harvard University, Feb 2018–Jun 2018
- Seismological Society of America Travel Grant, Apr 2017
- James Mills Peirce Fellowship, Harvard University, Sep 2012–Aug 2015
- Samsung Scholarship, Samsung, Sep 2012–Jun 2017
- Brain Korea 21 Scholarship, Korean Ministry of Education, Mar 2010–Jan 2011 and Sep 2011–Aug 2012
- Development of Energy Resources Scholarship, Korean Ministry of Knowledge Economy, Mar 2009–Dec 2009
- Presidential Science Scholarship, Korea Student Aid Foundation, Mar 2006–Feb 2010
- “Kumnamu” Scholarship, College of Engineering, Seoul National University, Sep 2006

## RESEARCH EXPERIENCE

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**California Institute of Technology**, Pasadena, CA, starting in Oct 2018 (expected)

*Texaco Postdoctoral Scholar*

**Harvard University**, Cambridge, MA, Jun 2018–Aug 2018

*Postdoctoral Fellow*

- Local 1-D near-surface seismic structure using frequency-dependent body-wave polarization

**Harvard University**, Cambridge, MA, Aug 2012–May 2018

*Graduate Researcher*; Advisor: Miaki Ishii

- Near-surface seismic structure using body-wave polarization
- Sharpness of Earth’s inner-core boundary inferred from reflected P waves
- Upper-mantle seismic structure using Radon transform of triplication data
- Three-dimensional earthquake directivity analysis and characterization of rupture processes

**Purdue University**, West Lafayette, IN, Jan 2011–Jul 2012

*Visiting Student Researcher*; Advisor: Maarten V. de Hoop

- Time-harmonic seismic data and blending in full waveform inversion

**Seoul National University**, Seoul, South Korea, Mar 2010–Feb 2012

*Graduate Researcher*; Advisor: Changsoo Shin and Maarten V. de Hoop

- Mathematical analysis of the full waveform inversion in complex-frequency domain

**TOTAL**, le Centre Scientifique et Technique Jean Féger (CSTJF), Department of “Methodes et Techniques Sismique”, Pau, France, Jan 2010–Feb 2010

*Visiting Researcher*; Supervisor: Henri Calandra

- Selection criterion of the Laplace damping constant for Laplace-domain waveform inversion

**Seoul National University**, Geophysical Prospecting Laboratory, Seoul, South Korea, Jan 2009–Jan 2010

*Research Assistant*; Advisor: Changsoo Shin

- Seismic waveform modeling and imaging techniques including full waveform inversion and migration

## PUBLICATIONS

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- **Park, S.** and Ishii, M., 2018, Frequency-Dependent Body-Wave Polarization for Constraining Local 1-D Near-Surface Structure: Application to USArray Data, *In prep.*
- **Park, S.** and Ishii, M., 2018, A Novel Approach Utilizing High-Frequency Triplication Data to Study Local Variations in the Upper-Mantle Transition Zone, *In prep.*
- **Park, S.** and Ishii, M., 2018, Double Discontinuities at the Base of the Mantle Transition Zone as Potential Barriers for Down-Wellings, *In prep.*
- **Park, S.** and Ishii, M., 2018, Patchy Melt Distribution Inferred from Missing 410-km Discontinuity, *In prep.*
- **Park, S.** and Ishii, M., 2018, Detection of Instrument Gain Problems Based on Body-Wave Polarization: Application to the Hi-net Array, *Seismological Research Letters*, *In review.*
- **Park, S.** and Ishii, M., 2018, Near-Surface Compressional and Shear Wave Speeds Constrained by Body-Wave Polarization Analysis, *Geophysical Journal International*, 213, 3, 1559–1571.
- **Park, S.** and Ishii, M., 2015, Inversion for Rupture Properties Based Upon Three-Dimensional Directivity Effect and Application to Deep Earthquakes in the Sea of Okhotsk Region, *Geophysical Journal International*, 203, 2, 1011–1025.
- **Park, S.**, Qiu, L., De Hoop, M. V., Shin, C., 2012, On Time-Harmonic Seismic Data and Blending in Full Waveform Inversion, *Proceedings of the Project Review, Geo-Mathematical Imaging Group*, 1, 305–318.
- **Park, S.**, 2012, *Convergence of Full Waveform Inversion in the Complex-Frequency Domain*, M.S. Thesis, Seoul National University.
- **Park, S.**, De Hoop, M. V., Calandra, H., and Shin, C., 2011, Full Waveform Inversion: A Diffuse Optical Tomography Point of View, *SEG Expanded Abstracts*, 30, 2471–2475.
- **Park, S.**, Ha, W., Shin, C., Pyun, S., and Calandra, H., 2010, A Strategy for Selecting the Laplace Damping Constants in the Laplace-Domain Inversion, Based on the Relationship Between the Laplace Damping Constant and the Detectable Depth of a High-Velocity Structure, *SEG Expanded Abstracts*, 29, 993–997.

