Stanford

Kentaro Hara

Associate Professor of Aeronautics and Astronautics

CONTACT INFORMATION

- **Administrative Contract**

  Renee Quiroz - Administrative Associate

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Bio

BIO

Ken Hara is an Associate Professor of Aeronautics and Astronautics at Stanford University. He received a Ph.D. in Aerospace Engineering and a Graduate Certificate in Plasma Science and Engineering from the University of Michigan, and B.S. and M.S. in Aeronautics and Astronautics from the University of Tokyo. He was a Visiting Research Physicist at Princeton Plasma Physics Laboratory as a Japan Society for the Promotion of Science Postdoctoral Fellow. Professor Hara's research interests include electric propulsion, low temperature partially ionized plasmas, plasma physics (plasma-wall interactions, plasma-wave interactions, kinetic and fluid instabilities), data assimilation, rarefied gas flows, and computational fluid and plasma dynamics. He is a recipient of the Air Force Young Investigator Program Award, the Department of Energy Early Career Award, and the Office of Naval Research Young Investigator Program Award.

ACADEMIC APPOINTMENTS

- Associate Professor, Aeronautics and Astronautics
- Member, Institute for Computational and Mathematical Engineering (ICME)

HONORS AND AWARDS

- Associate Fellow, American Institute of Aeronautics and Astronautics (2024)
- Best Paper Award, 37th International Electric Propulsion Conference (2024)
- NPSS Early Achievement Award, IEEE Nuclear and Plasma Sciences Society (2023)
- Noah Hershkowitz Early Career Award, Plasma Sources Science and Technology, IOP Publishing (2023)
- Young Investigator Program (YIP) Award, Office of Naval Research (2021)
- Kuriki Award for Young Professionals, Electric Rocket Propulsion Society (2019)
- Early Career Research Program Award, Department of Energy (2018)
- JPL Summer Faculty Research Program, Jet Propulsion Laboratory, Caltech (2017)
- Young Investigator Research Program (YIP) Award, Air Force Office of Scientific Research (2017)
- Postdoctoral Fellowship, Japan Society for the Promotion of Science (2015-2016)

- Nuclear and Plasma Sciences Society Graduate Scholarship Award, IEEE (2015)
- Outstanding Student Paper Award, 41st IEEE International Conference on Plasma Science (2014)
- Richard F. and Eleanor A. Towner Prize for Distinguished Academic Achievement, College of Engineering, University of Michigan (2013)
- Best Student Award, 41st Annual Meeting of Japan Society for Aeronautical and Space Sciences (2010)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Associate Editor, Plasma Sources Science and Technology, IOP Publishing (2025 - present)
- Editorial Board, Plasma Sources Science and Technology, IOP Publishing (2023 - 2025)
- Associate Editor, Transactions of the Japan Society for Aeronautical and Space Sciences (2025 - present)
- Plasmadynamics and Laser Technical Committee, American Institute of Aeronautics and Astronautics (2024 - present)
- Plasma Science and Applications Committee, Nuclear and Plasma Sciences Society, IEEE (2020 - present)
- Electric Propulsion Technical Committee, American Institute of Aeronautics and Astronautics (2018 - present)

PROFESSIONAL EDUCATION

- PhD, University of Michigan , Aerospace Engineering (2015)
- MS, University of Tokyo , Aeronautics and Astronautics (2010)
- BS, University of Tokyo , Aeronautics and Astronautics (2008)

LINKS

- Plasma Dynamics Modeling Laboratory: https://pdml.stanford.edu/

Teaching

COURSES

2025-26

- Fundamentals of Compressible Flow: AA 210A (Aut)
- Fundamentals of Plasmas II: AA 244B (Spr)
- Plasma Science and Technology Seminar: AA 296, ME 350 (Win)
- Spacecraft Electric Propulsion: AA 204 (Win)

2024-25

- Fundamentals of Compressible Flow: AA 210A (Aut)
- Plasma Science and Technology Seminar: AA 296, ME 350 (Win)
- Rarefied and Ionized Gases: AA 205, ME 362C (Spr)
- Spacecraft Electric Propulsion: AA 204 (Win)

2023-24

- Fundamentals of Compressible Flow: AA 210A (Win)
- Plasma Science and Technology Seminar: AA 296, ME 350 (Win)
- Spacecraft Electric Propulsion: AA 204 (Spr)

2022-23

- Advanced Plasma Physics and Engineering: AA 244B (Spr)
- Aircraft and Rocket Propulsion: AA 283 (Win)
- Fundamentals of Compressible Flow: AA 210A (Aut)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Danielle Brown, Claudia Parisuaña

