Stanford

Sigrid Elschot

Associate Professor of Aeronautics and Astronautics and, by courtesy, of Electrical Engineering

CONTACT INFORMATION

- **Administrator**

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Bio

BIO

Prof. Elschot's research involves space weather detection and modeling for improved spacecraft designs, and advanced signal processing and electromagnetic wave interactions with plasma for ground-to-satellite communication systems. These topics fall under the Space Situational Awareness (SSA) umbrella that include environmental remote sensing using satellite systems and ground-based radar. Her current efforts include using dust accelerators and light-gas guns to understand the effects of hypervelocity particle impacts on spacecraft along with Particle-In-Cell simulations, and using ground-based radars to characterize the space debris and meteoroid population remotely. She also has active programs in hypersonic plasmas associated with re-entry vehicles.

ACADEMIC APPOINTMENTS

- Associate Professor, Aeronautics and Astronautics

HONORS AND AWARDS

- Space Physics and Aeronomy Richard Carrington (SPARC) Education and Public Outreach Award, American Geophysical Union (2017)
- Vance D. and Arlene C. Coffman Faculty Scholar, Stanford University (2016-2020)
- DoE CAREER Award, DoE (2013-2017)
- Outstanding Professor in Aeronautics and Astronautics, Stanford University (2013)
- Presidential Early Career Award for Scientists and Engineers (PECASE), White House (2012)
- NSF CAREER Award, National Science Foundation (2011-2016)
- Hellman Faculty Scholar, Hellman Fellows Program (2010)
- Magazine Cover, IEEE Spectrum (2008)
- Joe D. Marshall Award for Outstanding Technical Briefing, AFTAC (2007)
- 1st Place Student Paper Competition, International Union of Radio Science (2002)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- AMISR Advisory Panel, AMISR (2020 - present)
- Fusion Energy Sciences Advisory Committee Member, Department of Energy (2017 - present)

- Elected Chair Commission G, URSI (2015 - present)
- Guest Expert, The Weather Channel (2015 - present)
- Guest Expert, PBS Chasing Pluto (2015 - present)
- Scientific Organizing Committee, Meteoroids 2016 (2015 - present)
- Elected Vice Chair Commission G, URSI (2013 - 2015)
- Member, Arecibo Science Advisory Panel (2011 - 2013)
- Co-Host National Geographic Channel, Known Universe (2011 - 2011)
- Guest Expert, PBS, Can We Make it to Mars (2011 - 2011)
- Micrometeoroid and Orbital Debris Panel Member, National Research Council Aeronautics and Space Engineering Board (2011 - 2011)
- Scientific Organizing Committee, Meteoroids 2010 (2010 - 2010)
- NEO Surveys and Hazard Mitigation Strategies Panel Member, National Research Council Aeronautics and Space Engineering Board (2009 - 2010)

LINKS

- Space Environment and Satellite Systems lab website: http://sess.stanford.edu/

Teaching

COURSES

2023-24

- Classical Dynamics: AA 242A (Aut)
- Introduction to Plasma Physics and Engineering: AA 244A (Win)
- Introduction to the Space Environment: AA 251 (Spr)

2022-23

- Air and Space Propulsion: AA 103 (Spr)
- Classical Dynamics: AA 242A (Aut)
- Introduction to Plasma Physics and Engineering: AA 244A (Win)

2021-22

- Classical Dynamics: AA 242A (Aut)
- Introduction to Plasma Physics and Engineering: AA 244A (Win)
- Introduction to the Space Environment: AA 251 (Spr)

2020-21

- Classical Dynamics: AA 242A (Aut)
- Introduction to Plasma Physics and Engineering: AA 244A (Win)
- Surviving Space: AA 108N (Spr)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Andy Castillo, Andrew Denig, Matthew Hunter, Frank Lai, Shane Lowe, Adnan Mansour, Guillem Megias i Homar

Doctoral Dissertation Advisor (AC)

Kofi Blake, Jared Blanchard, Nancy Diallo, Dennis Dong, Joseph Ferguson, Trevor Hedges, Michael Kwara, Raymond Lau, Neil Maitra, Xiaohan Mei, Ashwyn Sam

Orals Evaluator

Jared Blanchard, Jeff Park

Master's Program Advisor

Somrita Banerjee, Yasmina Elmore, Mythri Paluri, Alex Romano, Kendall Seefried, Chris Sowinski

Doctoral (Program)

