



# IRPS BULLETIN

Newsletter of the International Radiation Physics Society

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Happy Holidays  
from your IRPS  
executive council



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### **Editors**

R. Tosh    L. Hudson  
*Phone* : +1 301 975 5591                      *Phone* : +1 301 975 2537  
*email* : rtosh@nist.gov                      *email* : larry.hudson@nist.gov  
NIST, 100 Bureau Drive, Stop 8460  
Gaithersburg, MD 20899-8460, U.S.A.

### **Associate Editors**

D.C. Creagh                                      S.A. McKeown  
*email* :    *email* :  
Dudley.Creagh@canberra.edu.au              samsam.sm79@gmail.com  
Faculty of Education Science Technology and Mathematics  
University of Canberra  
Canberra ACT 2601 Australia

## MEMBERSHIPS

### **Membership Officer**

E. Ryan  
Department of Radiation Sciences  
University of Sydney  
75 East Street ,(P.O. Box 170)  
Lidcombe, N.S.W. 1825, Australia  
*email*: elaine.ryan@sydney.edu.au

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## From the Editors

Dear Reader,

As 2016 draws to a close, looking back it was a year of contrasts. The year has seen both nuclear dismantling and nuclear testing, rockets launched up and bombs dropped down, spacecraft circling Jupiter and solar-powered aircraft circling the Earth, 400 ppm of atmospheric CO<sub>2</sub> and a global-climate agreement, internet censorship in some areas and an internet littered with "fake news" in others.

Disturbingly, the Oxford English Dictionary has named "post-truth" the international word of the year 2016. And the growth of our reliance upon the internet and its myriad of alternative voices has helped facilitate the growth of unfiltered and sensational "post truths" while dismissing or devaluing evidence. In such a climate, the scientific research enterprise risks sharing in part of the collateral damage.

To state the obvious, IRPS stands for un-politicized science conducted as a rich international and collaborative activity. Most scientists have begun an investigation with a favorite hypothesis, only to have "reality" stubbornly steer us toward a clearer vision. No one claims that our models of the natural world are ultimate, but they are the best we have at present, and that is why they should provide the common basis for science policy and debate. Our field of Radiation Physics has much to contribute to the global community in 2017 including energy choices, biomedical applications, environmental sciences, security applications, advanced materials, *etc.*

It is with these assurances that we wish you tidings of comfort and joy in the new year.

*Larry Hudson and Ron Tosh, Editors*



## From the President

Dear Friends and Colleagues,

We live in momentous times. Many British and European scientists are surprised and extremely worried about the impending Brexit, and the effect on both scientific funding for those in Britain and Europe, and the social and collaborative relationships which we have enjoyed for many years. Many American scientists and 'friends of America' are surprised and extremely worried about the recent election outcome, and the effect on scientific funding, global economy and the social and collaborative relationships that we have enjoyed for many years. The overall funding situation in Australia remains extremely critical and indeed perhaps worse than either of the above. As you know, I have worked happily and successfully in the UK and USA, together with Germany during my D Phil, and a long-standing relationship with Tsukuba, and excellent experiments and visits to France and many other possibly affected places, and very good relations with China, for example; so I have a strong interest in positive outcomes.

So let's look forward! Our Society is based around education and collegial scientific meeting and exchange at many levels, and our recent on-line Council Meeting was well and enthusiastically attended, with many plans for exciting meetings and conferences coming up. While we have recently had a very successful ICDA-2 meeting in Surrey, UK, our IRRMA meeting next year will be in Chicago, USA (please note key dates for submission and registration on page 21 within), and the ISRP meeting the following year will be in beautiful Cordoba, Argentina. So we certainly depend upon good relations between countries of disparate backgrounds. And we are fortunate to do so.

We can and will hope that the effects of Brexit do not harm the ability of either side to interact on major experiments, cross borders, gain support and funding for excellent research; but of course this will require concerted constructive efforts from both sides in the international scientific community, and will also require that the relevant politicians are listening to the needs of their own constituencies and the research and education priorities for their nations. We also can and will hope that nothing would impair relations between the USA and its friends, for example. And similarly for other crises that may develop in areas of our membership.

