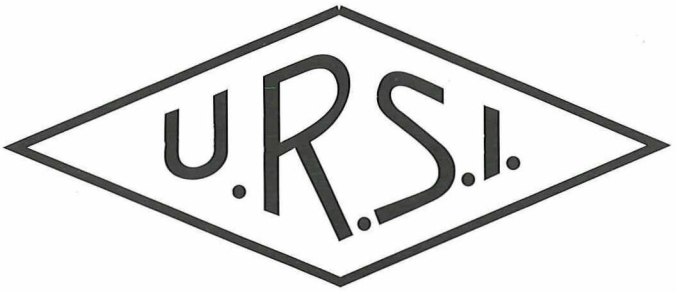
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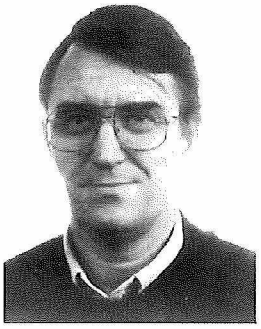
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Editorial

Dear URSI Correspondent,



Welcome to this March issue of our Bulletin. Beside the usual reports about conferences and activities organized by our Union you will find an interesting contribution by John Sahr and Frank Lind about the efficient use of commercial broadcast transmitters for remote sensing purposes. These authors describe a methodology for passive measurements of the atmosphere by using transmitters of opportunity. The basic idea is to make use of the concept of optimal reception in the context of non-dedicated equipment to perform so called passive radar experiments of the ionosphere.

In the administrative part of our Bulletin you will find the announcements of the scientific activities sponsered or supported by URSI. I suggest you take them into account when scheduling your future plans for the forthcoming period.

I wish you a pleasant reading.

Piotr Sobieski, Editor

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Passive Radio Remote Sensing of the Atmosphere using Transmitters of Opportunity

John D. Sahr
Frank D. Lind

Abstract

Commercial FM broadcasts near 100 MHz illuminate the natural environment with continuous, high power illumination. By fortunate coincidence these broadcasts are superb for radar applications. With proper signal processing and a bistatic, synchronous receiver system, target range may be resolved to about one kilometer, Doppler spectra resolved to a few meters per second, with integration times of the order 30 seconds. Such a system suffers no large ambiguities in range or Doppler shift, an extremely attractive feature in studies of meter scale irregularities in the ionosphere.

Introduction

When the first radio messages spanned the Atlantic Ocean in 1901, enormous opportunities for communications and commerce followed. The fact that the radio message travelled to points well beyond the horizon implied existence of a mechanism to redirect the electromagnetic waves. Although a high altitude conducting layer had been postulated by Gauss and Lord Kelvin in the mid 1800s, the early radio experiments of Marconi very directly demonstrated the existence of this conducting layer [Rishbeth and Garriot, 1969], which we call the ionosphere. These early radio broadcasts provided fundamental information about the structure of the ionosphere, if only by accident.

Scientists soon designed radio experiments specifically for the ionosphere. The principle instrument has been the ionosonde, which permits estimation of the electron density profile below the ionozation peak (near 400 km) [Breit and Tuve, 1926]. Additional active radar techniques have been developed subsequently, including HF and VHF coherent radars for ionospheric density irregularity studies, VHF studies of middle and upper atmospheric winds (MST radars), and "partial reflection" MF radars for upper atmospheric winds and tides. In 1960, the first powerful Thomson Scatter radars were built to directly observe the fluctuations of the ion gas (made observable by electron correlations to those fluctuations) [Hunsucker, 1991]. These radio experiments are conventional radars in that the transmitter and receiver share a single antenna, a topology which is called "monostatic" [Skolnik, 1990]. Radars have also been constructed with geographically distributed transmitters and receivers, a bistatic or multistatic topology. The European Incoherent Scatter (EISCAT) consortium operates a unique UHF radar (900 MHz) which has a transmit/receive function in Norway augmented by two receive-only stations in Sweden and Finland (the Norway site has additional radar instruments as well). For many years scientists have operated several simple yet elegant multistatic VHF radar experiments in Europe and America [McNamara et al. 1982; Kustov et al., 1996; Haldoupis and Schlegel, 1993].

All the instruments described above include a dedicated transmitter which provides carefully controlled illumination. The transmitters provide high power pulses which may be intricately modulated to achieve better estimates of range and other parameters than a simple pulse would permit. Indeed decades have been spent designing radar waveforms with nice properties [Levanon-1988]. Because the optimal detection strategy is based on the classical matched filter [Whalen, 1971], the transmitted waveform unambiguously describes the optimal receiver for target detection. So, it doesn't matter if a radar-appropriate waveform is transmitted by accident or by design. If we can obtain a record of the broadcast, we can perform radar experiments as if we had controlled the transmitter ourselves. This is the basic idea behind a completely passive radar.

We are building an explicitly passive radar at the University of Washington, using commercial FM broadcasts

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at 100 MHz as the illuminator for studying ion sound wave turbulence near the Northern Lights [Sahr and Fejer, 1996; Haldoupis, 1989]. Our implementation uses two geographically separated but time and frequency synchronous receivers. One receiver is located near the transmitter to directly record broadcasts, while the second is removed 100 km behind a mountain range. This attenuates the direct signal but permits observation of the scattering volume (see Figure 1). The data from the two receivers are brought to a common point via Internet connection, and then the data are processed to yield information about the scattering process.

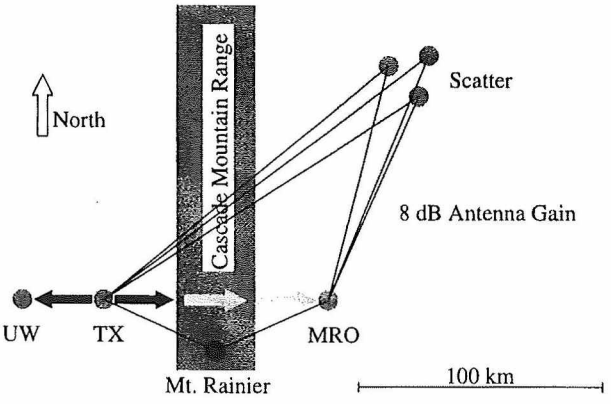


Figure 1

A schematic of our passive bistatic radar. Commercial FM broadcasts (TX) are directly detected by a receiver at the University of Washington (UW); a second receiver at the Manastash Ridge Observatory (MRO) receives an attenuated direct broadcast signal as well as scattered signals from targets to the north east, and some nearby topographical features (Mt. Rainier). E region scatter is expected at ranges out to 1000 km.

Why build a passive radar?

Significant logistic issues impede the split-receiver passive system. Because we wish to estimate the range of targets within a hundred meters, the two receivers must be time-aligned to a microsecond or less. We also wish to measure absolute Doppler velocities accurate to a few meters per second, which implies that the receivers must be frequency aligned to about one Hz (at 100 MHz operating frequency). Although the process used to create the optimal receiver is straightforward, it is computationally burdensome. In addition, it is not simple to provide a real time raw data flow of 500 000 samples/s between the between widely separated receivers.

With all these difficulties in mind, why even consider building a passive radar? If these logistic problems defined the whole issue, there would be little point in building a passive radar. However, conventional radars have their own significant operational problems.

For example, geophysically useful transmitters have sufficient power to require significant interaction with licensing agencies. Geophysically useful wavelengths may be completely unavailable due to commercial or military activity. Powerful transmitters are costly, approximately US $2000 per kilowatt of peak power, with power levels ranging from 10 kW to 2 MW [W. Swartz, personal communication, 1997]. Such transmitters are also expensive and complex to operate. A conventional radar locates a sensitive receiver near a powerful transmitter, switching a common antenna between the two, with plentiful opportunities for self-interference. The antenna switch inevitably degrades the receiver performance. The antenna is connected to the receiver most of the time, but the transmission line must accomodate the full power of the transmitter. The transmission lines are frequently long enough to noticably attenuate the transmitter and receiver signals. Dedicated transmitters are frequently modulated with waveforms which are convenient for signal processing but which may suffer range or Doppler (Nyquist) aliasing. Finally, powerful transmitters are hazardous because of large electric fields, high voltages, and high currents.

In contrast, a passive receive-only system eliminates licensing problems and expense associated with procuring and operating a high power transmitter. The transmit-receive switch is eliminated; sensitive and delicate preamplifiers may be mounted at the antenna terminals before any transmission line imposes loss, and the transmission line is far simpler and less costly because it need not endure high power. Significant safety hazards are eliminated. A receive-only passive system consumes very little power, is easily designed to avoid self interference, and will not interfere with other users in the vicinity.

Some Fundamental Issues

If a radar observes targets with small scattering cross sections, the quality of the data is directly related to the average transmitter power. Conventional radars often have very high peak power, but because the transmitter is usually off the average power may be only a few hundred watts to a few kilowatts. Thus, commercial FM broadcasts continuously emitting 10 to 100 kW are brighter than all but a few of the most powerful radars on the planet.