Postdoctoral Faculty Sponsor

Luca Vialetto

Doctoral Dissertation Advisor (AC)

Elias Bögel, Andy Castillo, Derek Kuldinow, Eva Marinopoulou, Ishaan Mishra, Vedanth Sharma, Shigemitsu Suzuki, Daniel Troyetsky

Master's Program Advisor

Allan Attia, Javid Hamidov, Cole Kindler, Pearl Klassen, Damian Meza, Umar Padela, Ileana Pal, Maan Pandya

Doctoral Dissertation Co-Advisor (AC)

James Hansen, Konstantinos Kotsarinis, Gary Li, Alka Panda

Publications

PUBLICATIONS

- **Density and translational temperature measurements of neutral atoms in a glow discharge using coherent Rayleigh scattering** *PLASMA SOURCES SCIENCE & TECHNOLOGY*
  Randolph, R., Flores Alfaro, G. M., Suzuki, S., Bak, J., Hara, K., Gerakis, A.
  2026; 35 (3)
- **Global eigenvalue method for stability analysis in crossed-field diodes** *PHYSICS OF PLASMAS*
  Castillo, A. M., Hopkins, M. M., Dwivedi, A., Bennett, N. L., Hara, K.
  2026; 33 (3)
- **High-order moment closure for nonmagnetized electrons in partially ionized plasmas.** *Physical review. E*
  Alvarez Laguna, A., Hara, K.
  2026; 113 (2-2): 025207
- **Analysis of non-local heat flux in capacitively coupled plasmas** *PLASMA SOURCES SCIENCE & TECHNOLOGY*
  Wu, G., Yamashita, Y., Mansour, A. R., Alvarez Laguna, A., Hara, K.
  2026; 35 (2)
- **Benchmark for two-dimensional large scale coherent structures in partially magnetized E x B plasmas-community collaboration & lessons learned** *PLASMA SOURCES SCIENCE & TECHNOLOGY*
  Powis, A. T., Ahedo, E., Alvarez Laguna, A., Barleon, N., Bello-Benitez, E., Beving, L., Boeuf, J., Bogopolsky, G., Bourdon, A., Cichocki, F., Cuenot, B., Denig, A., Donko, et al
  2026; 35 (2)
- **A Global Model of Direct Current (DC) Breakdown** *IEEE TRANSACTIONS ON PLASMA SCIENCE*
  Mansour, A. R., Hara, K.
  2026
- **Anode plasma formation and expansion in pulsed high-voltage diodes** *PHYSICS OF PLASMAS*
  Sharma, V., Hara, K.
  2025; 32 (11)
- **A self-consistent electrostatic electrified shallow water model for charged liquid surface dynamics** *PHYSICS OF PLASMAS*
  Suzuki, S., Shneider, M. N., Hara, K.
  2025; 32 (11)
- **Gradient-based calibration of the anomalous electron scattering frequency in a Hall effect thruster simulation** *JOURNAL OF APPLIED PHYSICS*

Troyetsky, D. E., Lopez Ortega, A., Hara, K.
2025; 138 (16)

