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Knowledge of Languages: English, Swedish, Italian, studied French, studied Finnish.

Education

Doctor of Philosophy (Ph.D.) in Space Physics, 15 March 2002. Title: Radio waves in the Ionosphere: Propagation, Generation, and Detection. Supervisors: B. Thidé and R. Boström.
Uppsala University, Sweden

Master of Science (M.Sc.) in Engineering Physics, specializing in Radiation Sciences, April 1993.
Title: Phase-Integral Formulas for Coulomb Wave Functions. Supervisors: S. Yngve and P.O. Fröman.
Ref [O1].
Uppsala University, Sweden

Work History**Research Engineer**

*Onsala Space Observatory at the Department of Earth and Space Sciences, Chalmers University
15 Aug 2010--*

Currently a staff member at Onsala space observatory, where I am responsible for running the local Lofar telescope. I also am involved in the design of the Band 1 feed for the SKA telescope.

Research Fellow

*Department of Physics and Astronomy, University of Glasgow
1 Feb 2007–2010*

Design of the Square Kilometre Array (SKA), especially its polarimetric capabilities.

Achievements

- Introduced a fundamental figure of merit for radio polarimeters, which makes it possible to properly assess the polarimetry from astronomical radio telescopes. Ref [29].
- Promoted the use of polarization diversity in aperture arrays for radio astronomy. Ref [O17].
- Developed a measurement equation for radio interferometer valid for (non-paraxial) wide fields of view and arbitrary polarization, which will be necessary for the full exploitation of the SKA (and other next generation low-frequency radio astronomy telescopes). Ref [23].
- Constructed a measurement model for high-precision timing of pulsars using polarimetry.

Research Fellow

*Department of Informatics in the School of Science and Technology, Sussex University
1 April 2004–31 December 2006*

Conducted research at the Science Science Centre. (<http://www.sussex.ac.uk/space-science/>)

Projects

- Investigated the possibility of detecting orbital angular momentum in radio waves. Ref [21,25,26].
- Developed novel signal processing algorithms and implemented them in FPGA and DSPs for use in state-of-the-art space-craft instrumentation. Ref [22].
- Introduced the covariant theory of electromagnetic coherence and polarization thus generalizing the Stokes parameters to describe a full electromagnetic wave field. Ref [17].
- Discovered that whistler waves can precess. Ref [16].
- Responsible for the design of the electron correlator dataset and its ingestion into ESA's long-term data storage initiative called Cluster Active Archive (CAA). Ref [O16].

Postdoctoral Researcher

School of Engineering and Information Technology, Sussex University

1 July 2001–31 March 2004

Responsible for the science exploitation of the electron correlator instrument, DWP, onboard the ESA/NASA space-craft mission Cluster-II. Ref [11].

Achievements

- Derived the sampling errors of correlators. Ref [O12,O13].
- Developed an alternative to standard interferometry and spatial filtering telescopes that is instantaneous, i.e., the technique can be used for nonstationary or transient sources. Ref [14].

Senior Scientist

Red Snake Radio Ltd.

1999–2001

Co-founded this company which developed smart antennas for 3G mobile networks, and led the research and development which resulted in three world patents. Ref [P1,P2,P3].

Projects

- Developed the antenna array for the LOIS project, which is a small, LOFAR-like radio interferometer located outside Växjö Sweden. Ref [O10,O11].

Research Assistant

Swedish Institute of Space Physics

2000–2001

Co-Investigator on the EFW instrument on the Cluster-II spacecraft mission. Ref [7].

Ph.D. fellowship, part-time (50%)

Department of Space Physics, Uppsala University, Sweden

July 1993–Sep 2000

My thesis was concerned with several aspects of radio wave theory.

Achievements

- Performed the first automated sweep measurements of Stimulated Electromagnetic Emissions (SEE) from the ionosphere using the SURA High-Frequency Radio Pumping facility in Russia. Ref [10]
- Performed the first polarimetric measurements of Stimulated Electromagnetic Emissions (SEE) from the ionosphere using the SURA High-Frequency Radio Pumping facility in Russia. Ref [5].
- Invented the full-vector, correlating interferometer based on tripole antennas. Ref [4].

System developer, part-time (50%)

Swedish Institute of Space Physics, Uppsala Division.