Not to make too much of an effective quote by Benjamin Franklin, *Unite or Die*; or *Join or Die*, one of our purposes in this Society is to unite scientists who come from different backgrounds with a shared direction towards Radiation Physics.



**Join, or Die** drawn by Benjamin Franklin and first published in his *Pennsylvania Gazette* on May 9, 1754. The original publication by the *Gazette* is the earliest known pictorial representation of colonial union produced by a British colonist in America.

On a gentler note, it is almost Advent as I write this and the issue shall probably reach you almost in the holiday season, so I wish all members a happy and Holy holiday season, Christmas and Hanukkah.

Best wishes to all,

*Chris Chantler*

# Vice President's Report, Sultan Dabagov F.S.U.

## A review of the 7<sup>th</sup> International Conference Channeling 2016 - Charged & Neutral Particles Channeling Phenomena Sirmione - Desenzano del Garda, September 25 - 30, 2016

The international conferences "**Charged & Neutral Particles Channeling Phenomena - Channeling**", headed by the National Institute for Nuclear Physics (INFN, Italy) in collaboration with Italian and other world centres and research initiatives, are unique meetings devoted to the discussion of advances in the physics of coherent/incoherent scattering of relativistic and nonrelativistic hadrons and leptons (protons, ions, electrons, muons and related antiparticles) in strong electromagnetic fields of various origins and within structures that are amorphous and crystalline, laser or plasma. These phenomena can be described within the unique phenomenology of beam channeling, *i.e.* effective propagation of particle beams down channels limited by transverse potential wells.

The "Channeling" topics cover fundamental research aspects, from theoretical to experimental, together with several well-known techniques for applications in scientific instrumentation both for large-scale experiments at famous accelerator centres and for laboratory table-top studies. Channeling 2016 was organized by INFN together with CERN - the European Organization for Nuclear Research, and MPhI - the National Research Nuclear University, where intense studies on interaction of relativistic particle interactions in crystals have been performed for a long time.

The Programme Committee of Channeling 2016 accepted more than 200 contributions, oral and poster, including 18 invited reports on the activities led by the recognized centres and groups, and experts, and I would like to emphasize a growing level of presentations that cover known channeling-physics topics as well as several new channeling-related research branches.

The conference was organized into five sessions: Channeling & Radiations in Crystals, Channeling & Radiations in Various Fields, X-Rays/Neutrons/Atoms Channeling, Charged Beams Shaping, and Novel Sources: FEL/Laser/Plasma Channels (three poster sessions). A satellite "Channeling Primer" opening session was hosted by the Comune di Sirmione Del Garda in the PalaCreberg congress centre. Following kind greetings of the Vice-Sindaco of the Comune di Sirmione, there was the stimulating introduction of the President of INFN Prof. F. Ferroni, and four plenary lectures on the advances in accelerator and beam channeling applications and on the history of channeling physics by G. Dattoli, F. Zimmermann, J. Remillieux, and N. Kalashnikov. Following greetings by the rector of MSTU (Adyghya, RF) Prof. S. Kuizheva we were treated to ancient Adygha dances. In addition to the scientific program composed by the Channeling Primer and various conference's sessions, Channeling 2016 hosted two mini-workshops, the mini-workshop "**Simulation Techniques for Particle Dynamics in Ordered Structures**" and, already known, the **AGTaX - Advanced Generation of THz and X-ray beams** mini-workshop (the 8<sup>th</sup> edition).

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The "Channeling" Awards for the year 2016 for recognized research in the field were presented to Dr. Robert Chehab for his work on Novel Positron Sources based on Crystal Channeling Professor Hartmut Backe for his work on Channeling & Channeling Radiation of Relativistic Electrons, Professor Nikolay P. Kalashnikov for his contributions to the Physics of Electromagnetic Radiation by Charged Particles in Crystals, and to Professor Alpic R. Mkrtchyan for his work on Novel X-Ray Sources & Optics. In addition to the established experts in the field, the Sirmione's meeting has revealed a growing channeling community, especially due to the numerous participation of young researchers.