- **Estimation of in-space thruster performance of a Hall effect thruster through extrapolation of plasma states using extended Kalman filter** *JOURNAL OF APPLIED PHYSICS*
  Zivre, T., Hara, K.
  2025; 138 (16)
- **Kinetic modeling of cathode plasma formation and expansion in a pulsed high-voltage anode-cathode gap** *JOURNAL OF APPLIED PHYSICS*
  Sharma, V., Yamashita, Y., Hara, K.
  2025; 138 (5)
- **Spatiotemporal state and parameter estimation of plasma dynamics using data assimilation** *PHYSICS OF PLASMAS*
  Dwivedi, A., Cerepi, M., Hara, K.
  2025; 32 (6)
- **Estimation of electron kinetics in low-temperature plasmas using data assimilation** *JOURNAL OF PHYSICS D-APPLIED PHYSICS*
  Dwivedi, A., Hara, K.
  2025; 58 (17)
- **Ten-moment fluid modeling of the Weibel instability** *JOURNAL OF PLASMA PHYSICS*
  Kuldinow, D. A., Hara, K.
  2025; 91 (2)
- **Electron Monte Carlo simulations of single- and dual-frequency RF breakdown** *PHYSICS OF PLASMAS*
  Yamashita, Y., Sharma, V., Sriraman, S., Hara, K.
  2025; 32 (4)
- **Three-body electron attachment in humid air** *PLASMA SOURCES SCIENCE & TECHNOLOGY*
  Vialetto, L., Hara, K.
  2025; 34 (3)
- **Propulsion Properties of Electric Sails** *JOURNAL OF SPACECRAFT AND ROCKETS*
  Gimelshein, S., Hara, K., Yamashita, Y., Destefano, A.
  2025
- **Finite ion temperature effects on electrostatic instabilities in partially magnetized plasmas** *PHYSICS OF PLASMAS*
  Denig, A. C., Hara, K.
  2025; 32 (2)
- **Discharge mode transition in partially magnetized E x B Penning discharge** *PHYSICS OF PLASMAS*
  Lee, M., Chung, K., Hara, K., Kim, J.
  2024; 31 (12)
- **Ten-moment fluid model for low-temperature magnetized plasmas** *PHYSICS OF PLASMAS*
  Kuldinow, D., Yamashita, Y., Hara, K.
  2024; 31 (12)
- **Electron inertial effects in the rarefied regime of a direct-current (DC) breakdown** *PLASMA SOURCES SCIENCE & TECHNOLOGY*
  Mansour, A. R., Vialetto, L., Yamashita, Y., Hara, K.
  2024; 33 (11)
- **Effects of the chirp rate on single-shot coherent Rayleigh-Brillouin scattering** *PHYSICAL REVIEW A*
  Suzuki, S., Gerakis, A., Hara, K.
  2024; 110 (3)
- **Case study in machine learning for predicting moderate pressure plasma behavior** *JOURNAL OF VACUUM SCIENCE & TECHNOLOGY A*
  Hussain, S., Lary, D. J., Hara, K., Bera, K., Rauf, S., Goeckner, M.
  2024; 42 (4)

- **Hysteresis between gas breakdown and plasma discharge** *PHYSICS OF PLASMAS*
  Yamashita, Y., Hara, K., Sriraman, S.
  2024; 31 (7)
- **Ten-moment fluid model with heat flux closure for gasdynamic flows** *JOURNAL OF COMPUTATIONAL PHYSICS*
  Kuldinow, D. A., Yamashita, Y., Mansour, A. R., Hara, K.
  2024; 508
- **Effects of multi-dimensionality and energy exchange on electrostatic current-driven plasma instabilities and turbulence** *JOURNAL OF PLASMA PHYSICS*
  Chan, W., Hara, K., Boyd, I. D.
  2024; 90 (2)
- **Loss cone effects and monotonic sheath conditions of a partially magnetized plasma sheath** *PHYSICS OF PLASMAS*
  Castillo, A. M., Hara, K.
  2024; 31 (3)
- **State estimation of the dynamic behavior of plasma properties in a Hall effect thruster discharge** *JOURNAL OF PHYSICS D-APPLIED PHYSICS*
  Troyetsky, D. E., Greve, C. M., Tsikata, S., Hara, K.
  2023; 56 (44)
- **Inertial and anisotropic pressure effects on cross-field electron transport in low-temperature magnetized plasmas** *JOURNAL OF PHYSICS D-APPLIED PHYSICS*
  Yamashita, Y., Lau, R., Hara, K.
  2023; 56 (38)
- **Dynamics of electrified liquid metal surface using shallow water model** *PHYSICS OF FLUIDS*
  Liu, Z., Hara, K., Shneider, M. N.
  2023; 35 (4)
- **Three-dimensional coupling of electron cyclotron drift instability and ion-ion two stream instability** *PHYSICS OF PLASMAS*
  Denig, A. C., Hara, K.
  2023; 30 (3)
- **Effects of macroparticle weighting in axisymmetric particle-in-cell Monte Carlo collision simulations** *PLASMA SOURCES SCIENCE & TECHNOLOGY*
  Hara, K., Robertson, T., Kenney, J., Rauf, S.
  2023; 32 (1)
- **Effects of the Wavelength of the Plasma Waves on Cross-Field Electron Transport in Partially Magnetized Plasmas** *IEEE TRANSACTIONS ON PLASMA SCIENCE*
  Sewell, S. T., Kumar, P., Hara, K.
  2022
- **Theory of gradient drift instabilities in low-temperature, partially magnetised plasmas** *JOURNAL OF PLASMA PHYSICS*
  Hara, K., Mansour, A. R., Tsikata, S.
  2022; 88 (4)
- **Estimation of plasma properties using an extended Kalman filter with plasma global models** *JOURNAL OF PHYSICS D-APPLIED PHYSICS*
  Greve, C. M., Hara, K.
  2022; 55 (25)
- **Full fluid moment modeling of rotating spokes in Penning-type configuration** *PLASMA SOURCES SCIENCE & TECHNOLOGY*
  Mansour, A. R., Hara, K.
  2022; 31 (5)
- **Mutually guided light and particle beam propagation.** *Scientific reports*
  Castillo, A. M., Kumar, P., Limbach, C. M., Hara, K.
  2022; 12 (1): 4810

