

## STAMATIOS M KRIMIGIS

*(Brief curriculum Vitae and publications)*

**Current position:** **Principal Staff**, Johns Hopkins University Applied Physics Laboratory (1972-present); **Space Department Head Emeritus** (2004-present)  
**Member, Academy of Athens**, Chair of Space Science (2005-present)

**Education:** BS (Physics), University of Minnesota, 1961;  
MS (Physics), University of Iowa, 1963;  
PhD (Physics), University of Iowa, 1965.

**Professional background:** Research Associate, 1965-1966; Assistant Professor of Physics, 1966-1968; Department of Physics and Astronomy, **University of Iowa. Johns Hopkins University Applied Physics Laboratory** (1968-present). *Supervisor* (Space Physics Section) and Principal Staff member (since 1972), 1968-1974. *Group Supervisor* (Space Physics and Instrumentation Group), 1974-1981. *Chief Scientist* (Space Department), 1980-1990. *Head* (Space Department), 1991-2004. *Emeritus Head*, 2004-present, Retired Principal Staff, part-time-on-call, 2020-present. *Supervisor*, Office of Space Research and Technology, Academy of Athens, Athens, Greece (2006-present). **Greece's Alternate Head Delegate to the ESA Council** (12/06-09/10). **Chair of the National Council of Research and Technology** of Greece (9/10-12/13). **Senior Councilor** (pro bono), Minister of Digital Governance of Greece (2019-present).

**Relevant experience:** *As Principal Investigator (PI) or Co-Investigator (Co-I), designed, built, flown and analyzed data from 21 instruments on NASA/ESA space missions, 1963 to present, as follows: PI--Cassini-Huygens MIMI instrument, 1990-present; Voyager 1 and 2 LECP instrument 1971-present. Explorer 47 and Explorer 50 (IMP-7 and 8) CPME, 1968-1996. AMPTE, 1973-1989. Lead Co-I or Co-I Galileo EPD, 1977-2003; Ulysses HI-SCALE 1978-2009; Geotail EPIC, 1985-present; ACE ULEIS and EPAM, 1988-present; MESSENGER EPS, 1998-present; Mariner 3, 4, 5 TRD (Mars and Venus) 1963-68; Explorer 33 and Explorer 35 EPD, 1965-1970. Injun 4 SSD, 1963-1966; Injun 5 SSD, 1966-1971; OGO-4 SSD, 1966-1970; Collaborating Scientist, New Horizons, 2002-present; Co-I, Parker Solar Probe, 2012-present. Also, numerous NSF grants, 1970-1990.*

Member, *Space Science Board*, National Academy of Sciences, and *Chair*, Committee on Solar and Space Physics 1983-1986; Member, *NASA Space Science and Applications Advisory Committee (SSAAC)*, 1987-1990; *NASA Inter-Agency Consultative Group for Space Science (IACG)*, 1987-1993; *NASA Discovery Program Science Working Group*, 1989-1992. Member or Chair of over 40 committees, Commissions, Working Groups at US and International level.

**Awards and honors:** **Fellow**, *APS, AGU, AAAS, AIAA*, 1980- 2007; **Lifetime Achievement Award**, Johns Hopkins Applied Physics Laboratory, 2004; **Member of the Academy of Athens**, Chair of Science of Space. 2004; **COSPAR Space Science Award**, 2002; **Smithsonian Institution Trophy for Achievement** to the NEAR team, 2002. *Aviation Week and Space Technology "Laurels in Space Award"* in 1996 for NEAR and 2001 for New Horizons. He was member of the teams that were awarded the **Smithsonian Collier Trophy** for Voyager (1980) and the **Air and Space Museum Trophy** for NASA's missions Voyager (1989), and Cassini (2012). **NASA Medal for Exceptional Scientific Achievement** (1981, 1986). **Basic Sciences Award**, International Academy of Astronautics (1994). He was awarded **Honorary Doctorates** from the University of

the Aegean (12/2009, Financial and Management Engineering), the University of Athens (05/2010 Department of Physics), the Hellenic International University (5/19/11, Science of Engineering), and Frederic University of Cyprus, 2019. The **Council of European Aerospace Societies** awarded Dr. Krimigis its 2010 **CEAS Gold Medal**. On September 2012 he received the **2012 IAA Laurels Award** for Team Achievement to leading NASA'S MESSENGER mission to Mercury. **The European Geosciences Union** awarded him the **Jean Dominique Cassini Medal and Honorary Membership**, and the **AIAA** the **James A. Van Allen Space Environments Award**, both for 2014. He received the **Trophy for Lifetime Achievement** by the Smithsonian National Air and Space Museum (NASM) in 2015, the American Astronautical Society (AAS) **Space Flight Award (2016)**, the **NASM Trophy for Current Achievement (New Horizons Team-2016)** and the **NASA Distinguished Public Service Medal**, also in 2016. Also, as member of NASA's **New Horizons** mission he received the **2016 IAA Laurels Award** for Team Achievement. In 2017 he was awarded the **IAA Theodore von Karman Award** (2017), and elected member of **Academia Europaea**, and in 2018 was honored by a special resolution of the **U. S. Senate** "for exceptional contributions to space science".