## INVITED TALKS

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- Columbia University, Lamont-Doherty Earth Observatory, Sep 2018, “A Novel Approach to Constrain Near-Surface P- and S-Wave Speeds Based on Body-Wave Polarization”.
- Seismology of the Americas (SSA Annual Meeting), May 2018, “Near-Surface P- and S-Wave Speeds Estimated Based upon Body-Wave Polarization”.
- University of Toronto, Apr 2018, “Right Under Your Feet—A Novel Approach to Constrain Near-Surface P- and S-Wave Speeds Based on Body-Wave Polarization”.
- California Institute of Technology, Apr 2018, “Near-Surface P- and S-Wave Speeds Constrained by Body-Wave Polarization”.
- Massachusetts Institute of Technology, Sep 2017, “Near-Surface Compressional and Shear Wave Speeds Constrained by Body-Wave Polarization Analysis”.
- Brown University, May 2017, “Right Under Your Feet—A Novel Approach to Constrain Near-Surface Seismic Wave Speed Based on Body-Wave Polarization”.
- U.S. Geological Survey (USGS) Menlo Park Science Center, Mar 2017, “A New Approach to Constrain Near-Surface Seismic Wave Speed Based on Body-Wave Polarization”.

- University of California, Berkeley, Mar 2017, “Right Under Your Feet—A Novel Approach to Constrain Near-Surface Seismic Wave Speed Based on Body-Wave Polarization”.
- Seoul National University, Jul 2015, “3-D Directivity Analysis and its Implications for Earthquake Rupture Processes”.
- Boston University, Nov 2014, “3-D Directivity Analysis and its Implications for Earthquake Rupture Processes”.

## CONFERENCE PRESENTATIONS

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### Conference Talks

- **Park, S.**, and Ishii, M., 2018, Near-Surface P- and S-Wave Speeds Estimated Based upon Body-Wave Polarization (Invited), *SSA Annual Meeting 2018, Miami, FL*.
- **Park, S.**, and Ishii, M., 2018, Detailed Structure of the Upper-Mantle Discontinuities Using a Novel Approach and High-Frequency Triplication Data, *SSA Annual Meeting 2018, Miami, FL*.
- **Park, S.**, and Ishii, M., 2018, Three-Dimensional Directivity Analysis for Resolving Source Parameters and Rupture Complexities, *SSA Annual Meeting 2018, Miami, FL*.
- Ishii, M. and **Park, S.**, 2017, Local Variations in the Upper-Mantle Transition Zone Structure from a Novel Approach Using High-Frequency Triplication Data, *AGU Fall Meeting 2017, New Orleans, LA*.
- **Park, S.**, and Ishii, M., 2017, A New Approach to Constrain Near-Surface Seismic Structure Based Upon Body-Wave Polarization, *SSA Annual Meeting 2017, Denver, CO*.
- **Park, S.**, and Ishii, M., 2016, A Novel Approach to Constrain Near-Surface Seismic Wave Speed Based on Polarization Analysis, *AGU Fall Meeting 2016, San Francisco, CA*.
- Ishii, M. and **Park, S.**, 2016, Constraining Seismic Structure of Upper-Mantle Discontinuities: A New Approach Using High-Frequency Triplication Data, *AGU Fall Meeting 2016, San Francisco, CA*.
- **Park, S.**, and Ishii, M., A New Approach to Study the Upper-Mantle Seismic Discontinuities Based on Triplication Data: Application to the Kuril Subduction Zone Using Hi-net Array, *AGU Fall Meeting 2015, San Francisco, CA*.
- **Park, S.**, De Hoop, M. V., Calandra, H., and Shin, C., 2011, Full Waveform Inversion: A Diffuse Optical Tomography Point of View, *SEG Annual Meeting 2011, San Antonio, TX*.
- **Park, S.**, De Hoop, M. V., Calandra, H., and Shin, C., 2011, Very Low Frequencies vs. Diffuse Optical Tomography, *Geo-Mathematical Imaging Group Project Review Meeting, West Lafayette, IN*.
- **Park, S.**, Ha, W., Shin, C., Pyun, S., and Calandra, H., 2010, A Strategy for Selecting the Laplace Damping Constants in the Laplace-Domain Inversion, Based on the Relationship Between the Laplace Damping Constant and the Detectable Depth of a High-Velocity Structure, *SEG Annual Meeting 2010, Denver, CO*.