- **Characterization of hollow cathode plasma turbulence using coherent Thomson scattering** *JOURNAL OF APPLIED PHYSICS*
  Tsikata, S., Hara, K., Mazouffre, S.
  2021; 130 (24)
- **Effects of multiply charged ions on microturbulence-driven electron transport in partially magnetized plasmas** *JOURNAL OF APPLIED PHYSICS*
  Kumar, P., Tsikata, S., Hara, K.
  2021; 130 (17)
- **Real-time state estimation of low-frequency plasma oscillations in Hall effect thrusters** *PHYSICS OF PLASMAS*
  Greve, C. M., Majji, M., Hara, K.
  2021; 28 (9)
- **2D radial-azimuthal particle-in-cell benchmark for E x B discharges** *PLASMA SOURCES SCIENCE & TECHNOLOGY*
  Villafana, W., Petronio, F., Denig, A. C., Jimenez, M. J., Eremin, D., Garrigues, L., Taccogna, F., Alvarez-Laguna, A., Boeuf, J. P., Bourdon, A., Chabert, P., Charoy, T., Cuenot, et al
  2021; 30 (7)
- **Application of State Estimation Methods to Low-Temperature Plasma Dynamics**
  Greve, C., Hara, K., Majji, M., IEEE
  IEEE.2021: 1-5
- **Nonlinear dynamics of coupled light and particle beam propagation** *Physical Review A*
  Kumar, P., Kuldinow, D., Castillo, A., Gerakis, A., Hara, K.
  2021; 103 (04)
- **Physics of ExB discharges relevant to plasma propulsion and similar technologies** *PHYSICS OF PLASMAS*
  Kaganovich, I. D., Smolyakov, A., Raitses, Y., Ahedo, E., Mikellides, I. G., Jorns, B., Taccogna, F., Gueroult, R., Tsikata, S., Bourdon, A., Boeuf, J., Keidar, M., Powis, et al
  2020; 27 (12)
- **Full fluid moment model for low temperature magnetized plasmas** *PHYSICS OF PLASMAS*
  Sahu, R., Mansour, A. R., Hara, K.
  2020; 27 (11)
- **Non-monotonic double layers and electron two-stream instabilities resulting from intermittent ion acoustic wave growth** *PHYSICS OF PLASMAS*
  Vazsonyi, A. R., Hara, K., Boyd, I. D.
  2020; 27 (11)
- **Cross-field electron diffusion due to the coupling of drift-driven microinstabilities** *PHYSICAL REVIEW E*
  Hara, K., Tsikata, S.
  2020; 102 (2)
- **Cross-field electron diffusion due to the coupling of drift-driven microinstabilities.** *Physical review. E*
  Hara, K., Tsikata, S.
  2020; 102 (2-1): 023202
- **Self-organized standing waves generated by AC-driven electron cyclotron drift instabilities** *APPLIED PHYSICS LETTERS*
  DesJardin, I. M., Hara, K., Tsikata, S.
  2019; 115 (23)
- **Two-dimensional hybrid-direct kinetic simulation of a Hall thruster discharge plasma** *PHYSICS OF PLASMAS*
  Raisanen, A. L., Hara, K., Boyd, I. D.
  2019; 26 (12)
- **2D axial-azimuthal particle-in-cell benchmark for low-temperature partially magnetized plasmas** *PLASMA SOURCES SCIENCE & TECHNOLOGY*
  Charoy, T., Boeuf, J. P., Bourdon, A., Carlsson, J. A., Chabert, P., Cuenot, B., Eremin, D., Garrigues, L., Hara, K., Kaganovich, I. D., Powis, A. T., Smolyakov, A., Sydorenko, et al

2019; 28 (10)

