

September 1, 2006

## CURRICULUM VITAE

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Name: **DAVID LARIO**  
Present address: Applied Physics Laboratory  
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### ACADEMIC RECORD

- **Graduated in Physics.** University of Barcelona (1991).
- **Master Degree in Physics (Astrophysics).** University of Barcelona (1993).  
**Title:** “Evolution and Modeling of Particle Events Associated with Interplanetary Shocks up to 1 AU”.
- **Ph. D. in Physics.** University of Barcelona (1997).  
**Thesis:** “Propagation of Low-Energy Particles through the Interplanetary Medium: Modeling the Influence of the Parent Interplanetary Shock”. Supervisors: Dr. Blai Sanahuja & Dr. Ana M. Heras.  
Qualification: *Cum Laude* with distinction.
- **Research Accreditation.** Agència per la Qualitat del Sistema Universitari (AQU Catalunya) (2004).

### AWARDS AND PRIZES

- **Degree award** with special distinction. University of Barcelona (1993-1994).
- **Extraordinary Ph. D. Prize.** University of Barcelona (1997-1998).
- **F.L. Scarf Award.** American Geophysical Union for the Ph.D. dissertation presenting the most impact on the field of Space Physics and Aeronomy (1999).
- Finalist of the **III Doctoral Council Award** of the University of Barcelona (1999).

**RESEARCH SPECIALTY** (UNESCO codes): 210203, 210201, 210603, 210602

### PROFESSIONAL EXPERIENCE

- **Senior Staff Scientist. Johns Hopkins University. Applied Physics Laboratory**  
October 2001-present  
Advanced studies on particle physics in interplanetary space.  
Analysis, interpretation, and modeling of data from the ACE, IMP-8, Cassini, Ulysses, Helios-1 and -2, Voyager-1 and -2 spacecraft.

- **Research Fellow. Johns Hopkins University. Applied Physics Laboratory**  
January 2000-October 2001  
Advanced studies on particle physics in interplanetary space.  
Analysis and interpretation of data from the ACE, IMP-8 and Ulysses spacecraft
- **Research Fellow. European Space Agency (ESA). Space Science Department**  
November 1997-November 1999  
Advanced studies on particle physics in interplanetary space.  
Analysis and interpretation of data from the WIND and Ulysses spacecraft
- **Research Assistant. University of Barcelona. Department of Astronomy and Meteorology**  
October 1991-October 1997  
Advanced studies on particle events associated with interplanetary shocks.
- **Teaching Assistant. University of Barcelona. Department of Applied Mathematics and Analysis**  
October 1991-February 1995
  - Numerical Calculus.
  - Introduction to Informatics, Numerical Calculus and Statistics.
  - Numerical Methods.
  - Computer Science.
- **Teaching Experience. University of Barcelona. Department of Astronomy and Meteorology**  
February 1995-October 1997
  - Programming and Numerical Techniques.

## FELLOWSHIPS

- Postdoctoral Fellowship at the Johns Hopkins University Applied Physics Laboratory. January 2000-September 2001
- Postdoctoral grant from the Internal ESA (European Space Agency) Research Fellowship Program. November 1997-November 1999
- Postgraduate grant by the CIRIT (Generalitat de Catalunya) on research training. February 1995-November 1997

## SCHOLARSHIPS

- Scholarship from the CIRIT (Generalitat de Catalunya) to work in the Space Science Department of ESA (1 month) November 1992.
- Scholarship from the CIRIT (Generalitat de Catalunya) to work in the Space Environment Laboratory of NOAA (National Oceanic and Atmospheric Administration, USA) (1 month) November 1993.

- Scholarship from the CIRIT (Generalitat de Catalunya) to work in the Astronomical Institute of Prague (Academy of Sciences of the Czech Republic) (1 month) November 1996.

## SPACE RESEARCH PROJECTS

- Project Title: A Comprehensive Survey of Energetic Ion Acceleration at Near-Earth by Interplanetary Shocks.  
Sponsoring Agency: NASA/HQ (NRA 02-OSS-02-RL)  
Reference: NNG04GA84G  
Sponsor Point-of-Contact: Dr. Eric Christian, NASA/HQ  
P.I.: Dr. G.C. Ho (Johns Hopkins University/APL)  
Period of Performance and Budget: January 2004–December 2006 → \$302,000.00
- Project Title: Energetic Particle Acceleration at CME-driven shocks  
Sponsoring Agency: NASA/HQ (LWS/DATM Program)  
Reference: NAG5-13487  
Sponsor Point-of-Contact: Dr. D. Sibeck, NASA/HQ  
P.I.: **Dr. D. Lario** (Johns Hopkins University/APL)  
Period of Performance and Budget: May 2003–May 2006 → \$329,835.00
- Project Title: Solar Energetic Particle Events in the Inner Heliosphere and Deep Space: A model for Forecasting Proton Fluxes and Anisotropies.  
Sponsoring Agency: NASA/HQ (LWS/DATM Program)  
Reference: NAG5-10787  
Sponsor Point-of-Contact: Dr. William J. Wagner, NASA/HQ  
P.I.: **Dr. D. Lario** (Johns Hopkins University/APL)  
Period of Performance and Budget: April 2001–April 2004 → \$255,086.00
- Project Title: An Engineering Model for Solar Energetic Particles in Interplanetary Space.  
Sponsoring Agency: European Space Agency (ESA)  
Reference: ESA 14098/99/NL/MM (+2 extensions /99/NL/MM/II, /99/NL/MM/III)  
Sponsor Point-of-Contact: Dr. Eamon J. Daly, ESA/TOS-EMA  
P.I.: Dr. B. Sanahuja (University of Barcelona).  
Period of Performance and Budget: February 2000–February 2001 → 30,000.00 Euros  
July 2001 – July 2002 → 30,000.00 Euros  
January 2003–September 2003 → 14,000.00 Euros
- Project Title: Interplanetary Shock Prediction Using Real Time Energetic Particle Observations.  
Sponsoring Agency: NASA/HQ (LWS/DATM Program)  
Reference: NAG5-10836  
Sponsor Point-of-Contact: Dr. William J. Wagner, NASA/HQ  
P.I.: Dr. G.C. Ho (Johns Hopkins University/APL)  
Period of Performance and Budget: April 2001–April 2002 → \$80,564.00