Power is not everything, of course. Many applications depend upon ability to resolve targets in range. A proper analysis shows that fine range resolution is not directly related to the duration of a transmitter waveform, but rather to its autocorrelation function (Levanon-1988). Furthermore, if the target has significant Doppler content (by motion or fluctuation) the transmitter waveform must also be uncorrelated with Doppler shifted and delayed copies of itself. So, for a candidate waveform $x(t)$ we study the Ambiguity Function $\chi(r,v)$

$$\chi(r,v) = \int_{-\infty}^{\infty} x(t)x^*(t - r/c)e^{2\pi i v t}dt \qquad (1)$$

The ambiguity function indicates the "blurring" imposed by the waveform, just as the "point spread function" describes the resolution of an optical system. If there is a single target at range r_1 with Doppler Shift v_1, then an ideal radar would return $\partial(r - r_1)\partial(v - v_1)$ as the density, while a real radar would instead produce a blurred density, $\chi(r - r_1, v - v_1)$.

A number of intricately coded waveforms have been developed to accomplish compact ambiguity [Nygren et

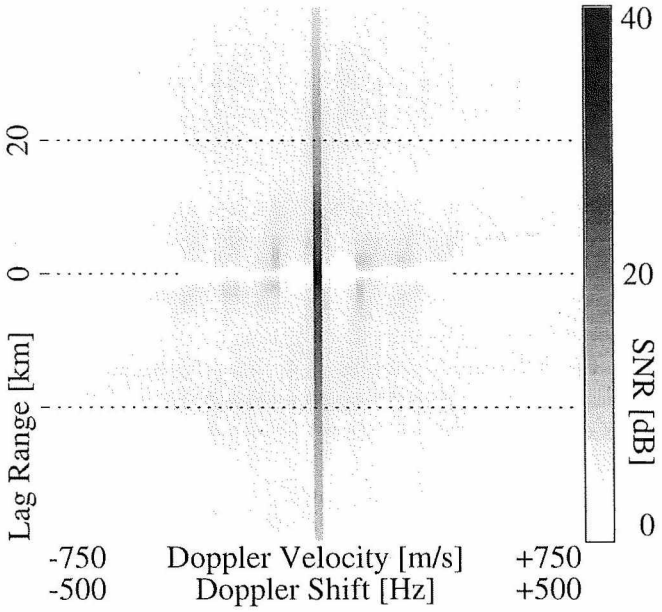


Figure 2

Example of the log self ambiguity function of a 10 s sample of a commercial FM broadcast. The clutter floor is typically 35 dB beneath the central spike; and the high range resolution is obscured by the presence of substantial ground clutter; Figure 3 shows the range resolution possible when the ground clutter is absent.

al., 1996], but the ambiguity function suggests that random signals should work well. Indeed random signals have been purposefully used in atmosperic and planetary radar applications [Sulzer, 1986; Hagfors and Kofman, 1991]. Random signals have two strong properties which make them attractive as radar waveforms. They have have compact and completely alias-free ambiguity; and the randomness of the waveform means that the received signals have no accidental correlations with receiver hardware which can lead to annoying systematic errors in parameter estimates. In particular, the received signal is guaranteed to be zero mean for all ranges, so that DC bias in the receiver chain can be removed by a blocking capacitor without impairing the spectral estimates.

Commercial FM broadcasts emit superb if accidental radar waveforms. An analysis is beyond the scope of paper, but commercial FM broadcasts are a kind of strongly nonlinear, non repetitive spread spectrum modulation which happens to have compact ambiguity. We've presented the observed ambiguity of a ten second sample of a station serving Seattle, Washington. The FM broadcast waveform shares the "no alias" property of random waveforms which make them completely immune to range and Doppler aliasing [Sahr and Fejer, 1996]. An example of the ambiguity of a real broadcast is shown in Figure 2.

Addressing the Logistical Problems

Earlier we enumerated several practical problems with a two receiver passive radar. Two of the problems, time and frequency reference, are easily solved using Global Positioning System (GPS) technology. With one GPS receiver at each site the receivers are time-synchronous to about 100 ns and frequency-synchronous to a few mHz.

The more difficult problems are associated with data transport and data processing. The two receivers communicate over an Internet connection which is capable of transferring about 500 k bits/s. Each receiver generates 500 000 samples/s, which (for 12 bit samples) is about ten times the peak capacity of the link. Fortunately it is not necessary to preserve the precision of the samples. In fact the sign bit alone suffices to generate superb cross ambiguity estimates. Using only the sign bit also helps reduce the burden of the front end signal processing, which involves calculation of the cross ambiguity function:

$$Q(r,\tau) = \int_T y(t)x^*(t-r)y^*(t-\tau)x(t-r-\tau)dt \qquad (2)$$

which provides an unbiased estimate of the target correlation function at lag τ and range r [Sahr and Lind, 1997]. Even with reduced precision data and various optimizations, the real time processing burden is about 10^{10} add/multiply operations per second. This is the single largest barrier to low cost operation, but we expect it to fall rapidly given the progress being made in computational equipment. Our data processing currently runs about one tenth as fast as the rate at which data is created. As we are using relatively slow desktop computers, we expect to solve the processing speed problem quite soon.

Figure 3 shows the cross ambiguity of the signal leaking over the mountains, computed from 10 s of data using only the sign bit. The range resolution is superb, and the slender ambiguity peak at zero Doppler indicates that the receivers are indeed frequency synchronous.

Other Examples of Passive Radar Systems

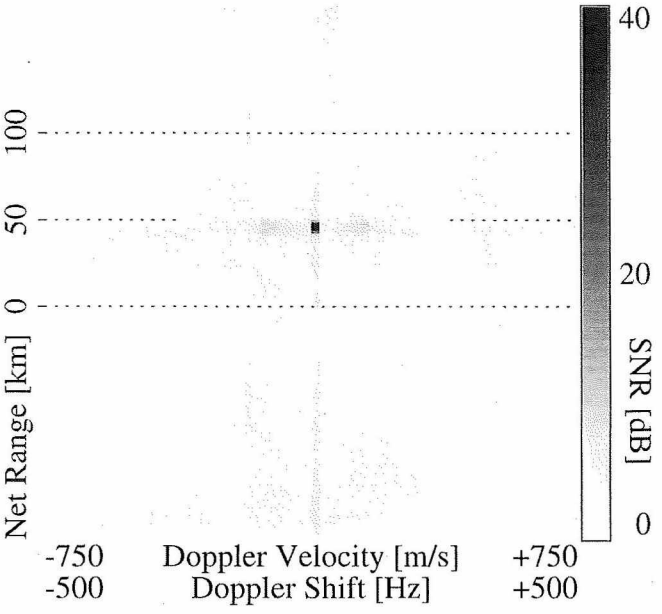


Figure 3

A cross ambiguity estimate from 10 seconds of data. The "excess range" and Doppler shift of potential targets is shown. For this example there is a single strong scatterer, which we believe to be Mt.~Rainier, a topographical feature which is visible to the transmitter and both receivers.

Although our radar may be among the first geophysical instruments to synthesize range-Doppler profiles in a completely passive sense, there have been several passive systems used for aerospace applications. Television and FM broadcasts have been used by the British Defense Research Agency [Howland-1994] and a commercially available system is available from Lockheed-Martin Federal Systems.

There have been other geophysically interesting passive systems which do not provide range resolution, but are otherwise coherent. Of particular note are the VLF beacon observations by [Pasko and Inan, 1994]. These systems are able to collect the reference and scattered signal at a single site because the ground wave and sky wave are significantly cross polarized. Because of the forward scattering geometry (and very low bandwidth of the transmitters) range resolution is not directly achievable. However, the propagation mode is strongly affected by D region absorption which closely tracks the solar terminator.

Russian scientists have observed the scatter of HF radio broadcasts from disturbed regions of the ionosphere heated by powerful transmitters on the ground [Beley et al., 1995]. Because the scattering process has relatively low Doppler content it is easily identified near the AM carrier, whose audio signal generates little content below 20 Hz.

In recent years investigators have developed a powerful new approach to ionospheric density mapping. Geographically dispersed receivers record the differential phase of stable dual frequency beacons on satellites. This differential phase is proportional to the column plasma density, and with enough intersecting sight lines a two dimensional cut of the ionospheric density can be reconstructed tomographically [Fremouw et al., 1992]. The technique is capable of deducing density structure above the plasma peak density. An older, related method involves measuring the scintillation of coherent radio sources to estimate parameters associated with turbulence in the middle ionosphere [Groves et al., 1996].

The experiments just mentioned use human generated radio broadcasts for geophysical imaging, but there are a few cases where natural illumination is also used. In ionospheric studies galactic radio sources near 30 MHz may be absorbed by significant ionization in the D region. The "imaging riometer" can track patches of ionization as they drift across the field of view near 85 km altitude. At extremely low frequencies, the interior of the Earth to depths of tens of km, may be imaged by carefully measuring the electric field at the Earth's surface and constructing a tomographic inverse based upon the variation of skin depth and penetration at different frequencies [Ogawa et al., 1996]. Although range information is not directly available, this system is unusual in that a natural source can serve as a coherent illuminator for detailed and tomographically resolved range information.