Previous editions of the "Channeling" conferences, starting from

Channeling 2004 .. [http:// www.lnf.infn.it/conference/channeling2004](http://www.lnf.infn.it/conference/channeling2004)

Channeling 2006 .. [http:// www.lnf.infn.it/conference/channeling2006](http://www.lnf.infn.it/conference/channeling2006)

were held at the National Laboratories of Frascati (LNF) and followed by

Channeling 2008 .. [http:// www.lnf.infn.it/conference/channeling2008](http://www.lnf.infn.it/conference/channeling2008) (Erice)

Channeling 2010 .. [http:// www.lnf.infn.it/conference/channeling2010](http://www.lnf.infn.it/conference/channeling2010) (Ferrara)

Channeling 2012 .. [http:// www.lnf.infn.it/conference/channeling2012](http://www.lnf.infn.it/conference/channeling2012) (Alghero)

Channeling 2014 .. [http:// www.lnf.infn.it/conference/channeling2014](http://www.lnf.infn.it/conference/channeling2014) (Capri)

and have demonstrated a growing interest of the researchers involved in continuously reinforced collaboration programs, some of which boast more than 35 years of history.

Since the first Channeling meeting we have prepared 10 books/special volumes of proceedings:

The proceedings of the Frascati conferences were published by SPIE - the International Society for Optical Engineering :

Proc. of SPIE, Vol 5974 [http://spie.org/x648.xml?product\\_id=634390&origin\\_id=x648](http://spie.org/x648.xml?product_id=634390&origin_id=x648)

Proc. of SPIE, Vol 6634 [http://spie.org/x648.xml?product\\_id=738020&origin\\_id=x648](http://spie.org/x648.xml?product_id=738020&origin_id=x648)

Those of the Erice meeting by World Scientific as a Special Issue of "The Science and Culture Series - Physics" : <http://www.worldscibooks.com/physics/7743.html>.

The Channeling 2010 proceedings were published by the Italian Physical Society as a Special Volume of Nuovo Cimento C : <http://www.sif.it/riviste/ncc/econtents/2011/034/04> as well as, separately, in book form as Channeling 2010 (SIF).

The main contributions to Channeling 2012 and Channeling 2014 were issued as dedicated volumes of Nuclear Instruments and Methods in Physics Research Section B : Beam Interactions with Materials and Atoms

<http://www.sciencedirect.com/science/journal/0168583X/309>

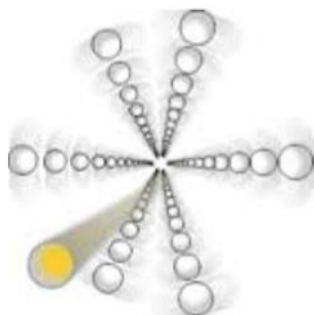
(v. 309 and v. 355), and in addition as books entitled "Channeling 2012" (MEPhI) and "Channeling 2014" (MEPhI), respectively.

Each of the proceedings was dedicated to a well-known physicist who in the past strongly contributed to the research in some specific branch of the physics of beam interactions in intense electromagnetic fields, delivering new ideas and knowledge to the community. Namely, the aforementioned books were devoted to the memories of Hans A. Bethe, Mikhail L. Ter-Mikaelyan, Jens Lindhard, Vitaly L. Ginzburg, Vladimir N. Baier, Giordano Diambri Palazzi, Muradin Kumakhov, respectively.

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The "Channeling" conference represents a tantalizing opportunity for a wide interdisciplinary community to gain information about present and future research projects in the field of relativistic/nonrelativistic beams and various radiation interactions in solids as well as radiation flux propagation in micro- and nano-channel structures of various origin and periodicity. In particular, this conference series has proven to be important both for experts and for young scientists with interest in undertaking new investigations following the development of next-generation accelerators and photon sources, as well as an excellent opportunity for exploring and discussing new international initiatives in beam shaping/penetration science, such as channeling of beams/radiation and related studies.