## ASTROPHYSICAL PROJECTS

- Project Title: Supercomputació i infraestructura de Recerca.  
Sponsoring Agency: DGU, Generalitat de Catalunya.  
Program: Grups de Qualitat.  
Reference: 1993SGR01093  
P.I.: Dr. R. Canal (University of Barcelona).  
Period of Performance and Budget: Through 1994 → 48,081.00 Euros
- Project Title: Galaxias en grandes estructuras. Formación, evolución y efecto lente gravitatoria.  
Sponsoring Agency: DGCYT, Spanish Ministerio de Educación y Ciencia.  
Program: Promoción General del conocimiento.  
Reference: PB93-0821-C02  
P.I.: Dr. B. Sanahuja (University of Barcelona).  
Period of Performance and Budget: June 1994–July 1997 → 54,512.00 Euros
- Project Title: Suport a la Recerca.  
Sponsoring Agency: DGU, Generalitat de Catalunya.  
Program: Grups de Qualitat.  
Reference: 1995SGR00569  
P.I.: Dr. B. Sanahuja (University of Barcelona).  
Period of Performance and Budget: January 1996–January 1997 → 48,081.00 Euros
- Project Title: Suport a la Recerca.  
Sponsoring Agency: DGU, Generalitat de Catalunya.  
Program: Infraestructura de recerca.  
Reference: 1995PIRA00201  
P.I.: Dr. B. Sanahuja (University of Barcelona).  
Period of Performance and Budget: January 1996–January 1997 → 24,040.00 Euros
- Project Title: Formación y evolución de galaxias y sus agrupamientos.  
Sponsoring Agency: DGCYT, Spanish Ministerio de Educación y Ciencia.  
Program: Promoción General del conocimiento.  
Reference: PB96-0173  
P.I.: Dr. E. Salvador (University of Barcelona).  
Period of Performance and Budget: July 1997–July 2000 → 26,445.00 Euros
- Project Title: Propagació pel camp magnètic interplanetari de partícules accelerades en xocs MHD generats per l'activitat solar.  
Sponsoring Agency: Centre de Supercomputació de Catalunya (CESCA). Fundació Catalana per la Recerca (FCR). University of Barcelona (UB).  
Program: Supercomputational Research Projects  
P.I.: Dr. B. Sanahuja (University of Barcelona).  
Period of Performance and Budget: Through 1993–1997 → ~2,400.00 Euros

## GRADUATE RESEARCH SUPERVISION

- Co-director of two PhD dissertations at the University of Barcelona (in progress):
  - "Generation of energetic particle fluxes associated with interplanetary shocks" by Àngels Aran Sensat.
  - "Energetic particle propagation in the downstream region of interplanetary shocks" (provisional title) by Neus Àgueda Costafreda.
- Co-director of a Master Research Work (former "tesina"):
  - "Síntesi de perfils de flux d'esdeveniments SEP" by Àngels Aran Sensat (University of Barcelona, September 2000).

## PROFESSIONAL AFFILIATIONS

- Sociedad Española de Astronomía (Spanish Astronomical Society) since 1995.
- American Geophysical Union (AGU) since 1998.

## PEER REVIEWING OF SCIENTIFIC PAPERS AND PROJECTS

Advances in Space Research. (October 2004).  
The Astrophysical Journal. (December 2003; July 2006).  
Geophysical Research Letters. (April-May 1999; March 2002; March 2004).  
Journal of Geophysical Research. (July 2000; December 2002; February 2005).  
Annales Geophysicae. (February 2003).  
Space Science Reviews. (November 2000).  
Proceedings of SOHO-ACE Workshop. (June 2001).  
NASA, NRA 00-OSS-1, Living With a Star Program. (November 2000).  
NASA, NRA 01-OSS-1, Guest Investigator Program. (July 2001).  
NASA, NRA 01-OSS-1, Solar & Heliospheric Physics Program. (April 2002).  
NASA, NRA 02-OSS-01, Living With a Star Program. (November 2002).  
NASA, NRA 03-OSS-01, Solar & Heliospheric Physics Program. (March 2004).  
NASA, NRA NNH05ZDA001N A.21, Living With a Star Program. (October 2005).  
NASA, NRA NNH05ZDA001N A.16, Heliospheric Physics Program. (March 2006).  
NSF, NSF 03-500, ATM-Solar-Terrestrial Program. (March 2003).  
NSF, NSF 05-508, ATM-Solar-Terrestrial Program. (March 2005).  
NSF, NSF 04-585, ATM-Solar-Terrestrial Program. (September 2005, 2006).

## SKILLS

Extensive experience in numerical calculations and computer programming.  
Computer Languages (FORTRAN 95, C, IDL, html)  
Operating Systems (UNIX, Linux, Windows, VMS)  
Text Processors ( $\text{T}_{\text{E}}\text{X}$ ,  $\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$ , Word)

Handling large databases (NSSDC, OMNI).

Foreign Languages (Fluent in English, Catalan, French and Spanish).

## PUBLICATIONS

### Books

- *Heliospheric energetic particle variations*. Authors: **D. Lario**, M. Pick. Chapter in the book "The Heliosphere through the solar cycle: Ulysses" edited by A. Balogh et al., Springer-Praxis, submitted (2006).
- *Radial evolution of the energetic particle response to ICMEs beyond 1 AU*. Authors: **D. Lario**. Invited paper to appear in the Geophysical Monograph No. 165 of the American Geophysical Union entitled "Solar Eruptions and Energetic Particles" edited by N. Gopalswamy et al., in press (2005).
- *Solar energetic particle variations*. Authors: **D. Lario**, G.M. Simnett. Chapter in the Geophysical Monograph No. 141 of the American Geophysical Union entitled "Solar Variability and its Effects on Climate" edited by J. Pap and P. Fox, 195-216 (2004).

### Refereed journal articles

- *Influence of large-scale interplanetary structures on energetic particle propagation: The September 2004 event at Ulysses and ACE*. Authors: **D. Lario**, R.B. Decker, O.E. Malandraki, to be submitted to *Journal of Geophysical Research*, (2006).
- *The variability of low-energy ion flux profiles on interplanetary shock fronts*. Authors: M. Neugebauer, J. Giacalone, E. Chollet, **D. Lario**. *Journal of Geophysical Research*, submitted, doi:10.1029/2006JA011832 (2006).
- *Radial and longitudinal dependence of solar 4-13 MeV and 27-37 MeV proton peak intensities and fluences: Helios and IMP-8 observations*. Authors: **D. Lario**, M.-B. Kallenrode, R.B. Decker, E.C. Roelof, S.M. Krimigis, A. Aran, B. Sanahuja. *Astrophysical Journal*, in press, (2006).
- *Particle acceleration at perpendicular shock waves*. Authors: G.P. Zank, G. Li, V. Florinski, Q. Hu, **D. Lario**, C. W. Smith. *Journal of Geophysical Research*, 111, A06108, doi:10.1029/2005JA011524 (2006).
- *CMEs and energetic particles*. Authors: H.V. Cane, **D. Lario**. *Space Sci. Rev.*, in press (2006).
- *Energetic particle observations. Report of Working Group C*. Authors: B. Klecker, and 15 co-authors with **D. Lario** among them. *Space Sci. Rev.*, in press (2006).
- *ICMEs at high latitudes and in the outer heliosphere. Report of Working Group H*. Authors: P. R. Gazis, and 16 co-authors with **D. Lario** among them. *Space Sci. Rev.*, in press (2006).
- *SOLPENCO: A Solar Particle ENgineering COde*. Authors: A. Aran, B. Sanahuja, **D. Lario**. *Adv. Space Res.*, 37, 1240-1246 (2006).
- *Fluxes and fluences of SEP events derived from SOLPENCO*. Authors: A. Aran, B. Sanahuja, **D. Lario**. *Annales Geophysicae*, 23, 3047-3053 (2005).