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2. should have a paper, of which he or she is the principal author, submitted for oral or poster presentation at a regular session of the General Assembly;

3. should hold a Ph.D. if older than 28 years, or have equivalent research experience as evidenced by a list of publications or contributions to conferences. This condition may be waived in the case of some applicants from developing countries.

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Annual Report for 1997 from ISES

1. Introduction

The International Space Environment Service (formerly named the International Ursigram and World Days Service IUWDS) is a joint service of URSI, IAU and IUGG and a permanent service of the Federation of Astronomical and Geophysical Data Services (FAGS), provides rapid information to the world community to assist in the planning, coordination and conduct of scientific and other work affected by the sun-earth environment.

Three basic mechanisms have been selected to accomplish this program. Firstly, ISES prepares the International Geophysical Calendar each year. This calendar gives a list of "World Days" which scientists are encouraged to use for carrying out their experiments. The calendar is prepared for ISES by the World Data Center-A for Solar Terrestrial Physics in Boulder, USA. The calendar is distributed widely to the scientific community and is also published in a number of journals.

Secondly, there is the International Ursigram Service for assisting those who need a specific state of solar activity, earth atmosphere or magnetosphere at the time of their experiment. Both programs are very flexible and can be easily adjusted to fit the needs of the scientific community.

Thirdly, ISES arranges Solar Terrestrial Prediction Workshops bringing together scientists, solar terrestrial forecasters, and users of forecasts to advance the science of forecasting. Such workshops were held in Boulder (1979), Meudon near Paris (1984), Leura near Sydney (1989), and Ottawa (1992). Each workshop resulted in a collection of papers - the Workshop Proceedings - being published and becoming important reference material for the field.

In addition, on behalf of COSPAR, each month ISES summarises the status of satellite orbits around the earth and of space probes in the interplanetary medium in the Spacewarn Bulletin. Future launches are announced, actual launches are reported, new satellites receive an international designation, decays in the earth atmosphere are predicted and announced, and finally series of satellites useful for international participation are listed. This bulletin is produced by the World Data Center-A for Rockets and Satellites at the Goddard Space Flight Center in Greenbelt, USA.

Indications are that the new solar cycle - Cycle Number 23 - will be of large amplitude, comparable to recent near record cycles. This level of activity, combined with the increasing sensitivity of modern technology, emphasises the relevance and importance of the services co-ordinated by ISES.

2. The International Ursigram Service

The International Ursigram Service operates through a number of Regional Warning Centres (RWC) scattered all around the world. Warning Centres are located in : Beijing (China), Boulder (USA), Moscow (Russia), Paris (France), New Delhi (India), Ottawa (Canada), Prague (Czech Republic), Tokyo (Japan), Sydney (Australia) and Warsaw (Poland).

In its own geographic area, each RWC collects data available concerning the state of the sun-earth environment. In some cases, these come from observatories operated directly by the Regional Warning Centre. In many cases, they are gathered from regional scientific institutes and universities.

These data and reports are coded according to the ISES code book and distributed daily, on request to users and to other RWCs. Data exchange is generally via a daily, or more frequent, message sent either by electronic mail or by facsimile transmission. Electronic transfer of data is also used to relay larger image files.

Information transmitted through the ISES network is analysed by Regional Warning Centres which produce a number of "summary" reports and forecasts. The "Geoalert", a forecast of solar-geophysical conditions for the next few days, is a particularly important one of these reports. Each RWC prepares its own forecast ("Geoalert") and sends it to the World Warning Agency (WWA) in Boulder each day. The WWA then issues a Geoalert which is distributed worldwide each day at 0300 UT through the ISES network.

3. Publications

The International Geophysical Calendar is distributed free of charge throughout the world. The present distribution is approximately 2000 copies produced at a nominal cost.

The Spacewarn Bulletin is also distributed free of charge throughout the world and the information is now available through an electronic bulletin board system.

The Geoalerts and the abbreviated Calendar records are published monthly in "Solar and Geophysical Data" produced and distributed by World Data Center-A for Solar Terrestrial Physics in Boulder, USA.

The daily Geoalerts and Ursigram messages are "real-time" information and only a summary is printed as the "ISES Alert Periods" in the Solar-Geophysical Data Books published by World Data Center-A. However, the production and distribution of Ursigrams is a very important part of the current expenses of the RWCs. This expense is borne by the host institutions.

The ISES Code Book has been updated and reprinted in a loose leaf format. Further updates occur on a regular basis as new codes are introduced or existing ones are changed. The updates are supplied to RWCs for distribution as required.

4. Recent ISES Activities

4.1. Proceedings of the 1996 Solar Terrestrial Predictions Workshop

ISES has sponsored five predictions workshops - Boulder in 1979; Paris in 1984; Sydney in 1989; Ottawa in 1992; and Hitachi Japan in 1996. The purpose of the meetings is to bring together scientists who study the solar terrestrial environment, forecasters who predict conditions, and the users of forecasts. By getting these people together ISES expects to improve the quality of forecasts and their value to the user community.

The papers from the last Workshop have been collected into a publication - the Workshop Proceedings. This serves as valuable reference material for all of those people interested in the solar terrestrial environment and its prediction. These proceedings will be available in early 1998 and will be distributed widely in the scientific and user community.

4.2. ISES Steering Committee Meeting

The next meeting of the ISES Steering Committee will be held in conjunction with the meeting of COSPAR to be held in Japan during July 1998.

4.3. Location and Timing of Next Predictions To Be Decided

The location and the timing of the next ISES Predictions Workshop will be determined during 1998. In accord with views expressed at the last meeting, this Workshop is likely to take place in 2001.

4.4. Solar Cycle Progress"

ISES activities are dictated to a great extent by the solar cycle and hence the outlook for the new solar cycle is of great interest to it.

The majority opinion of ISES centres of the outlook for the new solar cycle is that it will be large; an amplitude of around 160 is suggested making it comparable to the last two cycles and, as those cycles were, counted amongst the largest on the historical records. The cycle is expected to reach its peak early in the year 2000.

4.5. ISES Home Page on the Web

ISES has a home page on the Web and this contains information about ISES and its Warning Centres, copies of the ISES code book, and references to the home pages of ISES centres. The page is a good way to navigate the Web to obtain space environment services. The address for the page is: **http://www.sec.noaa.gov/ises/ises.html**

Dr. Richard Thompson

CONFERENCE REPORTS

BEACON SATELLITE SYMPOSIUM 1997

Sopron, Hungary, 30 June - 5 July 1997

The Beacon Satellite Symposium 1997 was held from June 30 to July 5 at Sopron, Hungary. The Local Organization Committee was chaired by Prof. Dr. P. Bencze of the Geodetic and Geophysical Research Institute of the Hungarian Academy of Sciences, the Programme Committee by Prof. Dr. Reinhart Leitinger of the University of Graz, Austria.

The Beacon Satellite Symposium 1997 was sponsored by URSI through its Commission G (Ionospheric Radio and Propagation) and organized by its Working Group G 2 (Studies of the Ionosphere Using Beacon Satellites), therefore it was considered an URSI-generated meeting. It was sponsored by the Hungarian National Committee of URSI and supported by the Hungarian Academy of Sciences. Organizers and participants wish to thank the following for financial support contributing to the success of the Symposium: URSI-Commission G, Hungarian Academy of Sciences, United States Air Force European Office of Aerospace Research and Development. Indirect support by our institutions (communication costs, copying, part of the printing costs, etc.) is gratefully acknowledged.

The Symposium was attended by 35 participants from 15 countries, among them were 8 young scientist and graduate students. 38 papers were given orally, 6 were presented as posters. Written versions of the majority of the papers will appear in the journal "Acta Geodetica et Geophysica Hungarica" (guest editors: P. Bencze and R. Leitinger).

The Call for Papers had listed the following primary topics: 1. Ionospheric tomography with emphasis on results and including "space tomography"; 2. Electron content from networks of GNSS (Global Navigation Satellite System) receivers - replacement of classical methods (Faraday effect on signals of geostationary satellites) - data for nowcasting applications - data for near real time modelling; 3. Electron content as input for regional and global ionospheric models; 4. Progress in scintillation modelling with emphasis on satellite to satellite propagation; and 5. New experiments and requirements of novel applications of transionospheric propagation of radio waves.

All topics with the exception of scintillation on satellite to satellite links were dealt with either through presentation of papers or in the discussion sessions. The number of presentations related to ionospheric tomography was less than anticipated. One reason was "competition" by other meetings (including the URSI General Assembly at Lille), but financial restrictions probably played a larger role. Five research groups with strong interest in ionospheric tomography had announced participation but had to withdraw: two from Russia, one from Ukraine, two from the USA. The funding situation was given as withdrawl reason in the case of the Russian, the Ukrainian, and one of the USA institutions.

A pre-meeting was held at the University of Graz on the occasion of "50 years of ionospheric research at the University of Graz". One of its purposes was a discussion of the beacon satellite situation, especially in view of the necessity to make use of Global Navigation Satellite Systems (GNSS - presently the US system GPS and its Russian equivalent GLONASS).

