CURRICULUM VITA: DARRELL F. STROBEL

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Education : North Dakota State University, Fargo, ND; B.S. (honors), 1964 Physics
Harvard University, Cambridge, MA; A.M., 1965; Ph.D., 1969 Applied Physics
Honorary: Observatoire de Paris, PSL Research University, Docteur Honoris Causa, 2018

Professional Experience: Professor, The Johns Hopkins University, 1984-2019, now Academy/Research Professor, 2019- ;
Principal Professional Staff, JHU/Applied Physics Laboratory, 1999-

Naval Research Laboratory,
Plasma Physics Division
Supervisory Research Physicist, 1973-1984
Head, Atmospheric Dynamics Section 1976-1984

Kitt Peak National Observatory, Tucson AZ
Research Associate, 1968-1970
Assistant Physicist, 1970-1972
Associate Physicist, 1972-1973

Sabbaticals at the Observatoire de Paris – Meudon, 1993-94, 1997-98, 2004-05

Professional Affiliations: American Astronomical Society – Division of Planetary Sciences, recipient of the 2012 Gerard P. Kuiper Prize; American Geophysical Union, Fellow in three sections; International Astronomical Union; International Academy of Astronautics, Member.

Professor Strobel is in the Department of Earth and Planetary Sciences of The Johns Hopkins University with a joint appointment in the Department of Physics and Astronomy and is on the Principal Professional Staff of Hopkins' Applied Physics Laboratory. He is the author of approximately 280 journal publications and book chapters. Professor Strobel was the Cassini Mission Orbiter Interdisciplinary Scientist for Aeronomy and a Co-Investigator on the New Horizons Pluto Kuiper-Belt Mission. Previously, he served as Co-Investigator/Science Team Leader of the Ultraviolet Spectrometer Experiment on the Voyager Mission. Prof. Strobel was a member of the Outer Planets Study Team of the NAS-ESF Joint Working Group on Planetary Exploration, 1983, that constructed plans for the Cassini-Huygens Mission and wrote its science objectives.

Professor Strobel was the recipient of the 2014 Henry L. Bolley Academic Achievement Award from NDSU Alumni Association; College of Science & Mathematics Distinguished Alumni Award in 2017. He served as an Associate Editor, Journal of Geophysical Research, 1976-79, Space physics section; 1982-84, Atmospheres section; 3 terms on the AGU Publications Committee, and 10 years of the AGU Books Board, Associate Editor, Icarus, 1980-2006, 2018-2021; on the National Academy of Sciences, National Research Council, SSB's, Committee on Solar and Space Physics, 1982-85, the Space Science Board (SSB), 1985-88, the Space Studies Board, 1988-89, the Committee on Planetary and Lunar Exploration (COMPLEX), 1992-96, 2007-08, the Committee on International Programs, 1996-98. He served as Chair of the Committee on Upper Atmosphere, American Meteorological Society, 1982-84, Naval Research Advisory Committee's Environmental Support Panel 1984-85, and as the Chair & Vice Chair of the Fachbeirat, MAX-PLANCK INSTITUT fur Kernphysik, 1994-2001. Asteroid **188502 Darrellstrobel (2004 PM115)** https://ssd.jpl.nasa.gov/sbdb.cgi?sstr=188502;orb=1;cov=0;log=0;cad=0#phys_par

Prof. Strobel is a physicist and expert in planetary atmospheres and astrophysics. He has studied a broad range of fundamental problems in atmospheric chemistry, dynamics, physics, and radiation pertinent to the Earth's atmosphere and the atmospheres of the giant planets and their satellites with the goal to understand the global structure of composition, pressure, temperature, and winds. Prof. Strobel has made fundamental contributions to our understanding of these atmospheres.