July 1993–Sep 2000

Developed and maintained the database management system (DBMS) software for scientific data called ISDAT, see <http://www.space.irfu.se/isdat/>, the main DBMS for the wave consortium on the ESA/NASA Cluster-II space-craft mission.

Teacher

Uppsala University

1995–1996

Responsible for the lessons in the course Classical Electrodynamics. Prepared course literature and created exam problems. Among the first in Uppsala University to develop web-based teaching materials, most of which are still in use today, see <http://www.plasma.uu.se/CED/Exercises/>.

Scientific Publications

- [29] T. D. Carozzi and G. Woan. "A Fundamental Figure of Merit for Radio Polarimeters". *IEEE trans. ant. prop., Special Issue, Antennas for Next Generation Radio Telescopes, Vol 59, No 6, pp 2058-2065, doi:10.1109/TAP.2011.2123862* . June 2011.
- [28] Nicolas Huber, MS Hromalik-Pouchet, Tobia D Carozzi, MP Gough, AM Buckley. "Parallel processing speed increase of the one-bit auto-correlation function in hardware". *Microprocessors and Microsystems Vol 35, No 3, pp 297-307, doi:10.1016/j.micpro.2011.01.001* . May 2011.
- [27] A.T. Karpachev, G.F. Deminova, N. Beloff, T.D. Carozzi, P.F. Denisenko, M. Lester, T. Karhunen, . "Asymmetric response of the topside ionosphere to large-scale IGW generated during the