### Conference Posters

- **Park, S.**, and Ishii, M., 2017, P- and S-Wave Speeds of the Very Upper Crust Estimated by a New Technique Based Upon Body-Wave Polarization, *AGU Fall Meeting 2017 New Orleans, LA*.
- **Park, S.**, and Ishii, M., 2017, Three-Dimensional Multi-Episode Directivity Analysis for Complex Ruptures, *SSA Annual Meeting 2017, Denver, CO*.

- Montenegro, D.M., Bogiatzis, P., **Park, S.**, and Ishii, M., 2016, An Automated Method for Determining Seismic Anisotropy: Application to Laterally Varying Anisotropy at the Japan Subduction Zone, *AGU Fall Meeting 2016, San Francisco, CA.*
- **Park, S.**, and Ishii, M., 2016, A New Approach to Study the Upper-Mantle Seismic Discontinuities Based on High-Frequency Triplication Data: Application to the Kuril Subduction Zone Using the Hi-net Array, *CIDER 2016 Summer Program, Santa Barbara, CA.*
- **Park, S.**, and Ishii, M., 2016, 3-D Directivity Analysis of Deep Earthquakes in the Sea of Okhotsk Region, *IRIS Workshop 2016, Vancouver, WA.*
- **Park, S.**, Ökeler, A., and Ishii, M., 2015, Upper-mantle seismic structure beneath a region northeast of Japan based on Hi-net array triplication data, *Gordon Research Conference – Interior of the Earth 2015, South Hadley, MA.*
- **Park, S.**, Ökeler, A., and Ishii, M., 2014, Upper-mantle seismic structure beneath a region northeast of Japan based on Hi-net array triplication data, *AGU Fall Meeting 2014, San Francisco, CA.*
- **Park, S.**, and Ishii, M., 2013, Inversion for Rupture Properties Based Upon Three-Dimensional Directivity Effect, *AGU Fall Meeting 2013, San Francisco, CA.*

## TEACHING EXPERIENCE

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### Harvard University, Cambridge, MA

- *Teaching Fellow*, “GeoSciFi Movies: Real vs. Fiction” in Freshman Seminar Program, Fall 2016 & Fall 2017
  - Developed a hands-on exercise for students to learn how to strengthen a building to be resilient to earthquakes and understand its societal impact.
- *Teaching Fellow*, “The Dynamic Earth: Geology and Tectonics Through Time” in Department of Earth and Planetary Sciences, Fall 2013
  - Led a weekly lab section and two field trips to Boston Bay and Appalachian basin (Mohawk Valley and Connecticut River Valley).

### Seoul National University, Seoul, South Korea

- *Teaching Assistant*, “Geophysical Engineering” in Department of Energy Resources Engineering, Fall 2011
  - Conducted field experiments (electrical and seismic surveys) with students to image subsurface structure around the campus.
- *Teaching Assistant*, “Engineering Mathematics” in Department of Energy Resources Engineering, Spring 2010
  - Lectured on PDE, Fourier analysis, and complex analysis.
- *Student Lecturer*, “Basic Calculus” in Department of Mathematical Science, Spring 2008 & Fall 2008
  - Officially lectured the course as a junior, for freshmen to take for credit.

## PROFESSIONAL SERVICE

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- Reviewer for Journal of Geophysical Research - Solid Earth
- Organizer of Agassiz Visiting Lecturer Series of 2017 at the Department of Earth & Planetary Sciences of Harvard University
- Organizer of Graduate Student Solid Earth Seminar, 2014-2015

## **COMPUTER EXPERIENCE**

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- Numerical seismic waveform modeling, inversion, and migration
- Matlab, Fortran, C, CUDA

## **MEMBERSHIPS**

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- AGU (American Geophysical Union)
- SSA (Seismological Society of America)