Joseph Ferguson, Konstantinos Kotsarinis

Publications

PUBLICATIONS

- **Time-Dependent Inversion of Energetic Electron Precipitation Spectra From Ground-Based Incoherent Scatter Radar Measurements** *JOURNAL OF GEOPHYSICAL RESEARCH-SPACE PHYSICS*
  Juarez Madera, D., Marshall, R. A., Elschot, S., Kaeppler, S., Reyes, P., Varney, R. H., Crew, A. B.
  2023; 128 (5)
- **Experimental evidence of rapid target charging electromagnetic pulse from hypervelocity impact** *INTERNATIONAL JOURNAL OF IMPACT ENGINEERING*
  Estacio, B., Young, S. Q., Lee, N., Elschot, S.
  2023; 173
- **Meteoroid orbit determination from HPLA radar data** *ICARUS*
  Blanchard, J. T., Lee, N., Elschot, S.
  2022; 386
- **Continuum to rarefied diffusive tortuosity factors in porous media from X-ray microtomography** *COMPUTATIONAL MATERIALS SCIENCE*
  Ferguson, J. C., Borner, A., Panerai, F., Close, S., Mansour, N. N.
  2022; 203
- **Theory of Power Generation From Spacecraft Charging** *IEEE TRANSACTIONS ON PLASMA SCIENCE*
  Young, S. Q., Stupl, J., Lee, N., Close, S.
  2022; 50 (1): 141-154
- **Microscopic ejecta measurements from hypervelocity impacts on aluminum and powdered regolith targets** *INTERNATIONAL JOURNAL OF IMPACT ENGINEERING*
  Shohet, G., Estacio, B., Matthews, I., Young, S. Q., Lee, N., Close, S.
  2021; 152
- **Dust and atmospheric influence on plasma properties observed in light gas gun hypervelocity impact experiments** *INTERNATIONAL JOURNAL OF IMPACT ENGINEERING*
  Estacio, B., Shohet, G., Young, S. Q., Matthews, I., Lee, N., Close, S.
  2021; 151
- **A thermodynamic analysis of hypervelocity impacts on metals** *INTERNATIONAL JOURNAL OF IMPACT ENGINEERING*
  Nuttall, A., Close, S.
  2020; 144
- **A technique for inferring lower thermospheric neutral density from meteoroid ablation** *PLANETARY AND SPACE SCIENCE*
  Limonta, L., Close, S., Marshall, R. A.
  2020; 180
- **Dust Charge Modeling and Ejecta Measurements for Hypervelocity Impacts on Aluminum and Powdered Regolith Simulant Targets**
  Shohet, G., Lee, N., Close, S., IEEE
  IEEE.2020
- **Harvesting Electromagnetic Energy from Hypervelocity Impacts for Solar System Exploration**
  Young, S. Q., Lee, N., Close, S., IEEE
  IEEE.2020

- **Inference of meteoroid characteristics using a genetic algorithm** *ICARUS*
  Tarano, A., Wheeler, L. F., Close, S., Mathias, D. L.
  2019; 329: 270–81
- **Meteoroid Impact Detection for Exploration of Asteroids: Small Satellites for Asteroid Characterization**
  Lee, N., Close, S.
  AMER INST AERONAUTICS ASTRONAUTICS.2018: 202–13
- **Plasma distributions in meteor head echoes and implications for radar cross section interpretation**
  Marshall, R. A., Brown, P., Close, S.
  PERGAMON-ELSEVIER SCIENCE LTD.2017: 203-208
- **How dust makes radio waves** *ASTRONOMY & GEOPHYSICS*
  Close, S., Fletcher, A.
  2017; 58 (3): 7
- **Particle-in-cell simulations of an RF emission mechanism associated with hypervelocity impact plasmas** *PHYSICS OF PLASMAS*
  Fletcher, A. C., Close, S.
  2017; 24 (5)
- **A CubeSat Platform for Characterizing the Reliability of Electronic Components**
  Tarantino, P., Lee, N., Close, S., IEEE
  IEEE.2017: 75–76
- **Experimental Verification of Pulsed Electrostatic Manipulation for Reentry Blackout Alleviation**
  Steffens, L., Krishnamoorthy, S., Guelhan, A., Close, S., IEEE
  IEEE.2017
- **Detection of hypervelocity impact radio frequency pulses through prior constrained source separation** *RADIO SCIENCE*
  Nuttall, A., Kochenderfer, M., Close, S.
  2016; 51 (10): 1660-1675
- **Mean thermo spheric density estimation derived from satellite constellations** *ADVANCES IN SPACE RESEARCH*
  Li, A., Close, S.
  2015; 56 (8): 1645-1657
- **Simulating plasma production from hypervelocity impacts** *PHYSICS OF PLASMAS*
  Fletcher, A., Close, S., Mathias, D.
  2015; 22 (9)
- **THE SOUTHERN ARGENTINA AGILE METEOR RADAR ORBITAL SYSTEM (SAAMER-OS): AN INITIAL SPORADIC METEOROID ORBITAL SURVEY IN THE SOUTHERN SKY** *ASTROPHYSICAL JOURNAL*
  Janches, D., Close, S., Hormaechea, J. L., Swarnalingam, N., Murphy, A., O'Connor, D., Vandepeer, B., Fuller, B., Fritts, D. C., Brunini, C.
  2015; 809 (1)
- **An FDTD model of scattering from meteor head plasma** *JOURNAL OF GEOPHYSICAL RESEARCH-SPACE PHYSICS*
  Marshall, R. A., Close, S.
  2015; 120 (7): 5931-5942
- **Design for CubeSat-based dust and radiation studies at Europa** *ACTA ASTRONAUTICA*
  Goel, A., Krishnamoorthy, S., Swenson, T., West, S., Li, A., Crew, A., Phillips, D. J., Screve, A., Close, S.
  2015; 136: 204-218
- **Design and testing of miniaturized plasma sensor for measuring hypervelocity impact plasmas** *REVIEW OF SCIENTIFIC INSTRUMENTS*
  Goel, A., Tarantino, P. M., Lauben, D. S., Close, S.
  2015; 86 (4)
- **Electrical Anomalies on Spacecraft due to Hypervelocity Impacts**
  Goel, A., Close, S., IEEE
  IEEE.2015