**Citations:** There are over 23,000 citations (Google Scholar) to the work of S. M. Krimigis. An interview with Thompson-Reuters on recent citations can be found at <http://sciencewatch.com/ana/st/planet/11sepPlanetKrim/>.

### **Specific Contributions to Space Science and Engineering**

**Solar and Interplanetary Physics:** 1) First comprehensive interplanetary diffusion model for the propagation of solar protons (*JGR, 1965*); 2) Discovery of electrons emitted in solar flare events (*JGR, 1965*). 3) First observation of ion acceleration associated with propagating interplanetary shock waves (*JGR, 1970*). 4) Discovery of the variability in elemental composition in solar particle events (*JGR, 1971*). 5) First multi-spacecraft studies of co-rotating solar particle events (*JGR, 1971*); and identification of very long mean-free-paths [ $> 1$  AU] (*JGR, 1973*). 6) Discovery of electron acceleration at interplanetary shocks (*JGR, 1976*). 7) Detection of Voyager's approach to heliosphere's Termination Shock (*Nature, 426, pp. 45-48, 2003*). 8) Crossing of Termination Shock by Voyager-1 in December 2004 (*Science, 2005*) and Voyager-2 in August 2007 (*Nature, 2008*). 9) First image of heliosphere using an energetic neutral atoms (ENA) camera on Cassini (*Science, 2009*)

**Earth's Magnetosphere:** 1) Discovery of trapped Helium nuclei in earth's radiation belts (*JGR, 1966*). 2) Discovery of trapped medium nuclei in earth's radiation belts (*JGR, 1970*). 3) Discovery of magnetospheric bursts of high-energy protons and electrons upstream of earth's bow shock and distant magnetotail (*JGR, 1976*). 4) First injection of an artificial plasma cloud in solar wind to study access of plasma into earth's magnetosphere (AMPTE, *JGR, 1986*).

**Planetary Magnetospheres:** 1) Discovery of hot [ $kT \approx 20-50keV$ ] plasma as principal characteristic in the magnetospheres of Jupiter, Saturn, Uranus, and Neptune (*Science, 1979-1989*). 2) Discovery of energetic neutral atom (ENA) emissions from Jupiter (*GRL, 1981*) and Saturn (*Nature, 1981*) that established the

field of ENA imaging sensors. 3) Characterization of composition and spectra of trapped particles in magnetospheres of Jupiter, Saturn, Uranus, and Neptune (*JGR*, 1981 -1991). 4) Establishment of upper limits to the magnetic moments of Mars (*Science*, 1965) and Venus (*Science*, 1967). 5) First image of Jupiter's magnetosphere through ENA during Cassini's flyby (*Nature*, 415, pp. 994-996, 2002), and discovery of a gaseous torus around the orbit of Europa (*Nature*, 421, 920-922, 2003). 6) Identification and detailed mapping of Saturn's ring current using both in situ and remote (ENA) sensors (*Nature*, 450, 1050-1053, 2007).

**Space Science Instrumentation:** 1) Pioneered use of very thin [ $\approx 25\mu\text{m}$ ] solid-state detectors on Injun-4 and -5 that resulted in the discovery of Helium and medium nuclei in earth's radiation belts (*JGR*, 1966-1970); and even thinner [ $2\text{-}5\mu\text{m}$ ] detectors on Voyagers 1 and 2 that measured the lowest energy Anomalous Cosmic Rays (ACR) in the outer solar system (*XXV ICRC*, Durban, 1997, *Nature*, 2003; *Science*, 2005). 2) Designed low-noise, low-threshold detector systems that resulted in the discovery of hot plasmas in the outer planets magnetospheres [Low Energy Charged Particle Experiment on Voyagers 1 and 2] (*Space Science Reviews*, 1977). 3) Conceived the first Energetic Neutral Atom (ENA) imaging system, obtained funding through NASA's Innovative Instrument Development grants in 1985 and oversaw (with other colleagues) the design (*Space Science Rev*, 2004) that has obtained images of Saturn's magnetosphere on the Cassini spacecraft and of the heliosphere.