Traditionally both presentation of papers and discussion of results from ionospheric research is considered important, the latter not only in the frame of the official sessions, but also during coffee and lunch breaks and in the evening. The opportunity to exchange results, plans, opinions on an individual basis is a very important part of a meeting. The arrangements in Sopron provided an excellent frame for this purpose. Official discussion sessions were included in the programme too: one on the results of the pre-meeting in Graz, the other on the availability of satellite radio beacons in the future and on the consequences of making use of beacon observations made by other organizations, e.g., by means of the Global Positioning System (GPS). Among others the discussion resulted in giving an official basis to the compilation of information on the "calibration" of electron content derived from GPS observations and on the achievable accuracies. A report is in preparation and will be available in the first quarter of the year 1998.

The Business Session of URSI Working Group G2 ("Beacon Satellite Group") reviewed once again the link to URSI Commission G and the internal structure of the Working Group with the conclusion that no changes are necessary. An other important topic was time and location of the next Beacon Satellite Symposium. In view of the continuing need for international cooperation and in view of the success of the Symposia, including especially BSS97, the group members present voted unanimously for a continuation of the Symposia series and for maintaining the traditional time interval of two to three years between

Symposia. Date and location remain in discussion: two invitations were issued but it was felt that a decision should be based mainly on estimates of maximizing access for colleagues both from developing countries and from East European countries. Therefore a decision will have to take into account travel and local expenses costs on the one hand and available financial support on the other hand. The latter is a matter of concern for the Beacon Satellite Group: we want to attract young scientists and traditionally beacon satellite studies have found nearly global distribution.

P. Bencze and R. Leitinger

ICPIG'97

Toulouse, France, 17 - 22 July 1997

The International Conference on Phenomena in Ionized Gases (ICPIG) is a biannual conference which covers most aspects of phenomena in ionized gases, with emphasis on low to moderate temperature plasmas. The tremendous growth in applications of low and moderate temperature plasmas (surface treatment, pollution control, microelectronics fabrication, and many others) makes this field dynamic, interdisciplinary, and rapidly evolving. The ICPIG series provides an international forum for presentation and discussion of fundamental physics of ionized gases and applied research underlying the newer as well as the more mature plasma-based technologies. There is no other international conference which covers the range of topics of the ICPIG.

The XXIII ICPIG was held on the downtown campus of the University of Toulouse, from Thursday, July 17, to Tuesday, July 22, 1997. This campus is located in the historic center of Toulouse, and the central location proved to be especially attractive to participants and their accompanying persons. Every effort was made to keep the cost low so that participants who could not attend the meeting in the USA for financial reasons were able to be present in Toulouse. The attractive location and the low cost were key factors in the large participation at the meeting.

The XXIV ICPIG will be held in Warsaw, Poland, in July 1999. Prof. Jerzy Wolowski (wolowski@ifpilm.ifpilm.waw.pl) is the chairman of the local organizing committee for the 1999 meeting.

The local organization was assured by members of two laboratories from the University of Toulouse, the Centre de Physique des Plasmas et Applications de Toulouse (CPAT) and the Laboratoire de Genie Electrique de Toulouse (LGET). Continuity from meeting to meeting and guidance are provided by the ICPIG International Scientific Committee (ISC) which meets annually.

The attendance at the XXIII ICPIG was larger than for the several previous meetings. A total of 561 participants from 36 countries took part in this meeting. Over 60 accompanying persons were present as well. One of the goals of the organization was to encourage student participation. To this end, low cost rooms were available for participants and the registration fee was reduced for students. These two factors were contributed to the large student participation (138 students were present). The generous support of the sponsors and contributors of the XXIII ICPIG enabled the Local Organizing Committee to support in full or in part a number of participants from Eastern European countries.

The technical sessions of the XXIII ICPIG consisted of invited talks and poster presentations. The invited talks were given in either plenary sessions (for general lectures of broad interest) or in parallel sessions (for more specialized topics) . The invited speakers were selected by the ISC. There were 31 invited speakers at the 1997 meeting, including 7 plenary lectures and 24 topical lectures. The international character of the ICPIG was reflected in the participation of 17 countries in the invited talks. The texts of the invited talks will be published early in 1998in a special issue of Journal de Physique III early in 1998.

There were 513 contributed papers presented in the form of posters at the meeting. The contributed papers themselves are short, a maximum of two pages in length, and these were printed and distributed to participants at the meeting. These ICPIG proceedings are organized in 5 volumes, one for each meeting day and a fifth one for 'late papers'. Additional copies of the proceedings are available and can be ordered from the conference scientific secretary, M.C. Bordage, CPAT, 118 route de Narbonne, 31062 Toulouse France. Contributed papers from the proceedings of the XXIII ICPIG will appear in the INSPEC data base.

The Penning Prize is awarded every two years, at the occasion of ICPIG, to an individual for work in the field of physics and technology of plasmas and ionized gases. The 1997 Penning prize, again sponsored by Philips Lighting, was awarded to Professor S. Takeda from Japan. The citation for the 1997 Penning Prize to Professor Takeda reads "for his many, long-standing contributions to the field of plasmas and ionized gases, and in particular, for his work on an extension of Paschen's law to high-frequency discharges and waves in plasmas". Professor Takeda accepted the Penning Prize, consisting of $1000 and a certificate, and presented a lecture on gas discharge work in Japan. He also received a gold medal from the city of Toulouse in recognition of his having been awarded the Penning Prize.

An industrial workshop has traditionally been organized to coincide with the ICPIG. This year the industrial workshop (Industrial Applications of Cold Plasmas), open to all registered participants of the ICPIG, was held in the

middle of the conference on Saturday afternoon. Six leaders in R&D in large companies accepted invitations to speak, and attendance at the workshop was very good. The topics convered included flat panel display technologies, plasma-based propulsion, plasmas for enviromental clean-up, and circuit breakers and switches.

In addition to the scientific program there were excursions for accompanying persons on three days and an excursion for all conference participants on Sunday. Other social events included the welcome reception on Wednesday evening, the conference banquet on Saturday and a reception at the Toulouse City Hall on Monday evening.

The success of this conference is due in part to the generous support of the sponsors. It is thanks to this support that the cost for participants was a minimum thereby allowing more people to attend. The organizers gratefully acknowledge the support of the following sponsors.

International Union of Pure and Applied Physics (IUPAP) Union Radio Scientifique Internationale (URSI) Mairie de Toulouse Conseil Général du Département de la Haute Garonne Conseil Régional de la Région Midi-Pyrénées Université Paul Sabatier Centre National de la Recherche Scientifique Association pour le Developpement de la Physique Atomique CRT Laser Plasma Commissariat à l,Energie Atomique (CEA), Cycle de Combustible Direction de la Recherche et Technologie (DRET) Electricité de France through the following organizations: Club Arc Electrique, Club Haute Température and Novelec

Industrial contributors : AGA S.A. Motorola Semiconducteurs S.A. Osram-Sylvania Inc Philips Lighting (for the Penning Award) Thomson Tube Electronics Schneider Electric

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ELECTROMAGENTICS IN MEDICINE

Chicago, Illinois, U.S.A., 3 - 5 November 1997

The third International Scientific Meeting on Electromagnetics in Medicine was held in Chicago, Illinois from 3 to 5 November 1997. This meeting was the third Scientific Meeting on Microwaves in Medicine. In the tradition of past meetings, this Scientific Meeting was sponsored by the International Union of Radio Science (URSI) through its Commission on Electromagnetics in Biology and Medicine (Commission K) and the Institute of Electrical and Electronic Engineers (IEEE) through its Microwave Theory and Techniques Society (MTT-S).

After observing the technology changes and receiving many feedbacks from attendees of the 2nd meeting and the 25th URSI General Assembly, we have decided to expand the meeting to cover both low and high frequencies instead of microwaves only. To reflect this expansion of the meeting's scope, we changed the name of the Scientific Meeting. The technical program was designed to render a broad coverage of the recent advances in the field of electromagnetics in medicine. A coordinated, single session format provided a comprehensive well-balanced scientific program. The International Scientific Meeting had become an outstanding forum for interdisciplinary discussion on key issues in research and technological development. It provided an opportunity to hear many interesting and challenging papers and learn a wide spectrum of new technologies and applications.

The meeting had a total of 76 attendees that include 21 students. The quality of presentationsand level of discussions were very high. All scheduled speakers (with the rare exception of two) showed up including Russian scientists. The technical program covered three full days. A single session format was adopted to encourage interdisciplinary dialogue. Sessions began on Monday morning and run through Wednesday afternoon . An invited lecture started the meeting at 9:00 am each morning on a topic of emerging interest. It was followed by sessions with six contributed papers each. Refreshments was available both mid-morning and mid-afternoon. The last session on Tuesday afternoon was a laboratory tours arranged for the benefit of registered participants and their guests. The organizers would like to take this opportunity to acknowledge the generous financial and material support of the International Union of Radio Science, the IEEE Microwave Theory and Techniques Society, the Motorola Corporation, the College of Engineering and the Department of Electrica.l Engineering and Computer Science of the University of Illinois at Chicago, and lastly the committee members and authors. Their collective effort has allowed this Scientific Meeting to become a reality General information regarding the Third International Scientific Meeting on Electromagnetics in Medicine was available on our WWW site.