- **Susceptibility of Spacecraft to Impact-Induced Electromagnetic Pulses**
  Fletcher, A., Mathias, D., Close, S., IEEE
  IEEE.2015
- **Numerical Modeling of Radio Wave Scattering from Meteor Head Plasma**
  Marshall, R. A., Close, S., IEEE
  IEEE.2015: 254
- **Plasma turbulence of nonspecular trail plasmas as measured by a high-power large-aperture radar** *JOURNAL OF GEOPHYSICAL RESEARCH-ATMOSPHERES*
  Yee, J., Close, S.
  2013; 118 (24): 13449-13462
- **Impact-Induced ESD and EMI/EMP Effects on Spacecraft-A Review** *IEEE TRANSACTIONS ON PLASMA SCIENCE*
  Garrett, H. B., Close, S.
  2013; 41 (12): 3545-3557
- **First Preliminary Results from US Round-Robin Tests** *IEEE TRANSACTIONS ON PLASMA SCIENCE*
  Vayner, B. V., Ferguson, D. C., Hoffmann, R. C., Wheelock, A. T., Likar, J. J., Prebola, J. L., Crider, D. H., Schneider, T. A., Vaughn, J. A., Hoang, B., Steele, K., Close, S., Goel, et al
  2013; 41 (12): 3310-3322
- **Detection of electromagnetic pulses produced by hypervelocity micro particle impact plasmas** *PHYSICS OF PLASMAS*
  Close, S., Linscott, I., Lee, N., Johnson, T., Strauss, D., Goel, A., Fletcher, A., Lauben, D., Srama, R., Mocker, A., Bugiel, S.
  2013; 20 (9)
- **Curved pleat folding for smooth wrapping** *PROCEEDINGS OF THE ROYAL SOCIETY A-MATHEMATICAL PHYSICAL AND ENGINEERING SCIENCES*
  Lee, N., Close, S.
  2013; 469 (2155)
- **The Meteoroid Input Function and predictions of mid-latitude meteor observations by the MU radar** *ICARUS*
  Pifko, S., Janches, D., Close, S., Sparks, J., Nakamura, T., Nesvorny, D.
  2013; 223 (1): 444-459
- **Theory and experiments characterizing hypervelocity impact plasmas on biased spacecraft materials** *PHYSICS OF PLASMAS*
  Lee, N., Close, S., Goel, A., Lauben, D., Linscott, I., Johnson, T., Strauss, D., Bugiel, S., Mocker, A., Srama, R.
  2013; 20 (3)
- **Plasma Turbulence of Non-Specular Trail Plasmas as Measured by a High Power Large Aperture Radar** *US-National-Committee-of-URSI National Radio Science Meeting*
  Yee, J., Close, S.
  IEEE.2013
- **Theory and experiments characterizing hypervelocity impact plasmas: Toward weatherproof spacecraft systems** *US-National-Committee-of-URSI National Radio Science Meeting*
  Lee, N., Close, S.
  IEEE.2013
- **Clustering and Confidence Intervals for Radar Target Identification and Estimation** *US-National-Committee-of-URSI National Radio Science Meeting*
  Volz, R., Close, S., Erickson, P. J.
  IEEE.2013
- **Inverse filtering of radar signals using compressed sensing with application to meteors** *RADIO SCIENCE*
  Volz, R., Close, S.
  2012; 47
- **Determining meteoroid bulk densities using a plasma scattering model with high-power large-aperture radar data** *ICARUS*
  Close, S., Volz, R., Loveland, R., Macdonell, A., Colestock, P., Linscott, I., Oppenheim, M.
  2012; 221 (1): 300-309