- *Key links in space weather: Forecasting solar-generated shocks and proton acceleration.* Authors: C.D. Fry, M. Dryer, W. Sun, C.S. Deehr, Z. Smith, T.R. Detman, A. Aran, **D. Lario**, B. Sanahuja, S.-I. Akasofu, *American Institute of Aeronautics and Astronautics (AIAA) Journal*, 43(5), 987-993 (2005).
- *Modeling the effects of the pitch-angle scattering processes on the transport of solar energetic particles along the interplanetary magnetic field.* Authors: N. Agueda, **D. Lario**, E. C. Roelof, B. Sanahuja. *Adv. Space Res.*, 35, 579-585 (2005).
- *A first step towards proton flux forecasting.* Authors: A. Aran, B. Sanahuja, **D. Lario**. *Adv. Space Res.*, 36, 2333-2338 (2005).
- *Heliospheric energetic particle observations during the October-November 2003 events.* Authors: **D. Lario**, R. B. Decker, S. Livi, S. M. Krimigis, E. C. Roelof, C. T. Russell, C. D. Fry. *Journal of Geophysical Research*, 110, A09S11, doi:10.1029/2004JA010940 (2005).
- *October/November 2003 ICMEs: ACE/EPAM solar energetic particle observations.* Authors: O. E. Malandraki, **D. Lario**, L. J. Lanzerotti, E. T. Sarris, A. Geranios, G. Tsiropoula. *Journal of Geophysical Research*, 110, A09S06, doi:10.1029/2004JA010926 (2005).
- *Advances in modeling gradual solar energetic particle events.* Authors: **D. Lario**. *Adv. Space Research*, 36, 2279-2288 (2005).
- *Predictions of Energetic Particle Radiation in the close Martian Environment.* Authors: McKenna-Lawlor, M. Dryer, C. D. Fry, W. Sun, **D. Lario**, C. S. Deehr, B. Sanahuja, V. A. Afonin, M. I. Verigin, G. A. Kotova, *Journal of Geophysical Research*, 110(A3), A03102, doi:10.1029/2004JA010587 (2005).
- *Heliospheric energetic particle observations by the Cassini spacecraft: Correlation with 1 AU observations.* Authors: **D. Lario**, S. Livi, E. C. Roelof, R.B. Decker, S.M. Krimigis, M.K. Dougherty. *Journal of Geophysical Research*, 109, A09S02, doi:10.1029/2003JA010107 (2004).
- *Low-energy particle response to CMEs during the Ulysses solar maximum northern polar passage.* Authors: **D. Lario**, R.B. Decker, E.C. Roelof, D.B. Reisenfeld, T.R. Sanderson. *Journal of Geophysical Research*, 109, A01107, doi:10.1029/2003JA010071 (2004).
- *Energetic H/He intensity ratio under solar maximum and solar minimum conditions: Ulysses observations.* Authors: **D. Lario**, E.C. Roelof, R. B. Decker, G.C. Ho, C.G. MacLennan, J.T. Gosling. *Adv. Space Research*, 32 (4), 585-590 (2003).
- *Onset Study for Impulsive Solar Energetic Particle Events.* Authors: G.C. Ho, E.C. Roelof, G.M. Mason, **D. Lario**, J.E. Mazur, *Adv. Space Research*, 32 (12), 2679-2684 (2003).
- *Solar maximum low-energy particle observations at heliographic latitudes above 75°.* Authors: **D. Lario**, E.C. Roelof, R. B. Decker, D.B. Reisenfeld. *Adv. Space Research*, 32 (4), 579-584 (2003).

- *Solar cycle variations of the energetic H/He intensity ratio at high heliolatitudes and in the ecliptic plane.* Authors: **D. Lario**, E.C. Roelof, R. B. Decker, G.C. Ho, C.G. MacLennan, J.T. Gosling. *Annales Geophysicae*, *21*, 1229-1243 (2003).
- *Using an MHD simulation to interpret the global context of a coronal mass ejection observed by two spacecraft.* Authors: P. Riley, J.A. Linker, Z. Mikic, D. Odstrcil, T.H. Zurbuchen, **D. Lario**, R.P. Lepping. *Journal of Geophysical Research*, *108*(A7), 1272-1282, 10.1029/2002JA009760 (2003).
- *The energetic storm particle event of October 20, 1989.* Authors: **D. Lario**, R.B. Decker. *Geophysical Research Letters*, *29*(10), 1393-1396, 10.1029/2001GL014017 (2002).
- *Joint Ulysses and ACE observations of a magnetic cloud and the associated solar energetic particle event.* Authors: **D. Lario**, D.K. Haggerty, E.C. Roelof, S.J. Tappin, R.J. Forsyth, J.T. Gosling. *Space Science Reviews*, *97*, 277-280 (2001).
- *26-day Analysis of energetic ion observations at high and low heliolatitudes: Ulysses and ACE.* Authors: **D. Lario**, E.C. Roelof, R.J. Forsyth, J.T. Gosling. *Space Science Reviews*, *97*, 249-252 (2001).
- *Comparison of >40 keV Electron Events at High and Low Heliolatitudes: Ulysses/HI-SCALE and ACE/EPAM.* Authors: S.E. Hawkins III, E.C. Roelof, R.B. Decker, G.C. Ho, **D. Lario**. *Space Science Reviews*, *97*, 269-272 (2001).
- *Energetic Proton Observations at 1 and 5 AU I: January-September 1997.* Authors: **D. Lario**, R.G. Marsden, T.R. Sanderson, M. Maksimovic, B. Sanahuja, A. Balogh, R.J. Forsyth, R.P. Lin, J.T. Gosling. *Journal of Geophysical Research*, *105*, 18235-18250 (2000).
- *Energetic Proton Observations at 1 and 5 AU II: Rising Phase of the Solar Cycle 23.* Authors: **D. Lario**, R.G. Marsden, T.R. Sanderson, M. Maksimovic, B. Sanahuja, S.P. Plunkett, A. Balogh, R.J. Forsyth, R.P. Lin, J.T. Gosling. *Journal of Geophysical Research*, *105*, 18251-18274 (2000).
- *Current sheet control of recurrent particle increases at 4-5 AU.* Authors: T.R. Sanderson, **D. Lario**, M. Maksimovic, R.G. Marsden, C. Tranquille, A. Balogh, R.J. Forsyth, B.E. Goldstein. *Geophysical Research Letters*, *26*, 1785-1788 (1999).
- *Energy Spectra of 50-keV to 20-MeV Protons Accelerated at Corotating Interaction Regions at Ulysses.* Authors: M.I. Desai, R.G. Marsden, T.R. Sanderson, **D. Lario**, E.C. Roelof, G.M. Simnett, A. Balogh, R.J. Forsyth, J.T. Gosling. *Journal of Geophysical Research*, *104*, 6705-6719 (1999).
- *Ulysses and WIND particle observations of the November 1997 Solar Events.* Authors: **D. Lario**, R.G. Marsden, T.R. Sanderson, M. Maksimovic, A. Balogh, R.J. Forsyth, R.P. Lin, J.T. Gosling. *Geophysical Research Letters*, *25*, 3469-3472 (1998).
- *Energetic particle events: efficiency of interplanetary shocks as 50 keV <math>E</math> <math>< 100</math> MeV-proton accelerators.* Authors: **D. Lario**, B. Sanahuja, A.M. Heras. *Astrophysical Journal*, *509*, 415-434 (1998).