The Winners of the young scientists paper competition were announced at the meeting banquet on Tuesday evening. They were : Dina Simunic - First Prize (University of Zagreb), D. S. Wu - Second prize (University of Illinois at Chicago), and Timothy Roberts - Third prize University of California at San Francisco).

Two technical (laboratory) tours were arranged for the benefit of registered participants and their guests. The Microfabrication Applications Laboratory (MAL) at the University of Illinois at Chicago is a research and development laboratory dedicated to the application of

integrated circuit and fiber optic technology to improve manufacturing methods for microfluidic, electromechanical, mechanical, chemical, optical and multi-functional devices, some of which have previously been built by more traditional techniques.

The Computer Assisted Visualization Environment (CAVE) Laboratory advances research in computer graphics and interactive techniques through its unique interdisciplinary blend of engineering, science, and art. EVL's current research emphasis is virtual reality. It is also involved in a number of related cutting-edge problems: multimedia; scientific visualization; new methodologies for informal science and engineering education; paradigms for information display; televisualization (distributed graphics over networks); algorithm optimization for massively parallel computing; sonification; and, abstract mathematical visualization.

An invited lecture started the meeting at 9:00 am each morning on a topic of emerging interest. Each lecture was scheduled for 40 minutes. The speakers and their subjects of the keynotes are Professor Thomas Senior on "URSI and bioelectromagnetics," Dr. Risto Ilmoniemi on "Recent Advances in Neuromagnetic Imaging and Stimulation," and Dr. Kenneth Carr, "Microwaves in Medicine." The titles of the technoical sessions were: Bioelectric Source Mapping and Imaging, Cardiac Therapy and Bioelectric Phenomena, Lightning Induced Damages and Electrical Injuries, Biomagnetic Stimulation and Measurement, MRI Modeling and Magnetic Stimulation, Medical Applications of Microwaves, Biological Effects and Health Protection, Dosimetry and Exposure Assessment, and a poster session entitled, Electromagnetics in Biology and Medicine.

James C. Lin
Chairman, Scientific Meeting

CONFERENCE ANNOUNCEMENTS

BIANISOTROPICS'98

Braunschweig, Germany, 3 - 6 June 1998

BIANISOTROPICS'98, an International Conference on Complex Media, will be held at the Technische Universität Braunschweig at Braunschweig, Germany from 3 to 6 June 1998.

The scope of the meeting encompasses a broad spectrum from fundamental theoretical work to technological applications for novel devices from the microwave to the optical regimes.

The conference will comprise 6 half-day sessions on a variety of research concerned with theory and applications of complex (i.e., chiral, anisotropic, bianisotropic, nonhomogeneous, nonlocal, nonlinear, random) media. There will be a mixture of special talks by key speakers, contributed papers and posters, and a round-table discussion in a multidisciplinary environment, bringing together applied mathematicians, physicists, engineers, material scientists from universities and industries.

The registration fee of DM 200,- (reduced rate of DM 100,- for students) includes one copy of the Proceedings, refreshments, and attendance at the social event. Assistance with accommodation arrangements will be provided by the organizers.

WWW

Up-to-date information about BIANISOTROPICS'98 is available on WWW at the address:

http://www.tu-bs.de/bian98/

Contact

Please address all correspondence and inquiries to

BIANISOTROPICS'98
Prof. Dr.-Ing. A.F. Jacob (Organizer)
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Tel: +49 - 531 - 391 2469
Fax: +49 - 531 - 391 5841
E-mail: chiral98@tu-bs.de

E-mail should be used for all correspondence whenever possible.

Mathematical Methods in Frequency Planning

Wroclaw, Poland, 23-25 June 1998

An URSI WGE1 Workshop on "Mathematical Methods in Frequency Planning" will be held in the city of Wroclaw, Poland, at the premises of the Wroclaw Technical University. It will be convened in the framework of the 14th International Wroclaw Symposium on Electromagnetic Compatibility, June 23-25, 1998.

The workshop stems from discussions at the General Assembly of the International Union of Radio Science (URSI), Lille, 1996. It is the first workshop of this kind organized by Working Group on Spectrum Management/ Frequency Utilization (URSI WGE1).

Programme Application of new mathematical tools is one of the most promising directions in solving RF spectrum congestion problems. At this workshop, selected new mathematical methods will be discussed, in view of their potential practical applications in frequency planning, in wireless telecommunication networks design, and in management of radio frequency spectrum.

Aim

This Workshop is intended to gather those interested in applied mathematics on the one hand, and those interested in solving practical spectrum management problems on the other hand. The aim is to exchange information and to stimulate new ideas.

Organisation

Dr. J. Finnie, UK Radiocommunications Agency phone (+44 171) 211 0043 fax (+44 171) 211 0053 email jsf@dircon.co.uk.
Dr. R. Leese, Oxford University phone (+44 1865) 271 698 fax (+44 1865) 271 768 email leese@maths.ox.ac.uk
Dr. R. Struzak, URSI WGE1, phone (+41 22) 361 0831 fax (+41 22) 3610831 email#1 ryszard.struzak@itu.int, email#2 ryszard.struzak@bluewin.ch

Participation

The Workshop is open to all scientists and engineers interested in the topic.

WWW

Web http:// www.emc98.wroc.pl

Contact

EMC Symposium & Exhibition
Mr. W. Moron, Symposium Organizing Chairman
PO Box 2141 PL-51-645 Wroclaw 14, Poland
phone (+48 71) 728812, fax (+49 71) 728878
e-mail emc@il.wroc.pl.

EMC'98 Roma

Rome, Italy, 14 - 18 September 1998

The 3rd International Symposium on Electromagnetic Compatibility will be held in Rome, Italy from 14 to 18 September 1998.

Organisation

Associazione Elettrotecnica ed Elettronica Italiana
Faculty of Engineering, University of Rome "La Sapienza"

Topics

1.EM Environment, 2.Transients, 3.ESD, 4.Lightning & EMP, 5.High Power Microwave, 6.Nonlinear System Behaviour, 7.EM Coupling, 8.Lines & Cables, 9.Shielding, 10.Filters, 11.Grounding, 12.Immunity, 13.Emission, 14.Numerical Modelling in EMC, 15.Neural Networks in EMC, 16.EMC Topology, 17.Design under EMC Constraints, 18.CAD for EMC, 19.EMC in Space Systems, 20.EMC in Avionic Systems, 21.Automotive EMC, 22.EMC in Railway Systems, 23.EMC in Automation Systems, 24.EMC in Information Systems, 25.EMC in Communication Systems, 26.EMC in Power Systems, 27.EMC in Power Electronics, 28.EMC Related to PCB & Chip Design, 29.EMC in Planar Integrated Circuits, 30.EMC in Interconnect & Packaging Structures, 31.EMC in Complex Large Systems, 32.EMC in Biomedical Devices, 33.EMC in Information Security, 34.Absorbers, Components & Materials in EMC, 35.Measurements & Instrumentation, 36.Anechoic Chambers & TEM Cells, 37.Standards & Regulations, 38.Spectrum Management & Engineering, 39.Human Exposure to EM Fields, 40.EMC Education, 41.EMC Management

Activities

- **Best Paper Awards**
- **Tutorials**
- **Workshops**
- **Technical Visits**
- **Technical Exhibition**
- **Social Activities**

Contact

Symposium Secretariat EMC'98 Roma
AEI-Ufficio Centrale Attn. Daniela Fioramonti
Piazzale R. Morandi 2, 20121 Milano, Italy
Tel: +39 2 77790205/218 Fax: +39 2 798817
E-mail: conferencesaei@aei.it
http://www.aei.it/emc98roma.html

ISSSE'98

Pisa, Italy, 29 September - 2 October 1998

"Co-Design of Radiocommunication Terminals: From Waves to Silicon through DSP"

It is likely that by the year 2010 the number of wireless communication links for information transmission will exceed the number of *wired* ones. Each and every wireless communications application, be it high-speed point-to-point or switched cellular, terrestrial or satellite-based, UHF or mm-wave, has benefitted in terms of spectral and power efficiency by advances in VLSI, microwave and Digital Signal Processing (DSP) components and techniques. The ultimate goal of the radiocommunication engineer is currently to exploit the *sinergy* of those advances through clever *co-design* of different, previously separately-designed subsytems., The Symposium will develop through parallel oral and poster sessions in the three main areas of *DSP-based Communication Equipments and Systems*, *VLSI Design and Components*, and *Microwave Theory and Techniques*.