Prof. Strobel was a primary contributor to our current knowledge of photochemical processes in the outer solar system. His 1974 paper on the photochemistry of hydrocarbons in Titan's atmosphere concluded that the photochemistry was irreversible due to the escape of H and H_2, and would lead to the formation of complex molecules, and a finite lifetime of CH_4 in the atmosphere without resupply. This influenced the Voyager Mission to make Titan a target of equal importance with Saturn and provided a rationale for the follow-up Cassini-Huygens Mission. As a Co-Investigator and Science Team Leader of the UV Spectrometer Experiment (UVS) on the Voyager Mission, he led in the identification of N_2 as Titan's and Triton's major atmospheric constituent and the interpretation of Voyager UV data in terms of energetics, density, and thermal structure of upper atmospheres.

Prof. Strobel is noted for his studies of magnetospheric plasma interactions with the extended atmospheres of Titan, Triton, and Galilean satellites, and the impact on their atmospheres/exospheres and the mass loading rates of the parent planets' magnetospheres. Using Voyager UVS data, he co-discovered the Io torus, a high density, high temperature, multiply ionized oxygen and sulfur plasma at Io orbital distance from Jupiter. Prof. Strobel developed the neutral cloud theory to explain the energetics and high EUV/UV luminosity of the Io plasma torus. He was a key member on the Hopkins team that used Hubble Space Telescope to discover the oxygen atmospheres on Europa and Ganymede. With colleagues, he constructed the widely accepted thermal structure models for the atmospheres of Io, Triton, and Pluto.

Since 1990, Prof. Strobel has been actively engaged as the Cassini Mission Orbiter Interdisciplinary Scientist for Aeronomy and a Co-Investigator on the New Horizons Pluto Kuiper-Belt Mission. For the former he has focused Titan's upper atmosphere: the escape rates and density profiles of CH_4 and H_2 and the inferred large downward H_2 flux into Titan's surface comparable to the H_2 escape flux out of the atmosphere. For planning the five low orbits during the Cassini Grand Finale, he focused on the variable structure of Saturn's thermosphere and developed an engineering model atmosphere which provided for the safe passage through its upper atmosphere. For New Horizons, he was actively involved in atmospheric modeling and interpretation of virtually all measurements obtained by the atmospheres team, especially the density and thermal structure of the atmosphere, the escape rates of N_2 and CH_4, a gravity wave model to account for the layering of the haze, upper limit to the ionosphere, and the slowing down of the solar wind by escaping CH_4.

His early studies of the earth's F-region ionosphere led to the recognition of the important role that thermospheric wind systems play in plasma transport and seasonal variations of the electron density. His comprehensive studies of N_2 photochemistry identified the important sources, sinks, and transport of nitric oxide in the upper atmosphere. His research on gravity wave saturation/breaking effects in the middle atmosphere led to the recognition that chemical tracers and heat transport provide important constraints on gravity wave induced diffusion. He was a leader in establishing the now widely held view that macroscopic eddy stresses are characterized by a large eddy Prandtl number.

Darrell Strobel - 2012 Gerard P. Kuiper Prize Citation

The Division for Planetary Sciences of the American Astronomical Society is pleased to award the 2012 Gerard P. Kuiper Prize for outstanding contributions to planetary science to Darrell Strobel.

Dr. Strobel is one of the very best experts on many aspects of planetary atmospheres and magnetospheres, on which he has made fundamental contributions over nearly 40 years. In the mid-70's he laid out the fundamentals of atmospheric photochemistry, playing a leading role in establishing the general methodology for this then emerging field, and opening the way to study and solve a rich suite of problems related to photochemistry throughout the diversity of planetary atmospheres. After crucial work on the photochemistry of the Earth's atmosphere that addressed the modelling of mesospheric nitric oxide, he pioneered the study of hydrocarbon chemistry in Jupiter's atmosphere, and his predictions were brilliantly confirmed by the Voyager measurements. As a co-investigator on the Ultraviolet Spectrometer (UVS) experiment on Voyager, he was the intellectual force in that team. He was a leading player in the interpretation of the UVS data in terms of energetics, density and thermal structure of the Giant Planets and Titan, and the discovery and characterization of Triton's tenuous N_2 atmosphere. He was also a key member of the team that used the Hubble Space Telescope to discover oxygen atmospheres of Europa and Ganymede and to characterize the SO_2 atmosphere of Io and its plasma torus. Being currently an Interdisciplinary Scientist on the Cassini Mission, he continues to be a driving force in mission science planning and many investigations of Titan's atmosphere.