- **A data-driven approach to model calibration for nonlinear dynamical systems** *JOURNAL OF APPLIED PHYSICS*
  Greve, C. M., Hara, K., Martin, R. S., Eckhardt, D. Q., Koo, J. W.
  2019; 125 (24)
- **Ion kinetics and nonlinear saturation of current-driven instabilities relevant to hollow cathode plasmas** *PLASMA SOURCES SCIENCE & TECHNOLOGY*
  Hara, K., Treece, C.
  2019; 28 (5)
- **An overview of discharge plasma modeling for Hall effect thrusters** *PLASMA SOURCES SCIENCE & TECHNOLOGY*
  Hara, K.
  2019; 28 (4)
- **Spatiotemporal data fusion and manifold reconstruction in Hall thrusters** *PLASMA SOURCES SCIENCE & TECHNOLOGY*
  Eckhardt, D., Koo, J., Martin, R., Holmes, M., Hara, K.
  2019; 28 (4)
- **Multispecies plasma fluid simulation for carbon arc discharge** *JOURNAL OF PHYSICS D-APPLIED PHYSICS*
  Mansour, A. R., Hara, K.
  2019; 52 (10)
- **Non-oscillatory quasineutral fluid model of cross-field discharge plasmas** *PHYSICS OF PLASMAS*
  Hara, K.
  2018; 25 (12)
- **Test cases for grid-based direct kinetic modeling of plasma flows** *PLASMA SOURCES SCIENCE & TECHNOLOGY*
  Hara, K., Hanquist, K.
  2018; 27 (6)
- **Amplification due to two-stream instability of self-electric and magnetic fields of an ion beam propagating in background plasma**
  Tokluoglu, E. K., Kaganovich, I. D., Carlsson, J. A., Hara, K., Startsev, E. A.
  AMER INST PHYSICS.2018
- **Numerical analysis of azimuthal rotating spokes in a crossed-field discharge plasma** *PLASMA SOURCES SCIENCE & TECHNOLOGY*
  Kawashima, R., Hara, K., Komurasaki, K.
  2018; 27 (3)
- **On limitations of laser-induced fluorescence diagnostics for xenon ion velocity distribution function measurements in Hall thrusters** *PHYSICS OF PLASMAS*
  Romadanov, I., Raitses, Y., Diallo, A., Hara, K., Kaganovich, I. D., Smolyakov, A.
  2018; 25 (3)
- **Generation of forerunner electron beam during interaction of ion beam pulse with plasma**
  Hara, K., Kaganovich, I. D., Startsev, E. A.
  AMER INST PHYSICS.2018
- **Kinetic simulations of ladder climbing by electron plasma waves** *PHYSICAL REVIEW E*
  Hara, K., Barth, I., Kaminski, E., Dodin, I. Y., Fisch, N. J.
  2017; 95 (5): 053212
- **Detailed modeling of electron emission for transpiration cooling of hypersonic vehicles** *JOURNAL OF APPLIED PHYSICS*
  Hanquist, K. M., Hara, K., Boyd, I. D.
  2017; 121 (5)
- **AMPLIFICATION DUE TO THE TWO-STREAM INSTABILITY OF SELF-ELECTRIC AND MAGNETIC FIELDS OF AN ION OR ELECTRON BEAM PROPAGATING IN BACKGROUND PLASMA**
  Tokluoglu, E. K., Kaganovich, I. D., Carlsson, J. A., Hara, K., Powis, A., IEEE
  IEEE.2017

- **ADVANCED MAGNETO-GAS-KINETIC SCHEME FOR MHD: ANALYSIS AND COMPARISON TO EXISTING MODELS**
  Anderson, S. E., Hara, K., Girimaji, S. S., IEEE
  IEEE.2017
- **NUMERICAL MODELING OF ROTATING SPOKES IN HALL THRUSTER DISCHARGE PLASMA**
  Kawashima, R., Hara, K., IEEE
  IEEE.2017
- **Electron acceleration due to the interaction between a neutralized ion beam and background plasma**
  Hara, K., Kaganovich, I. D., IEEE
  IEEE.2017
- **Quantitative study of the trapped particle bunching instability in Langmuir waves** *PHYSICS OF PLASMAS*
  Hara, K., Chapman, T., Banks, J. W., Brunner, S., Joseph, I., Berger, R. L., Boyd, I. D.
  2015; 22 (2)
- **Perturbation analysis of ionization oscillations in Hall effect thrusters** *PHYSICS OF PLASMAS*
  Hara, K., Sekerak, M. J., Boyd, I. D., Gallimore, A. D.
  2014; 21 (12)
- **Mode transition of a Hall thruster discharge plasma** *JOURNAL OF APPLIED PHYSICS*
  Hara, K., Sekerak, M. J., Boyd, I. D., Gallimore, A. D.
  2014; 115 (20)
- **One-dimensional hybrid-direct kinetic simulation of the discharge plasma in a Hall thruster** *PHYSICS OF PLASMAS*
  Hara, K., Boyd, I. D., Kolobov, V. I.
  2012; 19 (11)