**Sultan Dabagov,**  
**Chairman of the "Channeling" conferences**  
**INFN Laboratori Nazionali di Frascati**  
**RAS P.N. Lebedev Physical Institute**  
**NR Nuclear University MEPhI**



## Daily Photo Gallery:



<https://yadi.sk/d/4VeC4dkivhuAj>



# What's in a name ? That which we call a meson \*

**S.C. Roy**

Formerly Vice-President (S-E Asia), International Radiation Physics Society  
Presently Editor, Applied Radiation and Isotopes  
and Editor-in-Chief, Science and Culture

**Juliet:**

"What's in a name? That which we call a rose  
By any other name would smell as sweet."

This is the well known and often used famous quote from Shakespeare's Romeo and Juliet. Romeo Montague and Juliet Capulet met and fell in love in Shakespeare's lyrical tale of struggling lovers despite belonging to warring families. Here Juliet tells Romeo that a name is an artificial and meaningless convention, and that she loves the person who is called "Montague", not the Montague name and not the Montague family. Romeo, out of his passion for Juliet, rejects his family name and was baptized as Juliet's lover. In contrast we see below how a name matters to scientists when a new particle was baptized to its present name that we now know as the 'meson'.

Cosmic rays are high-speed particles with very high energy. These are the highest energies of known individual particles in the universe. The energy spectrum of primary cosmic rays extends from 1 GeV ( $10^9$  eV) to above  $10^{20}$  eV. C.T.R. Wilson (1869-1959) who wanted to understand the formation of clouds under laboratory conditions suspected the existence of high energy radiation outside our atmosphere<sup>1</sup>. About a decade later, the Austrian scientist V.F. Hess (1883-1964) experimentally observed that with increase of altitude the intensity of ionising radiation increases in a dramatic way which he called as "*Höhenstrahlung*" (high altitude radiation) or "*Ultra-Gammastrahlung*" (ultra-gamma radiation)<sup>2</sup>. It was R.A. Millikan (1868-1953) who initially was sceptical about the existence of such rays<sup>3</sup> and later introduced the term 'cosmic rays'<sup>4,5</sup>. In 1929, W. Bothe (1891-1957) and W. Kolhöster (1887-1946) found that cosmic rays are not photons, but consist of charged particles. With the discovery of the atomic nucleus, physicists tried to understand the forces which keep a nucleus or rather its constituent particles - protons and neutrons - bound together. In order to explain the interaction between protons and neutrons Heisenberg and Fermi proposed theories, but the energy calculated based on their assumptions was too small to account for the binding energy of the nucleus (the energy required to keep the particles together).

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\*A similar article has been published in the October 2016 issue of DREAM 2047, a magazine published by Vigyan Prasar, Dept. of Science and Technology, Govt. of India, and used with permission.

On November 17, 1935 Japanese physicist Hideki Yukawa<sup>6</sup> (1907-1981) read a paper which was later published in the Proceedings of the Phys-Math Soc. Japan<sup>7</sup> in which Yukawa wrote:

"Now such interaction between the elementary particles can be described by means of a field of force, just as the interaction between the charged particles is described by the electromagnetic field. ... In the quantum theory this field [field of force] should be accompanied by a new sort of quantum, just as the electromagnetic field is accompanied by the photon. In this paper the possible nature of this field and the quantum accompanying it will be discussed briefly and also their bearing on the nuclear structure will be considered."

By taking a particular wave-length, Yukawa calculated the mass of quanta as 200 times as that of the electron mass (i.e. about 100 MeV). Yukawa was skeptical about the correctness of his theory, as he noted: "As such a quantum with large mass and positive or negative charge has never been found by the experiment, the above theory seems to be on a wrong line." A particle with a heavy mass was first discovered in 1936 and was named as mesotron, with the understanding that the mass of the particle is 'intermediate' between the mass of electron and proton (proton mass is 1836 times the mass of the electron). "Mesos' in Greek means 'intermediate'. According to the Wikipedia article<sup>8</sup> on mesons, it was W. Heisenberg who pointed out to Yukawa that there is no "tr" in the Greek word "mesos", thus Yukawa renamed the 'mesotron' as 'meson'<sup>8</sup>. Interestingly, Yukawa did not use the term 'mesotron' in any of his publications till the one published<sup>9</sup> in 1939. However, controversy grew up in naming the particle as 'mesotron' and 'meson' which can be looked upon as a conflict between American scientists versus the others.