Through an exceptional scientific breadth, Dr. Strobel led seminal studies in fields such as atmospheric thermal structure and energy balance, neutral and ionospheric structure of upper atmospheres, and plasma interactions with extended atmospheres and mass loading in magnetospheres, addressing virtually all questions related to aeronomy in outer planets. In most of these areas, his physical grasp and novel work outlined new concepts and established gold standards for subsequent studies. In recent years, his unabated intellectual vigor and inextinguishable appetite for new challenges has led him to successfully attack seemingly intractable problems such as the quantitative modeling of hydrodynamic escape from weakly bound atmospheres, or the role of gravity and tidal waves in driving atmospheric dynamics.

Darrell Strobel is undoubtedly one of the most insightful and influential scientists in the field of planetary aeronomy, for which he clearly appears as one of the founding fathers. He has attracted to the field, and guided with dedication, many young planetary scientists, almost all of whom moved to very successful careers. For his many and impressive achievements, the Division for Planetary Sciences is proud to award the 2012 Gerald P. Kuiper Prize to Darrell Strobel.

Elected Fellow of the American Geophysical Union (2002) in Sections: Atmospheric Science, Planetary Science, Space Physics Aeronomy

Citation: For exceptional and fundamental contributions to understanding of the physics and chemistry of the atmospheres of the outer planets, their moons, and Earth.

Darrell F. Strobel Publications

Saur, J., Duling, S., Wennmacher, A., Willmes, C., Roth, L., Strobel, D. F., et al., Alternating north-south brightness ratio of Ganymede's auroral ovals: Hubble Space Telescope observations around the Juno PJ34 flyby. Geophysical Research Letters, 49, e2022GL098600, doi.org/10.1029/2022GL098600, 2022.

Marzok, A., S. Schlegel, J. Saur, L. Roth, D. Grodent, D. F. Strobel, K.D. Retherford, Mapping the Brightness of Ganymede's Ultraviolet Aurora using Hubble Space Telescope Observations, J. Geophys. Res., Planets, 127, e2022JE007256, doi.org/10.1029/2022JE007256, 2022.

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Strobel, D. F., Molecular Hydrogen in the Upper Atmospheres of Saturn and Titan, Icarus, 376, doi.org/10.1016/j.icarus.2021.114876, 2022.

Oliveira, J. Marques, B. Sicardy, A. R. Gomes-Júnior, J. L. Ortiz, D. F. Strobel, T. Bertrand, F. Forget, E. Lellouch, J. Desmars, D. Bérard et al. (227 more), Structure and evolution of Triton's atmosphere from the 5 October 2017 stellar occultation and previous observations, Astron. Astrophys., A&A 659, A136, doi.org/10.1051/0004-6361/2021414432021, 2022.

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Jacobs, A., et al., LORRI Observations of Waves in Pluto's Atmosphere, Icarus, 356, 113825, doi.org/10.1016/j.icarus.2020.113825, 2021.

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Strobel, D. F., and X. Zhu, Comparative Planetary Nitrogen Atmospheres: Density and Thermal Structures of Pluto and Triton, Icarus, 291, 55–64, doi.org/10.1016/j.icarus.2017.03.013, 2017.

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Roth, L., J. Saur, K. D. Retherford, A. Blocker, D. F. Strobel, and P. D. Feldman, Constraints on Io's interior from auroral spot oscillations, J. Geophys. Res. Space Physics, 122 (2), 1903-1927, doi:10.1002/2016JA023701, 2017.

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