- *Modeling the interplanetary propagation of 0.1-20 MeV shock-accelerated protons I: effects of the adiabatic deceleration and solar wind convection at low-energy.* Authors: **D. Lario**, B. Sanahuja, A.M. Heras. *Adv. Space Research*, 20, 115-120 (1997).
- *Modeling the interplanetary propagation of 0.1-20 MeV shock-accelerated protons II: evolution of the injection rate of shock-accelerated particles in long-lasting ESP events.* Authors: **D. Lario**, B. Sanahuja, A.M. Heras. *Adv. Space Research*, 20, 121-126 (1997).
- *Three Low-Energy Particle Events: Modeling the Influence of the Parent Interplanetary Shock.* Authors: A.M. Heras, B. Sanahuja, **D. Lario**, Z.K. Smith, T. Detman, M. Dryer. *Astrophysical Journal*, 445, 497-508 (1995).
- *Energy Spectrum of Low-Energy Fluxes of Particles Accelerated by Interplanetary Shocks.* Authors: **D. Lario**, B. Sanahuja, A.M. Heras. *Adv. Space Research*, Vol. 15, No. 8/9, pp. 389-392 (1995).
- *Energy Spectrum of shock-accelerated particles .* Authors: B. Sanahuja, A.M. Heras, **D. Lario**. *J. Geomag. and Geoelec.*, 47, 1121-1126 (1995).

#### Published Refereed Proceedings

- *Solar energetic particles, Commission 49: Interplanetary Plasma and Heliosphere,* Authors: **D. Lario**. *Reports on Astronomy 2002-2005, IAU Trans. XXVIA*, O. Engvold (Ed.), International Astronomical Union, in press (2006).
- *Modeling of solar energetic particles in interplanetary space.* Authors: R. Vainio, N. Agueda, A. Aran, **D. Lario**. *Proc. 2nd European Space Weather Week*, in press (2006).
- *The energetic storm particle event on 2003 October 24: A test of diffusive shock acceleration theory.* Authors: **D. Lario**, R. B. Decker, G.C. Ho, Q. Hu, C. W. Smith, M. I. Desai, A.-F. Vinas. *The Physics of Collisionless Shocks, Proc. 4th Annual IGPP Int. Astrophys. Conf., AIP Conf. Proc. 781 (G. Li, et al., Eds.)* 180-184 (2005).
- *Multi-spacecraft observations of interplanetary shocks accelerated particle events.* Authors: G.C. Ho, **D. Lario**, R.B. Decker, M.I. Desai, Q. Hu, J. Kasper, A.-F. Vinas. *Connecting Sun and Heliosphere, Proc. of the Conf. Solar Wind 11- SOHO 16, ESA SP-592*, 421-424 (2005).
- *Statistical properties of fast forward transient interplanetary shocks and associated energetic particle events: ACE observations.* Authors: **D. Lario**, Q. Hu, G.C. Ho, R.B. Decker, E.C. Roelof, C. W. Smith. *Connecting Sun and Heliosphere, Proc. of the Conf. Solar Wind 11- SOHO 16, ESA SP-592*, 81-86 (2005).
- *Energetic particle tracing of interplanetary CMEs: Ulysses/HI-SCALE and ACE/EPAM results.* Authors: O. E. Malandraki, **D. Lario**, T. E. Sarris, N. Tsaggas, E. T. Sarris. *Coronal and Stellar Mass Ejections, Proc. IAU Symposium No. 226 (K.P. Dere et al., Eds.), Cambridge Univ. Press*, 361-366 (2005).
- *ACE observations of energetic particles associated with transient interplanetary shocks.* Authors: **D. Lario**, G.C. Ho, R.B. Decker, E.C. Roelof, M.I. Desai, C.W. Smith. *Proc. Tenth International Solar Wind Conference, AIP Conference Proceedings, 679*, 640-643 (2003).

- *Composition Variations in Large Solar Energetic Particle Events*. Authors: G.C. Ho, E.C. Roelof, G.M. Mason, **D. Lario**, R.E. Gold, J.R. Dwyer, J.E. Mazur, *Proc. Tenth International Solar Wind Conference, AIP Conference Proceedings, 679*, 624-627 (2003).
- *High-latitude Ulysses observations of the H/He intensity ratio under solar minimum and solar maximum conditions*. Authors: **D. Lario**, C.G. MacLennan, E.C. Roelof, J.T. Gosling, G.C. Ho, S.E. Hawkins III. In *Solar and Galactic Composition: A joint SOHO/ACE Workshop, AIP Conference Proceedings, 598*, 183-188 (2001).
- *Energetic particle population in the downstream region of transient interplanetary shocks*. Authors: **D. Lario**, M. Vandas, B. Sanahuja. *Proc. Ninth International Solar Wind Conference, AIP Conference Proceedings, 471*, 741-744 (1999).
- *On the evolution of energetic particle fluxes at 5 AU during the rising phase of solar cycle 23: Ulysses/LET observations*. Authors: R. Marsden, **D. Lario**, T.R. Sanderson, M. Maksimovic, R.J. Forsyth. *Proc. Ninth International Solar Wind Conference, AIP Conference Proceedings, 609-612* (1999).

### Published Proceedings

- *Interplanetary coronal mass ejections during the October/November 2003 events: ACE/EPAM solar energetic particle observations*. Authors: O. Malandraki, **D. Lario**, L.J. Lanzerotti, E.T. Sarris, A. Geranios. *Proc. 29th Int. Cosmic Ray Conf., 1*, 269-272 (2005).
- *Energetic particle observations by the Cassini spacecraft during its heliospheric cruise to Saturn*. Authors: **D. Lario**, S. Livi, R.B. Decker, E.C. Roelof, S.M. Krimigis, M.K. Dougherty. *Proc. 28th Int. Cosmic Ray Conf.*, 3543-3546 (2003).
- *Energetic electrons associated with transient interplanetary shocks*. Authors: G.C. Ho, **D. Lario**, R.B. Decker, E.C. Roelof, M.I. Desai, C.W. Smith. *Proc. 28th Int. Cosmic Ray Conf.*, 3689-3692 (2003).
- *Energetic particle intensity increases at Voyagers 1 and 2 during 2002-03*. Authors: S.M. Krimigis, R.B. Decker, E.C. Roelof, **D. Lario**. *Proc. 28th Int. Cosmic Ray Conf.*, 3769-3772 (2003).
- *Potential Application of an Operational Code for Proton Flux Prediction. First Approach*. Authors: A. Aran, B. Sanahuja, **D. Lario**, V. Domingo. *ESA Space Weather Workshop: Looking Towards a Future European Space Weather Programme., ESA WPP-194* ([www.estec.esa.nl/wmwww/wma/spweather/workshops/SPW-W3/](http://www.estec.esa.nl/wmwww/wma/spweather/workshops/SPW-W3/)) (2003).
- *Re-examination of the October 20, 1989 ESP event*. Authors: **D. Lario**, R.B. Decker. *Proc. 27th Int. Cosmic Ray Conf.*, 3485-3488 (2001).
- *Major solar proton events observed by IMP-8 (from November 1973 to May 2001)*. Authors: **D. Lario**, R.B. Decker, T.P. Armstrong, *Proc. 27th Int. Cosmic Ray Conf.*, 3254-3257 (2001).
- *How to get SEP flux profiles at 0.4 and 1.0 AU*. Authors: A. Aran, B. Sanahuja, **D. Lario**, *Solar Encounter: The First Solar Orbiter Workshop. ESA SP-493*, 157-160 (2001).