Topics

• HW/SW co-design, • Modem Design, • Integrated modules and elements, • Signal Detection & Synchronization, • Data communication circuits, • Wireless Channel equalization, • Wireless transceivers, • 3rd Generation Wireless Radio Networks, • Digital signal processors, • Source & Channel Coding, • Advanced technologies for RF circuits, • Integrated Design Tools, • Hybrid μwave techniques, • Automotive Applications, • Broadband access systems, • Numerical & CAD Techniques, • DSP for smart antennas, • Satellite applications

Deadlines

Paper submission:	April 15, 1998
Notification of acceptance e-mailed:	June 1, 1998
Camera-ready due:	July 15, 1998

WWW

http://www.iet.unipi.it/ISSSE98

Contact

Organizing Secretariat, ISSSE'98
University of Pisa, Dept. Information Engineering
Via Diotisalvi 2, I-56126 PISA, Italy
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e-mail: incor@sirius.pisa.it

JINA'98

Nice, France, 17 - 19 November 1998

The tenth edition of the Journées Internationales de Nice sur les Antennes (JINA) will be held at the Acropolis Convention Center in Nice, France. As in previous editions, presentations will include invited conferences and convivial posters selected among submitted proposals.

Languages

French and English (with simultaneous translation).

Topics

* Theorical electromagnetism * Analytic and numerical techniques * Scattering and inverse scattering problems * Integration, coupling and interaction * Synthesis and optimization * CAD and expert systems
* Reflector antennas * Radiating elements and associated circuits * Frequency selective surfaces * Multifrequency and/or wideband antennas * Millimetre wave antennas * Array antennas
* Beamforming * Adaptive and signal processing antennas * Active and integrated antennas * Microstrip antennas
* Antennas for space applications * Antennas for mobile communications * Antennas for multimedia * Industrial applications * Medical applications * Measurements and instrumentation * Power handling
* Radar cross section

Special session: 9th European Electromagnetic Structures Conference (Radomes, IR-domes, Smart and Low-Observable Structures)

* Materials and manufacturing * Test and repair * Environmental aspects * RCS reduction and frequency selective surfaces (FSS) * Electromagnetic analysis and measurements

Deadlines

May 15, 1998 : submission of complete papers
July 15, 1998 : notification of accepted papers

Contact

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France Télécom/CNET
Fort de la Tête de Chien
F-06320 La Turbie, France
Fax : +33 4 92 10 65 19
E-mail : jina.cnet@wanadoo.fr

WWW

http://wwwelec.unice.fr/JINA-98/

COMMSPHERE'99

(English version overleaf)

Toulouse, France, 25-28 janvier 1999

SYMPOSIUM INTERNATIONAL SUR LE FUTUR DES TÉLÉCOMMUNICATIONS ET DE L'ENVIRONNEMENT ÉLECTROMAGNÉTIQUE

COMMSPHERE est un forum international rassemblant des scientifiques, des experts et des responsables d'administrations dans le but d'engager des discussions interdisciplinaires sur les défis soulevés par les télécommunications du futur ainsi que les autres utilisations du rayonnement électromagnétique. La conférence est organisée par l'URSI en collaboration avec l'UIT-R.

La conférence comprend une session d'ouverture, 5 demi journées de sessions plénières, 1 demi journée d'ateliers de travail en parallèle et une session de synthèse. Les actes des sessions plénières ainsi qu'une sélection des présentations effectuées au cours des ateliers seront publiés avant la fin de la conférence. Un compte-rendu de la session de synthèse paraîtra dans le *Radio Science Bulletin*.

Les contributions portent sur des sujets soigneusement sélectionnés de façon à appréhender des questions et des défis interdisciplinaires susceptibles d'influer sur le futur des télécommunications et des autres utilisations du rayonnement électromagnétique.

La possibilité, offerte aux participants, de procéder à un échange d'idées et d'expériences avec des représentants des instances décisionnelles est hautement profitable à l'ensemble des acteurs. Les conférences COMMSPHERE 1991, 1995, et 1997, se sont avérées d'une très grande utilité aux scientifiques, aux responsables d'administrations et aux industriels, et ont été considérées par l'UIT-R comme une préparation des CMR extrêmement utile.

Communications

Les sessions comprennent des exposés invités et des contributions. Des résumés d'une page doivent être adressés au secrétariat de la conférence avant le **14 août, 1998**. L'acceptation des contributions sera notifiée le **2 octobre, 1998**. Les articles (photo reproductibles) doivent être fournis pour **4 décembre, 1998**. Les conférenciers sont invités à prendre contact directement avec les organisateurs de sessions.

Sujets des sessions

1. Services scientifiques : radioastronomie, télédétection passive et active.
   (D. Breton, CNES, <Daniel.Breton@cnes.fr>)
2. La troisième génération des systèmes de communications personnelles de type cellulaires.
   (N. Spanjaard, CNET, <nicolas.spanjaard@cnet.francetelecom.fr>)
3. Systèmes de communications personnelles par satellite.
   (N. Lannelongue, Alcatel, <nlannelon.alcatel@e-mail.com>)
4. Technologies en vue d'améliorer l'efficacité spectrale des systèmes de communication par radio.
   (P. Delogne, UCL, <Delogne@tele.ucl.ac.be>)
5. Futurs systèmes de radiodiffusion sonore et télévisuelle à haute efficacité spectrale.
   (J.J. Delmas, TDF, <106167.2123@compuserve.com>,)

Sujets des ateliers

1. L'environnement électromagnétique
   (J. Hamelin, Ministère de l'Industrie, <joel.hamelin@industrie.gouv.fr>,
2. Systèmes de communications personnelles par satellite, y compris les problèmes de brouillage d'autres services.
   (D. Morris, IRAM, <Morris@iram.fr>; et N. Lannelongue, Alcatel, <nlannelon.alcatel@e-mail.com>)
3. Le débat UMTS-IMT-2000
   (N. Spanjaard, CNET, <nicolas.spanjaard@cnet.francetelecom.fr>)
4. Allocation des fréquences : utilisation possible de gabarits de la densité spectrale émise

Président :

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Dr. W.A. Baan, Pays-Bas
Prof. J. Bach Andersen, Danemark
Prof. Paul Delogne, Belgique
Dr. R. Jones, ITU-R, Suisse
Dr. A. Viterbi, EUA

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COMMSPHERE'99

Toulouse, France, 25-28 January 1999

(pour la version Française, veuillez voir la page précédente)

INTERNATIONAL SYMPOSIUM
ON THE FUTURE OF TELECOMMUNICATIONS
AND THE ELECTROMAGNETIC ENVIRONMENT

COMMSPHERE is an international forum of concerned scientists, experts and administrators, for interdisciplinary discussions of the challenges facing the future of telecommunications and other usages of the electromagnetic radiation. The conference is sponsored by URSI, in collaboration with ITU-R.

The conference is structured for an opening session, 5 half day plenary discussion sessions, 1 half day of parallel workshops and a summarizing session. Proceedings including contributions presented at the plenary sessions as well as selected presentations from the workshop sessions will be published during the conference. A report on the summary session will appear in *the Radio Science Bulletin.*

The presentations and the subjects are carefully selected so as to address current interdisciplinary issues and challenges likely to affect the future of telecommunications and other services.

The opportunity for the participants to exchange ideas and experience with the leaders influencing the line of events is highly beneficial to all parties involved. Previous COMMSPHERE meetings, in 1991, 1995 and 1997, have proven to be of great service to scientists, administrators and industries, and have been considered by the ITU-R as an extremely useful preparation for the coming WRC meetings.

Papers

The sessions will comprise both contributed and invited papers, focused on the topics. One page summaries should be sent to the secretariat no later than **August 14, 1998**. Authors will be notified by **October 2, 1998**. Photo ready manuscripts are due **December 4, 1998**. Authors are encouraged to contact the topic organizers.

Session topics

1. Science services: radioastronomy, passive and active remote sensing
   (D. Breton, CNES, <Daniel.Breton@cnes.fr>)
2. The third generation of cellular/personal communications
   (N. Spanjaard, CNET, <nicolas.spanjaard@cnet.francetelecom.fr>)
3. Satellite Personal Communications
   (N. Lannelongue, Alcatel, <nlannelon.alcatel@e-mail.com>)
4. Spectrum efficiency and enabling technologies for efficient spectrum usage (includes spectra of emissions, multiple access techniques, software analysis tools, filtering, linearization, coding, etc.)
   (P. Delogne, UCL, <Delogne@tele.ucl.ac.be>)
5. Future spectrum efficient sound and television broadcasting
   (J.J. Delmas, TDF, <106167.2123@compuserve.com>)

Workshop topics

1. The electromagnetic environment
   (J. Hamelin, Ministère de l'Industrie, <joel.hamelin@industrie.gouv.fr>,
2. Satellite personal communications, including interference problems with radioastronomy
   (D. Morris, IRAM, <Morris@iram.fr>; and N. Lannelongue, Alcatel, <nlannelon.alcatel@e-mail.com>)
3. The UMTS - IMT-2000 debate
   (N. Spanjaard, CNET, <nicolas.spanjaard@cnet.francetelecom.fr>)
4. Frequency allocations: from frequencies to frequency masks

Conference Chairperson :

Dr. Pierre Baüer
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Tel : 33 5 61 55 85 25, Fax : 33 5 61 55 85 00
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Dr. J. Shapira, Israel (Chair)
Dr. W.A. Baan, The Netherlands
Prof. J. Bach Andersen, Denmark
Prof. Paul Delogne, Belgium
Dr. R. Jones, ITU-R, Switzerland
Dr. A. Viterbi, USA