- **Measurements of freely-expanding plasma from hypervelocity impacts** *INTERNATIONAL JOURNAL OF IMPACT ENGINEERING*
  Lee, N., Close, S., Lauben, D., Linscott, I., Goel, A., Johnson, T., Yee, J., FLETCHER, A., Srama, R., BUGIEL, S., Mocker, A., Colestock, P., Green, et al
  2012; 44: 40-49

- **Analysis of electromagnetic and electrostatic effects of particle impacts on spacecraft** *ADVANCES IN SPACE RESEARCH*
  Kelley, M. C., Pancoast, S., Close, S., Wang, Z.
  2012; 49 (6): 1029-1033

- **Targeted Parameter Inflation Within Ground-Based Augmentation Systems to Minimize Anomalous Ionospheric Impact** *JOURNAL OF AIRCRAFT*
  Seo, J., Lee, J., Pullen, S., Enge, P., Close, S.
  2012; 49 (2): 587-599

- **Meteoroid head echo polarization features studied by numerical electromagnetics modeling** *RADIO SCIENCE*
  Vertatschitsch, L. E., Sahr, J. D., Colestock, P., Close, S.
  2011; 46

- **Coherent matched filter signal-processing algorithms for probing the ionosphere using broadband RF data** *JOURNAL OF GEOPHYSICAL RESEARCH-SPACE PHYSICS*
  Close, S., FLETCHER, A., Dunham, M., Linscott, I.
  2011; 116

- **A medium-scale traveling ionospheric disturbance observed from the ground and from space** *RADIO SCIENCE*
  Dymond, K. F., Watts, C., Coker, C., Budzien, S. A., Bernhardt, P. A., Kassim, N., Lazio, T. J., Weiler, K., Crane, P. C., Ray, P. S., Cohen, A., Clarke, T., Rickard, et al
  2011; 46

- **Analysis of ALTAIR 1998 meteor radar data** *JOURNAL OF GEOPHYSICAL RESEARCH-SPACE PHYSICS*
  Zinn, J., Close, S., Colestock, P. L., MacDonell, A., Loveland, R.
  2011; 116

- **Comparison of methods of determining meteoroid range rates from linear frequency modulated chirped pulses** *RADIO SCIENCE*
  Loveland, R., MacDonell, A., Close, S., Oppenheim, M., Colestock, P.
  2011; 46

- **Development and error analysis of nonlinear ionospheric removal algorithm for ionospheric electron density determination using broadband RF data** *JOURNAL OF GEOPHYSICAL RESEARCH-SPACE PHYSICS*
  Lay, E. H., Close, S., Colestock, P., Bust, G.
  2011; 116

- **Polarization and scattering of a long-duration meteor trail** *JOURNAL OF GEOPHYSICAL RESEARCH-SPACE PHYSICS*
  Close, S., Kelley, M., Vertatschitsch, L., Colestock, P., Oppenheim, M., Yee, J.
  2011; 116

- **Electromagnetic pulses generated by meteoroid impacts on spacecraft** *JOURNAL OF GEOPHYSICAL RESEARCH-SPACE PHYSICS*
  Close, S., Colestock, P., Cox, L., Kelley, M., Lee, N.
  2010; 115

- **Dependence of radar signal strength on frequency and aspect angle of non-specular trails** *J. Geophys. Res.*
  Close, S., Hamlin, T., Oppenheim, M., Cox, L., Colestock, P.
  2008; 113: A06203

- **Meteor head echo radar data: Mass-velocity selection effects** *Icarus*
  Close, S., Brown, P., Campbell-Brown, M., Oppenheim, M., Colestock, P.
  2007; 186: 547-556

- **A new method for determining meteoroid mass from head echo data** *J. Geophys. Res.*
  Close, S., Oppenheim, M., Durand, D., Dyrud, L.
  2005; 110: A09308

- **A technique for calculating meteor plasma density and mass from radar head echo scattering** *Icarus*

Close, S., Oppenheim, M., Hunt, S., Coster, A.
2004; 168: 43-52

- **Scattering characteristics of high-resolution meteor head echoes detected at multiple frequencies** *J. Geophys. Res.*
  Close, S., Oppenheim, M., Hunt, S., Dyrud, L.
  2002; 107: 1295

- **Analysis of Perseid meteor head echo data collected using the Advanced Research Projects Agency Long-Range Tracking and Instrumentation Radar (ALTAIR)** *Radio Sci.*
  Close, S., Hunt, S., Minardi, M., McKeen, F.
  2000; 35: 1233-1240