- *Gradual Solar Energetic Particle Events in Space Weather*. Authors: B. Sanahuja, **D. Lario**, A. Aran. *Highlights of Spanish Astrophysics II, ASSL series. Kluwer Academic Publishers* 257-260 (2001).
- *Solar Energetic Particle Events in the Rising Phase of the Solar Cycle 23: Observations at 1 and 5 AU*. Authors: **D. Lario**, R.G. Marsden, T.R. Sanderson, M. Maksimovic, A. Balogh, R.J. Forsyth, R.P. Lin, J.T. Gosling. *Proc. 26th Int. Cosmic Ray Conf.*, 6, 540-543 (1999).
- *A tool to model solar energetic particle events*. Authors: **D. Lario**, B. Sanahuja, A.M. Heras. *Proc. ESA Workshop on Space Weather.*, ESA WPP-155, 343-346 (1999).
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### Nonrefereed articles

- *Solar energetic particles: Multiple injections of particles from CMEs produce elevated minimum fluxes at 5 AU* Authors: **D. Lario**. *Ulysses high-light of the Month, helio2.estec.esa.int/ulysses/* (October, 2000).
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## Reports of space projects

- *An engineering model for solar energetic particles in interplanetary space.* Authors: A. Aran, B. Sanahuja, **D. Lario**. *Final report of ESA Contract 14098/99/NL/NM.* ESA/ESTEC (December, 2003). {[www.am.ub.es/~blai](http://www.am.ub.es/~blai)}

## LECTURES AND PRESENTATIONS ([O]=oral, [P]=poster)

- *Energetic particle environment in the innermost part of the heliosphere.* American Geophysical Union 2006 Fall Meeting (December, 2006) [**O-invited**]
- *The role of interplanetary shock surface fluctuations in shaping energetic storm particle events: Progress report on NASA LWS grant NAG5-13487.* American Geophysical Union 2006 Fall Meeting (December, 2006) [P]
- *Charged energetic particles in the innermost part of the heliosphere: Unsolved problems.* The 2<sup>nd</sup> Solar Orbiter Workshop (October, 2006) [**O-invited**] {[conferences.phys.uoa.gr/solo2006/](http://conferences.phys.uoa.gr/solo2006/)}
- *Heliospheric energetic particle variability over the solar cycle.* VII Reunión Científica de la Sociedad Española de Astronomía (SEA) (September, 2006) [**O-invited**] {[sea.am.ub.es/reunion/](http://sea.am.ub.es/reunion/)}
- *Helios and IMP-8 observations: Radial and longitudinal dependence of solar 4-13 MeV and 27-37 MeV proton fluxes and fluences.* 36th COSPAR Scientific Assembly (July, 2006) (by A. Aran) [O] {COSPAR2006-A-02607, D2.4-0009-06}
- *Comparing proton fluxes and fluences of SEP events with those predicted by SOLPENCO.* 36th COSPAR Scientific Assembly (July, 2006) (by A. Aran) [P] {COSPAR2006-A-01345, PSW1-0061-06}
- *Multi-spacecraft observations of interplanetary shock accelerated particle events.* 36th COSPAR Scientific Assembly (July, 2006) (by G.C. Ho) [O] {COSPAR2006-A-02070, D2.4-0016-06}
- *Radial and longitudinal dependence of solar 4-13 MeV and 27-37 MeV proton fluxes and fluences: Helios and IMP-8 observations.* American Geophysical Union 2005 Spring Meeting, SH44A-05 (May, 2006) [O] {EOS Trans. AGU, Vol. 87, No. 36, Jt. Assem. Suppl., Abstract SH44A-05}
- *Particle Acceleration at Perpendicular Shock Waves: Model and Observations.* American Geophysical Union 2005 Fall Meeting (December, 2005) (by G. P. Zank) [O] {EOS Trans. AGU, Vol. 86, No. 52, Fall Meet. Suppl., Abstract NG41A-07}
- *Radial and longitudinal dependence of solar 4-13 MeV and 27-37 MeV proton fluxes and fluences: Helios and IMP-8 observations.* American Geophysical Union 2005 Fall Meeting (December, 2005) [P] {EOS Trans. AGU, Vol. 86, No. 52, Fall Meet. Suppl., Abstract SH51C-1231}
- *SEP events with >40 MeV proton intensities above the streaming limit intensity.* Workshop on the Solar and Space Physics and the Vision for Space Exploration (October, 2005) [P] {[hesperia.gsfc.nasa.gov/sspvse/](http://hesperia.gsfc.nasa.gov/sspvse/)}

- *Radial and longitudinal dependence of solar 4-13 MeV and 27-37 MeV proton fluxes and fluences: Helios and IMP-8 observations.* Workshop on the Solar and Space Physics and the Vision for Space Exploration (October, 2005) [P] {hesperia.gsfc.nasa.gov/sspvse/}
- *Interplanetary coronal mass ejections during the October/November 2003 events: ACE/EPAM solar energetic particle observations.* 29th Int. Cosmic Ray Conf. (August, 2005) (by O.E. Malandraki) [O] {icrc2005.tifr.res.in}
- *Statistical properties of fast forward transient interplanetary shocks and associated energetic particle events: ACE observations.* Solar Wind-11/SOHO-16 Connecting Sun and Heliosphere (June, 2005) [O] {www.congrex.nl/05a13/}
- *Multi-spacecraft Observations of Interplanetary Shock Accelerated Particle Events.* Solar Wind-11/SOHO-16 Connecting Sun and Heliosphere (June, 2005) (by G.C. Ho) [P] {www.congrex.nl/05a13/}
- *Energetic particle acceleration at near-Earth by interplanetary shocks.* 2<sup>nd</sup> AOGS Meeting, Abstract 58-ST-A0926 (June, 2005) (by G.C. Ho) [O] {www.asiaoceania-conference.org/}
- *Energetic particle tracing of interplanetary CMEs: Ulysses/HI-SCALE and ACE/EPAM results.* Coronal and Stellar Mass Ejections, IAU Symp. No. 226 (June, 2005) (by O.E. Malandraki) [O] {srg.bao.ac.cn/IAUS226/}
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- *Associations between interplanetary transient shock parameters and >47 keV ion intensity histories.* 4th Annual International Astrophysics Conference on *The Physics of Collisionless Shocks*, Institute of Geophysics and Planetary Physics of the University of California at Riverside (February, 2005) [**O-invited**] {www.igpp.ucr.edu/Conferences\_Astro\_2005.htm}
- *Heliospheric energetic particle variability over the solar cycle.* American Geophysical Union 2004 Fall Meeting (December, 2004) [**O-invited**] {EOS Vol. 85, No. 47, Fall Meet. Suppl., SH52A-06}
- *Energetic Particle Acceleration at Near-Earth by Interplanetary Shocks.* American Geophysical Union 2004 Fall Meeting (December, 2004) (by G. C. Ho) [O] {EOS Vol. 85, No. 47, Fall Meet. Suppl., SH12A-07}
- *Multi-Spacecraft Observations of Energetic Heavy Ions Accelerated by Interplanetary Shocks Near Earth.* American Geophysical Union 2004 Fall Meeting (December, 2004) (by M. I. Desai) [P] {EOS Vol. 85, No. 47, Fall Meet. Suppl., SH21C-0433}
- *Modeling the Transport of Energetic Particles Along the IMF: A Monte-Carlo Simulation* Huntsville 2004 Workshop on *Challenges to Modeling the Sun-Earth System* (October, 2004) (by N. Agueda) [P] {science.nasa.gov/HSVWorkshop/}