Program Committee :

Delogne P., UCL, Belgium (Chair)

Andersen J. Bach , Aalborg Univ., Denmark; Baan W.A., NFRA, The Netherlands; Bauer P., CESBIO, France; Beringuer B., Météo France, France; Bloch J.J., Aérospatiale, France; Bonek E., T.U. Wien, Austria; Breton D., CNES, France; Curbelie B., CNES, France; Delmas J.J., TDF, France; Dumont P., Matra Marconi Space, France; Evans J., COMSAT, USA; Hall M.P.M., Rutherford Appleton Lab., U. K.; Hamelin J., Ministère de l'Industrie, France; Hattori T., Soghia Univ., Japan; Itoh T., UCLA, USA; Kato S., UNIDEN, Japan; Lannelongue N., Alcatel Espace, France; Lazareff B., IRAM, France; Lefeuvre F., LPCE/CNRS, France; Morinaga N., Osaka Univ., Japan; Morris D., IRAM, France; Pickholtz R.L., G. Washington Univ., USA; Rancy F., ANF, France; Shapira J., Israel; Spanjaard N., CNET, France; Struzak R., Switzerland; Tawil V., MSTV, USA; Teissier J., IPBS, France; Veyret B., Univ. Bordeaux, France; Viterbi A., Qualcomm; USA; Whiteoak J.B., CSIRO, Australia; Wood D., EBU, Switzerland.

URSI cannot be held responsible for any errors contained in this list of meetings.

April 1998

Climpara'98
Ottawa, Ontario, Canada, 27-29 April 1998
Contact : Dr. R.L. Olsen, Communications Research Centre, 3701 Carling Avenue, PO Box 11490 Station H, Ottawa, Ontario, K2H 8S2, CANADA, Tel: +1 613-998 2564, Fax: +1 613-998 4077, E-mail: rod.olsen@crc.doc.ca, http://www.crc.doc.ca/climpara98

May 1998

1998 International Wireless and Telecommunication Symposium/Exhibition
Kuala Lumpur, Malaysia, 11-15 May 1998
Contact : Dr. Sathish Chandran, Ericsson Malaysia, P.O. Box 8851, Pejabat Pos Kelana Jaya, 46799 Petaling Jaya, Selangor, Malaysia, Fax +60 3-7087919, e-mail: sathish@pc.jaring.my

1998 International Symposium on Electromagnetic Theory (Commission B Triennial Open Symposium)
Thessaloniki, Greece, 25-28 May 1998
Contact : Prof. Chalmers M. Butler, Chair, 1998 URSI Electromagnetic Theory Symposium, Department of Electrical and Computer Engineering, 102 Riggs Hall, Box 340915, Clemson University, Clemson, SC 29634-0915, USA, Tel. +1 864-656 5922, Fax +1 864-656 7220, e-mail: cbutler@eng.clemson.edu, http://ece.clemson.edu/cem/ursi/announce.html

EUSAR'98 - European Conference on Synthetic Aperture Radar
Friedrichshafen, Germany, 25-27 May 1998
Contact : Dr. Richard Klemm, FGAN-FFM, Neuenahrer Straße 20, D-53343 Wachtberg, Germany, Tel. +49 228-9435377, Fax : +49 228-348 953, e-mail: r.klemm@fgan.de, http://www.eds.dofn.de/eusar/index.html

June 1998

Day on Diffraction '98
St. Petersburg, Russia, 2-4 June 1998
Contact : Dr. Valery E. Grikurov, Dept. Math. & Comp. Phys., Inst. on Physics, St.Petersburg University, Uljanovskaia 1, Petrodvoretz, Russia, Fax : +7 812-428 7240 and +7 812-298 4436, E-mail: grikurov@mph.niif.spb.su, http://snoopy.phys.spbu.ru/~grikurov/dd98/dd98.html

MMET'98 - International Conference on Mathematical Methods in Electromagnetic Theory
Kharkov, Ukraine, 2-5 June 1998
Contact : MMET'98, c/o Dept. Computational Electromagnetics, IRE NAS, Ulitsa Proskury 12, Kharkov 310085, Ukraine, Tel: +380 572-448595, -377380, Fax: +380 572-441105, -377380, -365968, E-mail: veliev@dut.kharkov.ua or alex@emt.kharkov.ua, http://www.intec.rug.ac.be/ursi/mmet98.html

Bianisotropics'98
Braunschweig, Germany, 3-6 June 1998
Contact : Prof. Dr.-Ing. A.F. Jacob (Organizer), Institut für Hochfrequenztechnik, Technische Universität Braunschweig, D-38092 Braunschweig, Germany, Tel: +49 531-391 2469 , Fax: +49 531-391 5841 , E-mail: chiral98@tu-bs.de, http://www.tu-bs.de/bian98/

International Conference on Telecommunications
Chalkidiki, Greece, 22-25 June 1998
Contact : Dr. I. Gragopoulos, Aristotle University of Thessaloniki, Greece, E-mail : itse@egnatia.ee.auth.gr, http://www.athena.auth.gr/ICT98.html

EMC Wroclaw'98 - 14th International Wroclaw Symposium on Electromagnetic Compatibility
Wroclaw, Poland, 23 - 26 June 1998
URSI Working Group E1 will organise a Workshop on "Mathematical Methods in Frequency Planning" during this conference.
Contact : EMC Symposium, Box 2141, 51-645 Wroclaw 12, Poland, Fax : +48 71-728878, e-mail: emc@il.wroc.pl, http://www.emc98.wroc.pl/

July 1998

CPEM98 - Conferences on Precision Electromagnetic Measurements
Washington, DC, U.S.A., 6-10 July 1998
Contact : Katherine H. Magruder, Conference Secretary, NIST, Bldg. 220, Room B162, Gaithersburg, MD 20899-0001, USA, Tel. : +1 301-975 4223; Fax : +1 301-926 3972; e-mail : katherine.magruder@nist.gov., http://www.eeel.nist.gov/cpem98/

IGARSS'98 - 1998 IEEE International Geoscience and Remote Sensing Symposium
Seattle, Washington, U.S.A., 6-10 July 1998
Contact : Tammy I. Stein, IEEE Geoscience and Remote Sensing Society, 2610 Lakeway Drive, Seabrook TX 77586, U.S.A., Fax +1 281-291 9224, Email tstein@phoenix.net, http://engine.ieee.org/society/grs/igarss.html

32nd COSPAR Scientific Assembly
Nagoya, Japan, 12-19 July 1998
Contact : COSPAR Secretariat, 51, Bd de Montmorency, F-75016 Paris, France, Tel. +33 1-4525 0679, Fax +33 1-4050 9827, E-mail : COSPAR@paris7.jussieu.fr, http://www.mpae.gwdg.de/COSPAR/COSPAR.html

August 1998

Vth International Suzdal Symposium on Modification of the Ionosphere by Powerful Radio Waves
Moscow, Russia, 26-29 August 1998
Contact : Prof. V.V. Migulin, Vth International Suzdal Symposium, Russian URSI Committee, Russian Academy of Sciences, Mokhovaja St. 11, 103907 Moscow, Russia, Fax +7-095 334-0124

September 1998

EMC Roma'98
Rome, Italy, 14-18 September 1998
Contact : Symposium Secretariat EMC'98 Roma, AEI-Ufficio Centrale, Attn. Daniela Fioramonti, Piazzale R. Morandi 2, I-20121 Milano, Italy, Tel. : +39 2-77790205/218, Fax : +39 2-798817, E-mail: conferencesaei@aei.it, http://www.aei.it/emc98roma.html

Physics and Engineering of Millimeter and Submillimeter Waves
Kharkov, Ukraine, 15-17 September 1998
Contact : Dr. A.A. Kostenko, Institute of Radiophysics and Electronics, National Academy of Science of Ukraine, 12 Acad. Proskura St., Kharkov 310085, Ukraine, Tel. & Fax +380 572-44 1105, E-mail : symposium@ire.kharkov.ua, http://www.intec.rug.ac.be/ursi/SMW98.html

URSI Commission F Triennial Open Symposium Wave Propagation and Remote Sensing
Aveiro, Portugal, 22-25 September 1998
Contact : Dr. Armando C.D. Rocha, Instituto de Telecunicaçoes, Universidade de Aveiro, 3810 Aveiro, Portugal, Tel. +351 34-370324, Fax +351 34-381128, E-mail : arocha@av.it.pt, http://www.av.it.pt/ursi/

ISSSE'98 - 1998 International Symposium on Signals, Systems and Electronics
Pisa, Italy, 29 September - 2 October 1998
Contact : Organizing Secretariat, ISSSE'98, University of Pisa, Dept. Information Engineering, Via Diotisalvi 2, I-56126 PISA, Italy, Tel. : +39 50-879740/879768, Fax : +39 50-879812, e-mail: incor@sirius.pisa.it, http://www.iet.unipi.it/ISSSE98