- November 30, 1979, substorm". *Journal of Atmospheric and Solar-Terrestrial Physics*, Vol 73, Issues 5-6, pp 567-577, doi:10.1016/j.jastp.2010.11.014. (<http://www.sciencedirect.com/science/article/pii/S1364682610003469>) . April 2011, .
- [26] S. M. Mohammadi, Lars K. S. Daldorff , Kamyar Forozesh , Bo Thide , Jan Bergman , Brett Isham , Roger Karlsson , Tobia D. Carozzi . "Orbital angular momentum in radio---Measurement methods". *Radio Science*, Vol 45, pp RS4007, doi:10.1029/2009RS004299, July 2010.
 - [25] A.T. Karpachev, N. Beloff, T.D. Carozzi, P.F. Denisenko, T.J.T. Karhunen, and M. Lester . "Detection of large scale tids associated with the dayside cusp using superdarn data". *Journal of Atmospheric and Solar-Terrestrial Physics*, Vol 72, No 9-10, pp 653-661, doi:10.1016/j.jastp.2010.02.018. 2010.
 - [24] S. M. Mohammadi, L. K. S. Daldorff, J. E. S. Bergman, R. L. Karlsson, B. Thid'e, K. Forozesh, T. D. Carozzi and B. Isham. " Orbital angular momentum in radio—a system study". *IEEE trans. ant. prop.*, Vol 58, No 2, pp 565-572, doi:10.1109/TAP.2009.2037701. 2009.
 - [23] T. D. Carozzi and G. Woan. "A generalized measurement equation and van Cittert-Zernike theorem for wide-field radio astronomical interferometry". *MNRAS*, Vol 395, No 3, pp 1558-68, doi:10.1111/j.1365-2966.2009.14642.x. (2009).
 - [22] E. Cabal-Yepez, T.D. Carozzi, R. de J. Romero-Troncoso, M.P. Gough, N. Huber. "FPGA-based system for frequency detection of the main periodic component in time series information". *Digital Signal Processing*, Vol 18, No 6, pp 1029-1044. (2008).
 - [21] B. Thidé, H. Then, J. Sjöholm, K. Palmer, J. Bergman, T. D. Carozzi, Ya. N. Istomin, N. H. Ibragimov and R. Khamitova. "Utilization of Photon Orbital Angular Momentum in the Low-Frequency Radio Domain". *Phys Rev Lett*, Vol 99, pp 087701, doi:10.1103/PhysRevLett.99.087701. (2007).
 - [20] A. T. Karpachev, G. F. Deminova, N. Beloff, T. D. Carozzi, P. F. Denisenko, T. J. T. Karhunen and M. Lester. "Global pattern of the ionospheric response to large-scale internal gravity waves". *J Atmos Solar-Terr Phys*, Vol 69, No 8, pp 906-924. (2007).
 - [19] S. Savin, E. Arnata, M. André, M. Dunlop, Y. Khotyaintsev, P. M. E Decreau, J. L. Rauch, J. G. Trotignon, J. Buechner, B. Nikutowksi, J. Belcki, A. Skalsky, S. Romanov, L. Zelenyi, A. M. Buckley, T. D. Carozzi, M. P. Gough, P. Song, H. Reme, A. Volosevich, H. Alleyne and E. Panov. "Experimental study of nonlinear interaction of plasma flow with charged thin current sheets: Hall dynamics, mass and momentum transfer". *Nonlinear Proc Geophys*, Vol 13, No 4, pp 377-392. (2006).
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 - [17] T. D. Carozzi and J. E. S. Bergman. "Real irreducible sesquilinear-quadratic tensor concomitants of complex bivectors". *J Math Phys*, Vol 47, pp 032903, doi:10.1063/1.2173176. (2006).
 - [16] R. L. Karlsson, T. D. Carozzi, J. E. S. Bergman and A. I. Eriksson. "Precession of the whistler polarisation plane normal observed on Freja". *Geophys Res Lett*, Vol 32, pp L23107, doi:10.1029/2005GL024748. (2005).
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- SELECTED NON-REFEREED PAPERS.
- [O21] TD Carozzi, MV Ivashina. "Towards a uniform evaluation of the science quality of SKA technology options: Polarimetric aspects". *Electromagnetics in Advanced Applications (ICEAA), 2012 International Conference on*. (Sept 2012).
- [O20] Norman Gray, TD Carozzi, Graham Woan. "Managing Research Data: Gravitational Waves". *arXiv:1207.3923*. (Jul 2012).
- [O19] Luis M Ledesma-Carrillo, Eduardo Cabal-Yepez, R de J Romero-Troncoso, Arturo Garcia-Perez, Roque Alfredo Osornio-Rios, Tobia D Carozzi. "Reconfigurable FPGA-Based unit for Singular Value Decomposition of large mxn matrices". *Reconfigurable Computing and FPGAs (ReConFig), 2011 International Conference on*. (Nov 2011).
- [O18] T. D. Carozzi, G. Woan, R. Maaskant. "Polarization Diversity for SKA Wide-field Polarimetry". *SKA Conference, Widefield Science and Technology for the SKA*. (2009).
- [O17] T. D. Carozzi, G. Woan, R. Maaskant. "Polarization Diversity for SKA Wide-field Polarimetry". *SKA Conference, Widefield Science and Technology for the SKA*. (2009).
- [O16] I. Bates, H. Alleyne, K. Yearby, S. Walker, A. Buckley and T. Carozzi. "Digital wave processor data in the Cluster Active Archive". *European Space Agency (Special Publication) ESA SP, Vol 598, pp 489-493*. (2006).
- [O15] P. Canu, P. Décréau, S. Escoffier, N. Cornilleau-Wehrin, D. Fontaine, M. Dunlop, J.G. Trotignon, J.L. Rauch and T. Carozzi. "A search for electron scale structures close to the magnetopause". *European Space Agency (Special Publication) ESA SP, Vol 598, pp 385-391*. (2006).
- [O14] T. D. Carozzi, A. M. Buckley, M. P. Gough and E. Chambers. "Detection of weak plasma oscillations using the electron autocorrelator on Cluster". *Proceedings of the 28-th general assembly of the International Union of Radio Science (URSI), New Delhi India, October 23-29*. (2005).
- [O13] T. D. Carozzi and A. M. Buckley. "Sampling errors of correlograms with and without sample mean removal for higher-order complex white noise with arbitrary mean". *arXiv:physics/0506030*. (2005).
- [O12] T. D. Carozzi and A. M. Buckley. "Deriving the sampling errors of correlograms for general white noise". *arXiv:physics/0505145*. (2005).
- [O11] Jan Bergman, Tobia D. Carozzi, and Roger Karlsson. "Present and future applications of the information dense antenna". *Proceedings of the Nordic Shortwave Conference HF-04, Fårö Sweden, August 10-12*. (2004).