- *Energetic particle response to ICMEs at low and high heliographic latitudes.* American Geophysical Union Chapman Conference on *Solar Energetic Plasmas and Particles* (August, 2004) [**O-invited**] {www.srl.utu.fi/Chapman/}
- *The Energetic Storm Particle Event of October 24, 2003.* 35th COSPAR Scientific Assembly (July, 2004) [O] {COSPAR04-A-03242. D1.3/E2.4-0042-04}
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- *A solar particle engineering code: SOLPENCO.* 35th COSPAR Scientific Assembly (July, 2004) (by A. Aran) [O] {COSPAR04-A-02827. PSW1-0019-04}
- *Transverse Anisotropies of 40-90 MeV Solar Energetic Protons: A Re-interpretation.* 35th COSPAR Scientific Assembly (July, 2004) (by E.C. Roelof) [O] {COSPAR04-A-03241. D1.2-0020-04}
- *Modeling the effects of the pitch-angle scattering processes on the transport of energetic particles along the interplanetary magnetic field.* 35th COSPAR Scientific Assembly. (July, 2004) (by N. Agueda) [P] {COSPAR04-A-02918. D1.2-0046-04}
- *Energetic storm particle events observed on ACE and Wind during solar cycle 23.* 35th COSPAR Scientific Assembly. (July, 2004) (by G.C. Ho) [P] {COSPAR04-A-01568. D1.3/E2.4-0057-04}
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- *CME associated energetic particles.* International Space Science Institute Workshop on Coronal Mass Ejections (March, 2004) [**O-invited**]
- *Effects of pitch-angle scattering and magnetic mirroring beyond 1 AU on solar energetic particles.* American Geophysical Union 2003 Fall Meeting, (December, 2003) [P] {EOS Vol. 84, No. 46, F1189, SH11D-1140}
- *Heliospheric energetic particle observations by the Cassini spacecraft.* 28th Int. Cosmic Ray Conf., (August, 2003) [P]
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- *Low-energy particle response to CMEs at high heliographic latitudes.* 2nd Elmau CME-Workshop, (February, 2003) [**O-invited**].
- *Key links in space weather forecasting: Forecasting solar-generated shocks and proton acceleration.* AIAA Aerospace Sciences Meeting, (January, 2003) (by C.D. Fry) [O]
- *ACE observations of energetic particles associated with transient interplanetary shocks.* American Geophysical Union 2002 Fall Meeting, (December, 2002) [P] {EOS Vol. 83, No. 47, F1145, SH62A-09}
- *Modeling gradual solar energetic particle events: historical review.* 34th COSPAR Scientific Assembly. The 2nd World Space Congress, (October, 2002) [**O-invited**] {COSPAR02-A-01090. PSW1-C0.2-D0.1-E2.4-F0.1-PSRB2-0014-02}
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- *Two examples of high-energy ESP events*. American Geophysical Union 2001 Fall Meeting, (December, 2001) [P] {EOS Vol. 82, No. 47, F1009, SH41B-0754}
- *Energetic Storm Particle events observed on ACE from September 1997 to December 2000*. American Geophysical Union 2001 Fall Meeting, (December, 2001) (by G.C. Ho) [O] {EOS Vol. 82, No. 47, F992, SH12C-08}
- *Observations of the H/He intensity ratio during the two Ulysses fast latitude scans*. Ulysses/Voyager/ACE Heliospheric Workshop, (October, 2001) [P].
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- *CMEs, Shocks and Solar Energetic Particles*. Int. Solar Cycle Studies – Solar Variability, Climate and Space Weather. (June, 2001) [**O-invited**]
- *Composition variations of Hydrogen, Helium and Iron Ions during Large SEP Events*. American Geophysical Union 2001 Spring Meeting. (May, 2001) (by G.C. Ho) [P] {EOS Vol. 82, No. 20, S310, SH31A-06}
- *Using global MHD simulations to interpret in situ observations of CMEs*. American Geophysical Union 2001 Spring Meeting. (May, 2001) (by P. Riley) [P] {EOS Vol. 82, No. 20, S324, SH42A-07}
- *How to get SEP flux profiles at 0.4 and 1.0 AU*. Solar Encounter: The First Solar Orbiter Workshop. (May, 2001) (by A. Aran) [P]
- *High-latitude Ulysses observations of the H/He intensity ratio under solar minimum and solar maximum conditions*. Authors: **D. Lario**, C.G. MacLennan, E.C. Roelof, J.T. Gosling, G.C. Ho, S.E. Hawkins III. Joint SOHO/ACE workshop “Solar and Galactic Composition”, (March, 2001) [P].
- *Stereoscopic view of Solar Energetic Particle Events: Observation and Modeling*. American Geophysical Union 2000 Fall Meeting. (December, 2000) [**O-invited**] {EOS Vol. 81, No. 48, F972}
- *Energetic Particle Observations from the CPME and EPE Instruments on IMP-8 during the Bastille Day 2000 Event*. American Geophysical Union 2000 Fall Meeting. (December, 2000) (by R.B. Decker) [P] {EOS Vol. 81, No. 48, F956}
- *Solar Energetic Particle Events related to the Bastille Day 2000 Solar Storm*. American Geophysical Union 2000 Fall Meeting. (December, 2000) [P] {EOS Vol. 81, No. 48, F956}