November 1998

IEEE-APS conference on Antennas and Propagation for Wireless Communications
Waltham, MA, USA, 2-4 November 1998
Contact : Prof. Tuli Herscovici, APWC98, 52 Agnes Drive, Framingham, MA 01701, USA, Tel. : +1 508-788 5152 , Fax : +1 508-788 6226, E-mail : tuli@tiac.com, http://www.tiac.net/users/tuli/apwc98/welcome.html

JINA 98 - Tenth International Symposium on Antennas
Nice, France, 17-19 November 1998
Contact : Secretariat JINA 98, France Telecom/CNET, Fort de la Tête de Chien, F-06320 La Turbie, France, Fax: +33 4-9210 6519, E-mail: jina.cnet@wanadoo.fr, http://wwwelec.unice.fr/JINA-98/

December 1998

Asia-Pacific Microwave Conference
Yokohama, Japan, 8-11 December 1998
Contact : Prof. Yoshio Kobayashi, Faculty of Engineering, Saitama University, Urawa, Saitama 338, Japan, Fax +81 48-857 2529, E-mail : yoshio@reso.ees.saitama-u.ac.jp

1999

January 1999

Commsphere'99
Toulouse, France, 25-28 January 1999
Contact : Dr. Pierre Baüer, CESBIO, 18, avenue Edouard Belin, F-31401 Toulouse Cédex 4, France, Tel : +33 5-6155 8525, Fax : +33 5-6155 8500, e-mail : pierre.bauer@cesbio.cnes.fr

February 1999

EMC Zurich '99 - 13th International Zurich Symposium and Technical Exhibition on Electromagnetic Compatibility
Zurich, Switzerland, 16-18 February 1999
Contact : Dr. Gabriël Meyer, Communication Technology Laboratory, Sternwartstraße 7, CH-8092 Zurich, Switzerland, Tel. +41 1-632 2790, Fax +41 1-632 1209, E-mail : gmeyer@nari.ee.ethz.ch, http://www.nari.ee.ethz.ch/emc/emc.html

August 1999

XXVIth URSI General Assembly
Toronto, Canada, 13-21 August 1999
Contact : URSI GA '99 Secretariat, National Research Council Canada, Ottawa, Ontario K1A 0R6, Canada, Tel. +1 613-993 7271, Fax +1 613-993 7250, E-mail : ursi99@nrc.ca, http://www.nrc.ca/confserv/ursi99/welcome.html

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News from the URSI Community

NEWS FROM URSI MEMBER COMMITTEES

UNITED KINGDOM

1998 QMW Antenna Symposium

The 1998 Queen Mary and Westfield College Antenna Symposium will be held from 22 and 23 April 1998 at the Queen Mary and Westfield College of the University of London in London, U.K.

Topics

The symposium provides an informal occasion for the presentation of contributions dealing with recent developments in the theory and practice of microwave antennas. Titles for papers are invited and as in previous years the Antenna Symposium welcomes contributions on all types of antennas but especially in the areas of Antenna Technology, Antenna Modelling and Antenna Measurement.

As in past years participants from both Academia and Industry are invited with the intention of attracting significant numbers of Reseach Students and Junior Research Workers.

WWW

http://www.elec.qmw.ac.uk/antenna/symposium.html

Contact

Dr. M.R. Rayner
Electronic Engineering Department
Queen Mary and Westfield College
Mile End Road, London E1 4NS, U.K.
Tel. +44 171-975 5340, Fax +44 181-981 0259
E-mail : m.r.rayner@qmw.ac.uk

UTC Time Step

On n'introduira pas de seconde intercalaire à la fin de juin 1998. La différence entre UTC et le Temps Atomique International TAI est:
de 1998 janvier 1, 0h UTC , jusqu'à nouvel avis :
UTC-TAI = -31 s

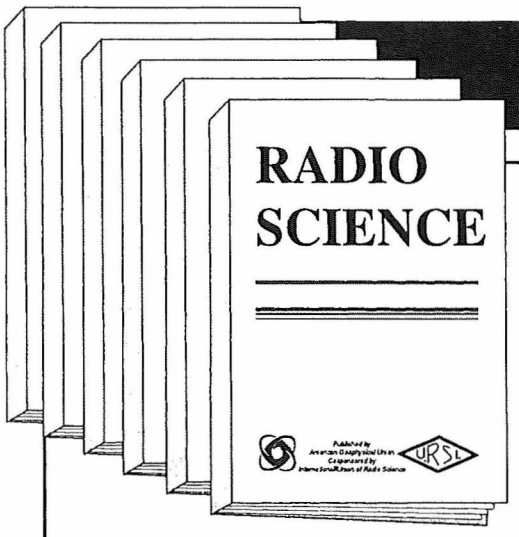
Des secondes intercalaires peuvent être introduites à la fin des mois de décembre ou de juin, selon l'évolution de UT1-TAI. Le Bulletin C est diffusé deux fois par an, soit pour annoncer un saut de seconde, soit pour confirmer qu'il n'y aura pas de saut de seconde à la prochaine date possible.

Daniel GAMBIS
Directeur, Bureau Central de l'IERS
Service International de la Rotation Terrestre

No positive leap second will be introduced at the end of June 1998. The difference between UTC and the International Atomic Time TAI is:
from 1998 January 1, 0h UTC , until further notice :
UTC-TAI = -31 s

Leap seconds can be introduced in UTC at the end of the months of December or June, depending on the evolution of UT1-TAI. Bulletin C is mailed every six months, either to announce a time step in UTC or to confirm that there will be no time step at the next possible date.

Daniel GAMBIS
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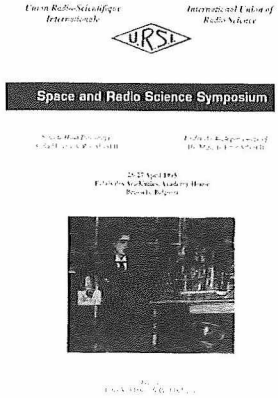
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URSI Publications

Proceedings of the "Space and Radio Science Symposium"

Editors: Peter Van Daele and Paul Delogne
ISBN 90-9008628-5



This "Space and Radio Science Symposium" was held on 26-27 April 1995, at the occasion of the 75th Anniversary of our Union.

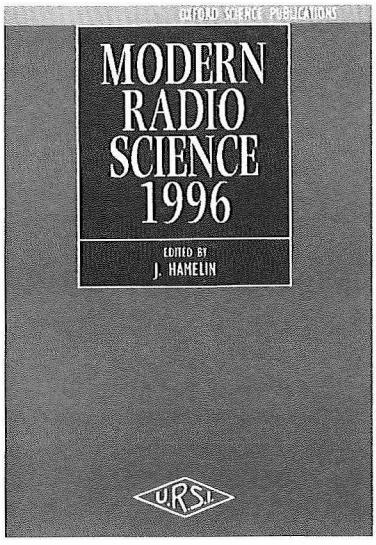
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* Prof. H. Matsumoto (Kyoto University, Japan)
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Modern Radio Science 1996

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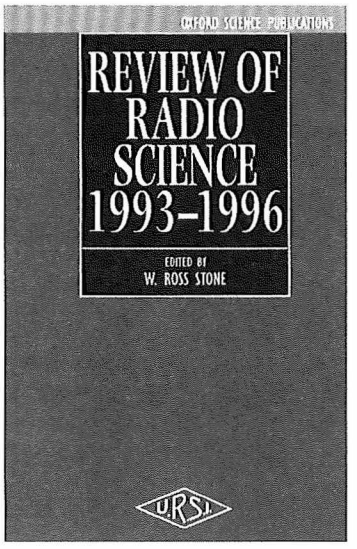


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Review of Radio Science 1993-1996

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Handbook on Radiopropagation Related to Satellite Communications in Tropical and Subtropical Countries

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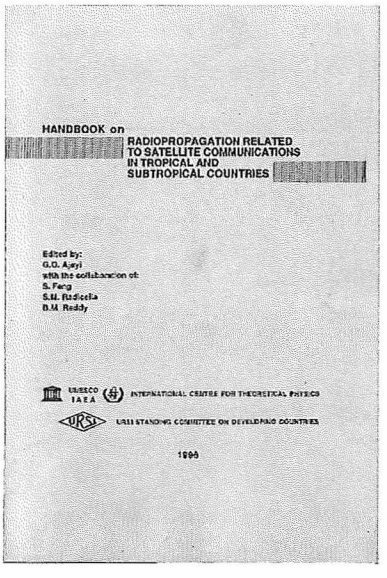


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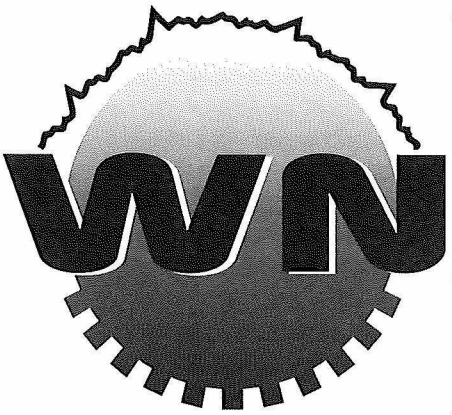
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