Millikan was a strong advocate in naming the particle as 'mesotron'. The name was first proposed in print in a letter published in *Nature* dated 30 September 1938 by C.D. Anderson and S. H. Neddermeyer. On 7 December 1938, Millikan wrote a letter to the *Physical Review*<sup>10</sup>:

"After reading Professor Bohr's address at the British Association in last September in which he tentatively suggested the name 'yukon' for the newly discovered particle, I wrote to him incidentally mentioning the fact that Anderson and Neddermeyer had suggested the name 'mesotron' (intermediate particle) as the most appropriate name. I have just received Bohr's reply to this letter in which he says "I take pleasure in telling you that everyone at a small conference on cosmic ray problems including Auger, Blackett, Heisenberg and Rossi, which we have just held in Copenhagen, was in complete agreement with Anderson's proposal of the name 'mesotron' for the penetrating cosmic ray particle". "

Naming of this new particle was so varied that to settle the issue it was voted for and settled for 'mesotron' as has been found from the foreword written by A.H. Compton in the Proceedings of the Chicago Conference on cosmic ray physics held in June 1939. Compton wrote:

"An editorial problem has arisen with regard to the designation of the particle of mass

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intermediate between the electron and the proton. In the original papers and discussions (at the conference) no less than six names were used. A vote indicated equal choice between *meson* and *mesotron* with no considerable support for *mesoton*, *barytron*, *yukon*, and *heavy electron*. Except where the authors have indicated a distinct preference to the contrary, we have chosen the term *mesotron*."

However, the naming controversy was still haunting the scientists. It is known that H.J. Bhabha, M.H.L. Pryce et al. at a meeting in E. Bretscher's house in Cambridge agreed henceforth to use the word 'meson'<sup>11</sup>. It is to be noted in this connection that Bhabha in the meantime had received international recognition as one of the leading scientists in cosmic ray research for his detailed study on the meson lifetime and its consequences for cosmic ray phenomena. Bhabha, however, preferred to use the name meson. Bhabha sent a paper for publication in *Nature* under the title "The fundamental length introduced by the theory of the mesotron (meson)", keeping the option open in changing the name if required. Bhabha while sending the paper on 17 December, 1938 wrote to Bohr that he had called the new particle as meson. Dirac and other physicists in Cambridge found 'meson' better than 'mesotron'.<sup>12</sup> But if he (Bohr) were not agree with the name meson, Bhabha would be willing to change the name to mesotron and that the change could be made in the proof. The paper was published<sup>13</sup> in *Nature* in February 1939 with no change in the title. In the footnote Bhabha wrote his argument against the word mesotron as follows: "It is felt that 'tr' in this word is redundant, since it does not belong to the Greek root 'meso' for middle, the 'tr' in neutron or electron belong, of course, to the roots, "neutr" and "electra". ... It would therefore be more logical and also shorter to call the new particle a meson instead of mesotron." In the letter of December 17, 1938, Bhabha had informed Bohr about the footnote and the paper was published on February 18, 1939. This leaves no doubt that Bhabha was the first person who officially sealed the name meson for this particle.

And so it was settled for 'meson' until Millikan came back into the picture about six years later, when he wrote<sup>14</sup> to the Soviet physicist A. Alichanow on 14 February, 1945 that he was "particularly pleased to find you, contrary to the British and Indian scientists, writing 'mesotron' and not 'meson'". On 5 November, 1946, he reported the following to Robert Borde at the University of California, Berkley in connection with the history of the word 'mesotron'.

"I have no idea who started the use of "meson". A couple of years ago I wrote to Bethe, about the only man in this country who was using "meson", and asked him if he did not think it would not be desirable if we got together and tried to get some common usage."