- *26-day Analysis of Energetic Ion Observations at High and Low Heliolatitudes: Ulysses and ACE*. 34th ESLAB Symposium: The 3-D Heliosphere at Solar Maximum. (October, 2000). [O]
- *Joint Ulysses and ACE observations of a solar energetic particle event related to the same CME*. 34th ESLAB Symposium: The 3-D Heliosphere at Solar Maximum. (October, 2000). [P]
- *Gradual Solar Energetic Particle events in Space Weather*. IV Scientific Meeting of the Spanish Astronomical Society. (September, 2000) (by B. Sanahuja). [O]
- *ACE/Ulysses comparison of ion events*. ACE Science Working Team. APL/JHU (September, 2000) [O]
- *Solar energetic ion events at 1 AU (ACE) and at mid-latitudes ( $\sim 50^\circ S$ ) at 3.5–5 AU (Ulysses)*. American Geophysical Union 2000 Spring Meeting. (June, 2000) [**O-invited**] {EOS, Vol. 81, No. 19, S361}
- *Beam-like  $\sim 40$ -300 keV electron events measured at 1 AU by ACE/EPAM (1997-present) and from 1.5–5 AU during the Ulysses/HI-SCALE in-ecliptic mission (1990-1992)*. American Geophysical Union 2000 Spring Meeting. (June, 2000) (by S.E. Hawkins III) [O] {EOS, Vol. 81, No. 19, S349}
- *Latest Ulysses' energetic particle observations: solar maximum orbit*. Ulysses Science Working Team No. 43. APL/JHU (April, 2000). [O]
- *Solar Energetic Particle Events in the Rising Phase of the Solar Cycle 23: Observations at 1 and 5 AU*. 26th Int. Cosmic Ray Conf. (August, 1999). [O]
- *Modeling Solar Energetic Particle Events Associated with Interplanetary Shocks*. American Geophysical Union 1999 Spring Meeting. (June, 1999) [**O-invited**] {EOS, Vol. 80, No. 17, S302}
- *Energetic particle fluxes at 5 AU during transient SEP events: Ulysses observations*. European Geophysical Society 24th General Assembly. (April, 1999). [O]
- *Energetic particle events: 1997/1998 overview*. Ulysses Science Working Team No. 41. ESA (April, 1999). [O]
- *First Solar Energetic Particle Events of the Approaching Solar Maximum*. WIND 3D Plasma and Energetic Particles team meeting. Berkeley (December, 1998). [O]
- *Energy Spectra of 50-keV to 20-MeV Protons Accelerated at Corotating Interaction Regions at Ulysses and Their Implications for Shock Acceleration Mechanisms*. American Geophysical Union 1998 Fall Meeting. (December, 1998). [P] {EOS, Vol. 79, No. 45, F714}
- *Solar Energetic Particle Events: A Tool to Model Particle Fluxes*. ESA Workshop on Space Weather. (November, 1998). [P]
- *Energetic particle propagation in the downstream region of interplanetary shocks*. Solar Wind 9. (October, 1998). [P]
- *On the evolution of energetic particle fluxes at 5 AU during the rising phase of solar cycle 23: Ulysses/LET observations*. Solar Wind 9. (October, 1998). [P]

- *Ulysses and WIND particle observations of the November 1997 solar events.* Ulysses Aphelion Workshop. (October, 1998) (by R. Marsden) [P]
- *WIND and Ulysses low-energy particle observations during the November 1997 and April-May 1998 solar particle events.* ISTP Science Workshop. (September, 1998). [O]
- *Low-Energy Cosmic Rays.* 16th European Cosmic Ray Conf. (July, 1998) (by B. Sanahuja). [**O-invited**]
- *Modeling particle events associated with interplanetary shocks.* American Geophysical Union 1998 Spring Meeting. (May, 1998). [**O-invited**] {EOS, Vol. 79, No. 17, S159}
- *COSPIN/LET observations during the particle events in November 1997.* Ulysses Science Working Team Meeting No. 39. (April, 1998). [O]
- *Ulysses and WIND observations of the transient particle events in November 1997.* European Geophysical Society 23rd General Assembly. (April, 1998). [O]
- *Interplanetary conditions during the first three years of WIND.* Toward Solar Max 2001. The present achievements and future opportunities of ISTP and GEM. (February, 1998) (by T.R. Sanderson). [P]
- *Low-energy ESP events: the role of the solar wind convection and the adiabatic deceleration terms of the transport equation.* 3rd SOLTIP Symposium. (October, 1996). [P]
- *Solar and interplanetary modulation of Energetic Storm Particle events.* 3rd SOLTIP Symposium. (October, 1996) (by B. Sanahuja). [O]
- *Evolution of the injection rate of shock-accelerated particles in long lasting ESP events. Influence of the shock on the energy spectrum.* 31st COSPAR Scientific Assembly. (July, 1996). [O]
- *Modeling the IP propagation of 0.1-20 MeV shock-accelerated protons. Effects of the adiabatic deceleration and the solar wind convection at low energy.* 31st COSPAR Scientific Assembly. (July, 1996). [P]
- *Interplanetary transport of shock-accelerated protons at low ( $\sim 500$  keV) and high ( $\sim 20$  MeV) energy.* 8th European Meeting in Solar Physics. (May, 1996). [O]
- *Energy spectrum evolution of shock-accelerated protons in energetic storm particle events.* 8th European Meeting in Solar Physics. (May, 1996). [P]
- *Do "typical" low-energy ESP events exist ?* 24th Int. Cosmic Ray Conf. (September, 1995). [P]
- *Injection Rate of Shock-Accelerated Particles at the Cobpoint: Dependence on the Heliolongitude.* 24th Int. Cosmic Ray Conf. (September, 1995). [O]
- *Energy Spectrum of Low-Energy Fluxes of Particles Accelerated by Interplanetary Shocks.* 30th COSPAR Scientific Assembly. (July, 1994). [P]
- *Modeling Fluxes and Anisotropies of Energetic Particle events Associated with Interplanetary Shocks .* 2nd SOLTIP Symposium. (June, 1994) (by B. Sanahuja).[O]
- *How to Get Good Fits for the Flux and Anisotropy Profiles in ESP events.* 2nd SOLTIP Symposium. (June, 1994). [P]

- *Modelización de sucesos ESP a 10-20 MeV. Fiabilidad de la extensión.* Third Latin American Conference on Space Geophysics. (November, 1993). [P]
- *Efectos a gran escala de los choques interplanetarios en el suceso de partículas de baja energía (0.5–1.5 MeV) asociado.* Third Latin American Conference on Space Geophysics. (November, 1993). [P]
- *Upstream Anisotropies in Low-Energy Particle Events: A Clue to the Influence of IP Shocks.* Third Latin American Conference on Space Geophysics. (November, 1993). [P]

## SEMINARS

- *Energetic particle response to CMEs at low and high heliographic latitude.* University of Maryland {space.umd.edu} (February, 2004).
- *Energetic particles in the solar maximum and solar minimum heliosphere.* University of Barcelona (February, 2003).
- *Solar energetic particle events in the rising phase of solar cycle 23: Observations at 1 and 5 AU.* University of Maryland {space.umd.edu} (May, 2000).
- *Modeling solar energetic particle events associated with interplanetary shocks.* The Johns Hopkins University/Applied Physics Laboratory (March, 1999).
- *Energetic particles in the interplanetary medium.* Space Science Department of the European Space Agency (ESA) (July, 1998).
- *Propagation of Low-Energy Particles through the Interplanetary medium: Modeling their injection from Interplanetary Shocks.* Universitat de Barcelona (July, 1997).
- *Influence of Interplanetary Shocks on Low-Energy Particle Events.* Space Environment Laboratory of the National Oceanic and Atmospheric Administration (NOAA) (November, 1993).