**Spacecraft Missions Initiated and Managed:** 1) Conceived and implemented the Active Magnetospheric Particle Tracer Explorers (**AMPTE**) program as Principal Investigator (1979-1989). 2) Spearheaded (with others) the design of the Advanced Composition Explorer (**ACE**), the world's only real-time space weather satellite (1997-present). 3) Advanced the **Discovery** mission line with NASA and won the implementation of the first mission, the Near Earth Asteroid Rendezvous (**NEAR**) to orbit (and then land) on the asteroid Eros (1996-2001). 4) Initiated and organized the team to propose the **MESSENGER** mission to orbit the planet Mercury for the first time (2000-2011). 5) Spearheaded the team that proposed and won the competition for the first mission designed to encounter the planet Pluto (**New Horizons**, launched January 2006) and investigate Kuiper Belt objects. 6) Proposed (with others) initiation of the **Solar Terrestrial Probes**, oversaw the implementation of the first one (**TIMED**) at APL and the initiation of **STEREO**. 7) Led the JHU/APL effort for initiation and implementation of NASA's **Living With a Star** (LWS) program, and the implementation studies of Radiation Belt Storm Probes (**RBSP**, renamed **Van Allen Probes**) and **Parker Solar Probe** missions.

**Publications of Stamatios M Krimigis**  
**(In refereed Journals, book chapters and peer-reviewed Conference**  
**proceedings)**  
**(Updated December 2020)**

**1963**

1. Krimigis, S. M., Solar protons and their geophysical effects, *Proc. Iowa Academy of Science*, 70, 393-402, 1963.

**1965**

2. Krimigis, S. M., Interplanetary diffusion model for the time behavior of intensity in a solar cosmic ray event, *J. Geophys. Res.*, 70, 2943-2960, 1965.
3. Van Allen, J. A., Frank, S. M. Krimigis and H. K. Hills, Absence of Martian radiation belts and implications thereof, *Science*, 149, 1228-1233, 1965.
4. Van Allen, J. A. and S. M. Krimigis, Impulsive emission of ~40 keV electrons from the sun, *J. Geophys. Res.*, 70, 5737-5751, 1965.

**1966**

5. Krimigis, S. M., Interplanetary diffusion and cosmic ray modulation, in *Recent Advances in Cosmic Ray Research*, Gauger and Masley, eds., Western Periodicals Co., North Hollywood, California, 147-170, 1966.
6. Krimigis, S. M. and T. P. Armstrong, Observations of protons in the magnetosphere with Mariner 4, *J. Geophys. Res.*, 71, 4641-4650, 1966.
7. Krimigis, S. M. and J. A. Allen, Observations of ~500 keV protons in interplanetary space with Mariner IV, *Phys. Rev. Lett.*, 16, 419-423, 1966.

**1967**

8. Krimigis, S. M. and J. A. Van Allen, Geomagnetically trapped alpha particles, *J. Geophys. Res.*, 72, 5779-5797, 1967.
9. Krimigis, S. M. and J. A. Van Allen, Observations of the February 5-12, 1965, solar particle event with Mariner 4 and Injun 4, *J. Geophys. Res.*, 72, 4471-4486, 1967.
10. Krimigis, S. M., J. A. Van Allen and T. P. Armstrong, Simultaneous observations of solar protons inside and outside the magnetosphere, *Phys. Rev. Lett.*, 18, 1204-1207, 1967.

11. Van Allen, J. A., S. M. Krimigis, L. A. Frank and T. P. Armstrong, An upper limit on the intrinsic magnetic dipole moment of Venus based on the absence of a Venusian radiation belt, *Science*, 158, 1673-1675, 1967.

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12. Armstrong, T. P. and S. M. Krimigis, Observations of protons in the magnetosphere and magnetotail with Explorer 33, *J. Geophys. Res.*, 73, 143-152, 1968.
13. Krimigis, S. M., Cosmic-ray observations in 1964-65 with Mariner IV, Proc. 10<sup>th</sup> International Cosmic Ray Conference, *Canadian J. Phys.*, 46, S976-S980, 1968.
14. Krimigis, S. M., Observations of low energy (~0.5 MeV) trapped protons with Injun IV, *Earth's Particles and Fields*, Reinhold Book Corp., New York, B. McCormac, ed., 89-101, 1968.
15. Krimigis, S. M. and J. A. Van Allen, Distribution and energy spectrum of alpha particles in the radiation zones, *Earth's Particles and Fields*, Reinhold Book Corp., New York, B. McCormac, ed., 127-140, 1968.
16. Van Allen, J. A., S. M. Krimigis, L. A. Frank and T. P. Armstrong, Observed absence of energetic electrons and protons near Venus, *J. Geophys. Res.*, 73, 421-425, 1968.