Hans Bethe, in the meantime, suggested that "it might be well to keep the name 'mesotron' for the experimental thing and 'meson' for the theoretical". Millikan found it neither wise nor practical. He also reported in his letter to Borde that he "spoke to [W.F.G] Swann about this recently in

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Philadelphia and he feels very vigorously about it that the use of 'meson' is a very unfortunate one, not only because it violates all historical and etymological properties but is also so close in name to a word that has come in French to be used as a word for a house of ill fame, that he will not tolerate its use at all."

In 1946, M. Conversi, E. Pancini and O. Piccioni<sup>15</sup> showed that the "mesotron" which was discovered by Neddermeyer and Anderson, and by Street and Stevenson "was not the particle predicted by Yukawa as the mother of nuclear forces, but was instead almost completely unreactive in a nuclear sense"<sup>17</sup>. The controversy died down after the discovery of the  $\pi$ -meson and its subsequent decay to the  $\mu$ -meson, the latter one being the controversial mesotron which is now known as the muon.

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2. Carlson P., A century of cosmic rays, Phys. Today 65, 30-36, 2012.
3. Jackson D.P., Welker, M.T., Measuring and modelling cosmic ray showers with an MBL system: An undergraduate project, Am. J. Phys. 69, 896-900, 2001.
4. Friedlander M., A century of cosmic rays, Nature 483, 400-401, 2012.
5. In 1925 Millikan and G. Harvey Cameron did a series of experiments in deep snow-fed lakes at high altitudes in the California mountains. Millikan claimed that these measurements showed for the first time that cosmic rays were of extra-terrestrial origin and he began to call them cosmic rays. However his claim launched a famous controversy with European scientists, who claimed the discovery for Victor F Hess. See the book 'The origin of the concept of nuclear forces' by L.M. Brown and H. Rechenberg, IOP Publishing Ltd. 1996, p. 199.
6. After the Indian C.V. Raman, H. Yukawa was the second Asian to receive the Physics Nobel Prize, in 1949 "for his prediction of the existence of mesons on the basis of theoretical work on nuclear forces."
7. Yukawa H., On the interaction of elementary particles- I, Proc. Phys.-Math. Soc. Japan 17, 48-57, 1935.
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12. Courtesy Niels Bohr Archive, Copenhagen for H.J. Bhabha and N. Bohr correspondence.
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## Note from the Editors

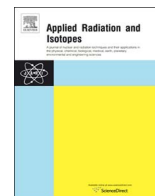
In the last issue of the Bulletin, the president's column promised a review of some of the key archival journals of interest to the membership. In that issue, the special emphases and selection criteria of the journal Radiation Physics & Chemistry (RPC) were reviewed by its current editor Christopher Chantler. Reviews of other high-profile international journals were promised, including explicitly Applied Radiation and Isotopes (ARI). As it happens, ARI is presently celebrating its 60th anniversary with a virtual special issue, which can be found at:

<http://www/journals.elsevier.com/applied-radiation-and-isotopes/virtual-special-issue/virtual-special-issue-to-celebrate-journals-60th-anniversary>

While the entire issue will be of interest to many of our members, the introductory editorial by Bert M. Coursey provides just the review and overview we were seeking for ARI.

**This is reprinted on the following pages (14 to 19)  
with permission from Elsevier.**

This article can also be found online at : <http://dx.doi.org/10.1016/j.apradiso.2016.10.013>



## Editorial

## 60 year anniversary of Applied Radiation and Isotopes



## 1. Introduction

2016 marks the 60th anniversary of the International Journal of Applied Radiation and Isotopes (ARI). The ARI founding father, Henry Seligman, has described the genesis of the journal at the *International Conference on Peaceful Uses of Atomic Energy* in Geneva in 1955 (Seligman, 1988). At the time, Seligman was Director of the Isotopes Division at the United Kingdom Atomic Energy Research Establishment (AERE), Harwell. His counterpart in the USA, who Seligman described as the “King of Isotopes” was Paul Aebersold, Director of the Isotopes Division of the US Atomic Energy Commission, Oak Ridge, TN. At the conference, they were approached by an enterprising young publisher, Robert Maxwell, who attended their session on isotopes and quickly persuaded them that they should form a scientific journal to promote peaceful uses of radiation and isotopes. Aebersold's lasting contribution to the journal was the choice of color scheme for the journal. The yellow and blue was a reminder of his Budgerigar parakeet! Seligman and Aebersold identified eight other leading scientists with a good geographical distribution to join them on the editorial board. No one was identified as editor in chief.