## MISCELLANEOUS

- Monographic courses:
  - “Plasma Physics in the interplanetary medium”  
University of Barcelona (December, 1999) by Dr. B. Sanahuja and D. Lario.
- Chairman of a session at the 26th International Cosmic Ray Conference (1999).

## REFERENCES

Available upon request from:

- Dr. R.G. Marsden  
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## RESEARCH ACTIVITY

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My research activity comprises the study of the physics of the heliosphere and of the solar-terrestrial environment. My research interests include both aspects of this study: the analysis of observational data from interplanetary spacecraft and the modeling and theoretical interpretation of these data.

I regularly perform comprehensive analyses of data from several spacecraft such as the Advanced Composition Explorer (ACE, at the Lagrangian point L1 between the Sun and the Earth), the Interplanetary Monitoring Platform (IMP-8, orbiting the Earth), the Geosynchronous Operational Environmental Satellites (GOES, in geostationary orbit), the Cassini spacecraft (en route to Saturn), the Ulysses spacecraft (orbiting around the Sun at high heliographic latitudes) and the Voyagers spacecraft close to the termination shock of the heliosphere. I also analyze solar data to identify the origin of the heliospheric activity detected by these spacecraft (i.e., solar flares, coronal mass ejections, coronal holes, etc.). Publications of these analyses include, e.g., [1], [2], and [3].

The exhaustive survey of these data allowed me to understand the response and performance of instruments on board spacecraft under different (and extreme) conditions as well as to study several heliospheric phenomena such as (a) the simultaneous observation of solar energetic particle events by distant spacecraft at both low and high heliographic latitudes [e.g. 2, 3, 4, 5], (b) the solar cycle variations of the energetic particle contents in the heliosphere [e.g., 3, 6], (c) the magnetic shielding of distant spacecraft from new solar injections of energetic particles [7], (d) the re-acceleration of energetic particles at shocks associated with corotating interaction regions [1], and (e) the effects that coronal mass ejections produce on the energetic particle population in the interplanetary medium [8]. Models for these new phenomena have not yet been developed and this constitutes one of the goals of my proposed research activity.

The work performed in my PhD dissertation (awarded with the 1999 F.L. Scarf Award conferred by the American Geophysical Union to the best Doctoral Thesis in Space Physics and Aeronomy during that year) focused on the development of a model able to forecast energetic particle fluxes associated with interplanetary shocks. My model was the first ever to combine the simulations of interplanetary shock propagation with the transport of the shock-accelerated particles [9]. This model is the basis of a Solar Particle Engineering Code (SOLPENCO) that allows near-instant prediction of fluxes and fluences of energetic particles in the interplanetary medium. This code has been developed under two projects funded by NASA under the Living With a Star; Data, Analysis, Theory and Modeling (LWS/DATM) Program (grant NAG5-10787, PI: **D. Lario**) and by the European Space Agency (TOS-EMA Space Weather Projects; Contract ESA 14098/99/NL/MM). Expansion of this code is one of my next primary goals.

I also participate in a number of scientific projects currently in progress (see page 3 of my résumé). A particular research area sponsored by NASA under the LWS/DATM Program (grant NAG5-13487, PI: **D. Lario**) is the study of the energetic particle acceleration at transient interplanetary shocks. By using data from the ACE and IMP-8 spacecraft I characterize the energetic particle events associated with interplanetary shocks, compare with the predictions of theories, and determine the energetic particle acceleration mechanism working at these shocks [e.g., 10].

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Reference numbers are specified in the list of my ten most relevant publications (next page).

## TEN MOST RELEVANT SCIENTIFIC CONTRIBUTIONS

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- [1] *Energetic Proton Observations at 1 and 5 AU I: January-September 1997*. Authors: **D. Lario**, R.G. Marsden, T.R. Sanderson, M. Maksimovic, B. Sanahuja, A. Balogh, R.J. Forsyth, R.P. Lin, J.T. Gosling. *Journal of Geophysical Research*, 105,18235-18250 (2000).
- [2] *Energetic Proton Observations at 1 and 5 AU II: Rising Phase of the Solar Cycle 23*. Authors: **D. Lario**, R.G. Marsden, T.R. Sanderson, M. Maksimovic, B. Sanahuja, S.P. Plunkett, A. Balogh, R.J. Forsyth, R.P. Lin, J.T. Gosling. *Journal of Geophysical Research*, 105, 18251-18274 (2000).
- [3] *Solar energetic particle variations*. Authors: **D. Lario**, G.M. Simnett. Chapter number 12 in the Geophysical Monograph No. 141 of the American Geophysical Union entitled "Solar Variability and its Effects on Climate" 195-216 (2004).
- [4] *Heliospheric energetic particle observations during the October-November 2003 events*. Authors: **D. Lario**, R.B. Decker, S. Livi, S.M. Krimigis, E.C. Roelof, C.T. Russell, C.D. Fry. *Journal of Geophysical Research*, doi:10.1029/2004JA010940, (2005).
- [5] *Solar maximum low-energy particle observations at heliographic latitudes above 75°*. Authors: **D. Lario**, E.C. Roelof, R. B. Decker, D.B. Reisenfeld. *Adv. Space Research*, 32 (4), 579-584 (2003).
- [6] *Solar cycle variations of the energetic H/He intensity ratio at high heliolatitudes and in the ecliptic plane*. Authors: **D. Lario**, E.C. Roelof, R. B. Decker, G.C. Ho, C.G. MacLennan, J.T. Gosling. *Annales Geophysicae*, 21, 1229-1243 (2003).
- [7] *Heliospheric energetic particle observations by the Cassini spacecraft: Correlation with 1 AU observations*. Authors: **D. Lario**, S. Livi, S.M. Krimigis, R.B. Decker, E.C. Roelof, M.K. Dougherty. *Journal of Geophysical Research*, 109, A09S02, doi:10.1029/2003JA010107 (2004).
- [8] *Low-energy particle response to CMEs during the Ulysses solar maximum northern polar passage*. Authors: **D. Lario**, R.B. Decker, E.C. Roelof, D.B. Reisenfeld, T.R. Sanderson. *Journal of Geophysical Research*, 109, A01107, doi:10.1029/2003JA010071 (2004).
- [9] *Energetic particle events: Efficiency of interplanetary shocks as  $50 \text{ keV} < E < 100 \text{ MeV}$ -proton accelerators*. Authors: **D. Lario**, B. Sanahuja, A.M. Heras. *Astrophysical Journal*, 509, 415-434 (1998).
- [10] *The energetic storm particle event of October 20, 1989*. Authors: **D. Lario**, R.B. Decker. *Geophysical Research Letters*, 29(10), 1393-1396, 10.1029/2001GL014017 (2002).