#### 1969

17. Armstrong, T. P., S. M. Krimigis and J. A. Van Allen, Observations of the solar particle event of 7 July 1966 with University of Iowa detectors, *Annals of the IQSY*, 3, 313-328, 1969.
18. Fritz, T. A. and S. M. Krimigis, Initial observations of geomagnetically trapped protons and alpha particles with OGO-4, *J. Geophys. Res.*, 74, 5132-5138, 1969.
19. Krimigis, S. M., Observations of low energy solar protons with Mariners 4 and 5, Trudi Mezhdunarodnovo Seminara, *Proc. of the Ioffe Physico-Technical Institute*, Academy of Sciences of the USSR, G. E. Kocharov, ed., Leningrad, 43-86, 1969.
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21. Krimigis, S. M. and D. Venkatesan, The radial gradient of interplanetary radiation measured by Mariners 4 and 5, *J. Geophys. Res.*, 74, 4129-4145, 1969.
22. Krimigis, S. M., J. A. Van Allen and T. P. Armstrong, Solar particle observations inside the magnetosphere during the 7 July 1966 proton flare event, *Annals of the IQSY*, 3, 395-407, 1969.

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23. Armstrong, T. P., S. M. Krimigis and K. W. Behannon, Proton fluxes at 300 keV associated with propagating interplanetary shock waves, *J. Geophys. Res.*, 75, 5980-5988, 1970.
24. Krimigis, S. M., Alpha particles trapped in the Earth's magnetic field, *Earth's Particles and Fields*, D. Reidel Publishing Co., Dordrecht-Holland, B. McCormac, ed., 364-379, 1970.
25. Krimigis, S. M., The radial gradient of 0.3 MeV protons in inter-planetary space, measured with Mariner 5, Proc. 11<sup>th</sup> International Cosmic Ray Conference, *Acta Physica Academiae Scientiarum Hungaricae*, 29, Suppl. 2, 125-132, 1970.

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27. Krimigis, S. M., P. Verzariu, J. A. Van Allen, T. P. Armstrong, T. A. Fritz and B. A. Randall, Trapped energetic nuclei  $Z \geq 3$  in the Earth's outer radiation zone, *J. Geophys. Res.*, 75, 4210-4215, 1970.
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### 1971

29. Armstrong, T. P. and S. M. Krimigis, Statistical study of solar protons, alpha particles and  $Z \geq 3$  nuclei in 1967-1968, *J. Geophys. Res.*, 76, 4230-4244, 1971.
30. Gleeson, L. J., S. M. Krimigis and W. I. Axford, Low-energy cosmic rays near Earth, *J. Geophys. Res.*, 76, 2228-2235, 1971.
31. Krimigis, S. M., Energetic particles, in *The Outer Solar System, Advances in the Astronautical Sciences, Vol. 29I*, J. Vagners, ed., 529-542, 1971.
32. Krimigis, S. M. and P. Verzariu, Implications on particle storage at the sun from observations of solar-flare proton spectrums, *J. Geophys. Res.*, 76, 792-807, 1971.
33. Krimigis, S. M., E. C. Roelof, T. P. Armstrong and J. A. Van Allen, Low-energy ( $\geq 0.3$  MeV) solar particle observations at widely separated points ( $> 0.1$  AU) during 1967, *J. Geophys. Res.*, 76, 5921-5946, 1971.
34. Krimigis, S. M., P. Verzariu, D. Venkatesan and B. A. Randall, Redistribution of trapped protons following the 8 March 1970 magnetic storm, Report UAG-12, Part I, *World Data Center A*, 156-159, 1971.
35. Venkatesan, D. and S. M. Krimigis, Observations of low-energy (0.3 to 1.8 MeV) differential spectrums of trapped protons, *J. Geophys. Res.*, 76, 7618-7631, 1971.

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44. Krimigis, S. M. and P. Verzariu, Measurements of geomagnetically trapped alpha particles, 1968-1970: 1. Quiet time distributions, *J. Geophys. Res.*, 78, 7275-7285, 1973.
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48. Armstrong, T. P. and S. M. Krimigis, Variations in the charge composition of the July 2-12, 1974 solar particle event, *Proc. 14<sup>th</sup> International Cosmic Ray Conference*, 5, 1592-1596, 1975.
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51. Krimigis, S. M., J. W. Kohl and T. P. Armstrong, The magnetosphere contribution to the quiet-time low energy nucleon spectrum in the vicinity of Earth, *Geophys. Res. Lett.*, 2, 457-460, 1975.
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53. Krimigis, S. M., E. T. Sarris and T. P. Armstrong, Observations of Jovian electron events in the vicinity of Earth, *Geophys. Res. Lett.*, 2, 561-564, 1975.
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