- [O10] Roger Karlsson, Walter Puccio, Jan Bergman, Tobia D. Carozzi and Bo Thidé. "Three-channel digital radio vector field sensor: Description and Demonstration". *Proceedings of the Nordic Shortwave Conference HF-04, Fårö Sweden, August 10-12*. (2004).
- [O9] T. D. Carozzi,. "Hamiltonian formulation of radio wave propagation in a cold, stratified magnetoplasma". *IRF scientific report 268, ISSN 0284-1703*. (2000).
- [O8] T. D. Carozzi. "Evolution equations for radio wave polarization in a cold, stratified magnetoplasma". *IRF scientific report 271, ISSN 0284-1703*. (2000).
- [O7] V. L. Frolov, B. Thide, and T. Carozzi,. "Some new observations of the upshifted maximum in stimulated electromagnetic emission spectra". *Proceedings of the IV Suzdal URSI (International Union of Radio Science) Symposium on Ionospheric Modification by Powerful Radio Waves (ISIM-3), edited by B. Thide, p. 40, Swedish Institute of Space Physics, Uppsala, Sweden, August 15-20* . (1994).
- [O6] E. N. Sergeev, V. L. Frolov, G. P. Komrakov, B. Thide, and T. Carozzi. "Temporal evolution of HF-excited plasma waves, measured at different pump frequencies by means of stimulated electromagnetic emission". *Proceedings of the IV Suzdal URSI (International Union of Radio Science) Symposium on Ionospheric Modification by Powerful Radio Waves (ISIM-3), edited by B. Thide, pp. 66-67, Swedish Institute of Space Physics, Uppsala, Sweden, August 15-20*. (1994).
- [O5] V. L. Frolov, L. M. Erukhimov, S. M. Grach, G. P. Komrakov, E. N. Sergeev, B. Thide, and T. Carozzi. "Features of broad upshifted maximum in the spectrum of stimulated electromagnetic emission". *Proceedings of the IV Suzdal URSI (International Union of Radio Science) Symposium on Ionospheric Modification by Powerful Radio Waves (ISIM-3), edited by B. Thide, p. 69, Swedish Institute of Space Physics, Uppsala, Sweden, August 15-20*. (1994).
- [O4] T. Carozzi. "A magnetospheric sounding experiment using the HF heater at Tromsø". *Proceedings of the IV Suzdal URSI (International Union of Radio Science) Symposium on Ionospheric Modification by Powerful Radio Waves (ISIM-3), edited by B. Thide, p. 79, Swedish Institute of Space Physics, Uppsala, Sweden, August 15-20* . (1994).
- [O3] T. Carozzi. "EM field of obliquely incident HF radio waves in the ionospheric reflection region". *Proceedings of the IV Suzdal URSI (International Union of Radio Science) Symposium on Ionospheric Modification by Powerful Radio Waves (ISIM-3), edited by B. Thide, p. 100, Swedish Institute of Space Physics, Uppsala, Sweden, August 15-20*. (1994).
- [O2] Tobia Carozzi. "Electromagnetic field theory, An advanced electrodynamic exercises book, ". *Swedish Institute of Space Physics, Uppsala Division* . (1999). http://www.plasma.uu.se/CED/Exercises/EMFT_Exercises.pdf.
- [O1] T. Carozzi. "Phase-Integral Formulas for Coulomb Wave Functions". *UUDTP Report 81*. June (1994).
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- PATENTS.
- [P3] J. Bergman, T. Carozzi, R. Karlsson. "Multipoint antenna device". *International Patent Number WO 03/007422*. 2003.
- [P2] J. Bergman, T. Carozzi, R. Karlsson. "System for three-dimensional evaluation". *International Patent Number WO 03/067710 A1*. 2003.
- [P1] J. Bergman, T. Carozzi, R. Karlsson. "Method and system for obtaining direction of an electromagnetic wave". *International Patent Number WO 99/66341*. 2000.

Awards

- **Science research grant for ionospheric acoustic gravity waves**, International Space Science Institute (ISSI), Bern Switzerland, <http://www.issi.unibe.ch/teams/IGW/>, September 2005
- **Certificate of outstanding contribution to Cluster**, European Space Agency (ESA), September 2005
- **Group Achievement Award** , NASA/GSFC , August 2004 Cluster Science team
- **Best contribution**, Nordic HF conference, August 2004
- **Winner**, ALMI innovation of the year in Uppland Sweden, 2000, For smart mobile telephone antenna with positioning capability based on the 3D polarization of microwaves.
- **Runner-up**, Venture Cup, 2000, For business idea involving personal positioning services using smart mobile telephone antennas.

Professional memberships

Swedish National Commity for Radio Science SNRV
(Swedish equivalent of URSI)

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