They also formed for the journal an Advisory Board of distinguished scientists in many disciplines. Among these were two Nobel Prize winners, John Cockcroft and George de Hevesy. Cockcroft shared the Noble Prize in Physics in 1951 with Ernest Walton for splitting the atom; their work with the *Cockcroft-Walton* proton accelerator on a lithium-7 target producing two helium nuclei (Cockcroft and Walton, 1932). de Hevesy, the Hungarian radiochemist, received the 1943 Nobel Prize in Chemistry for his work using radioisotopes as tracers, the first use being lead-212 as a tracer in agricultural studies. This was a nice touch for a journal on *radiation and isotopes* to have a Nobel Prize winner from each discipline on the Advisory Board.

Harwell and Oak Ridge, the two biggest suppliers of isotopes for the expanding world market, were soon joined by other federal laboratories with reactors and accelerators in France, the USSR, and Canada. A News and Notes section in the first issue gives details of schedules for isotope production in UK, USA, USSR and Austria. The editors thus had a great vehicle in the journal to promote sales of radioisotopes from their facilities. The publisher benefited from library subscriptions and paid advertisements from producers and suppliers to the growing nuclear industry. And, academic and industrial investigators now had a journal to showcase their new applications in the field.

The journal was launched in 1956 as one of the first titles of Pergamon Press. The preface to the first issue (Fig. 1) was written by Sir John Cockcroft. His editorial shows the unbridled enthusiasm coming out of the Geneva Conference on *Peaceful Uses of Atomic Energy*. He expresses the hope that the journal will stimulate progress in the science and technology of applied radioactivity and radiation.

It was important in 1956 to have the editors widely distributed geographically because manuscripts were submitted by post and it was not uncommon to receive packages from the far corners of the world consisting of tissue thin papers barely held together by scores of exotic postage stamps. (Considered an advantage if the editor happened to be a stamp collector.) It is not clear how the editors divided up duties for the first issue, but we do have an invitation to submit a manuscript from Paul Aebersold to Wilfrid B. Mann at the US National Bureau of Standards (NBS), which is shown here as Fig. 2. Mann had also worked for Cockcroft during and following WWII and Cockcroft had encouraged him to take a position in the Radioactivity Section at NBS. Mann submitted a paper on *The Preparation and Maintenance of Standards of Radioactivity* which was accepted and published on page 1 of volume 1 of ARI (Mann, 1956). Mann joined the editorial board in 1965.

Henry Seligman and Wilfrid Mann would define the course of ARI for the next 35 years. Entertaining articles on Seligman's colorful early career are contained in a special issue of ARI on the occasion of his 75th birthday (Maxwell, 1984; Rose and Mann, 1984) (See Fig. 3). In 1958 Seligman left Harwell to become Deputy Director General for Research and Isotopes at the IAEA. In 1973, he became the first Editor-in-Chief of ARI. As EIC for ARI and Deputy DG for the IAEA, he was in the ideal position to be the international advocate for applications of radiation and isotopes. Seligman, a physical chemist, welcomed Wilfrid Mann, a nuclear physicist, as Editor-in-Chief for North America in 1976. (See Table 1) Mann (See Fig. 4) also had a colorful early career, also detailed nicely in the contributions on the occasion of his 75th birthday (Coursey and McLaughlin, 1984) and in his autobiography, published by Pergamon Press (Mann, 1982). Seligman was the senior manager and administrator and used his world-wide contacts in the industrial nations and in the developing world to encourage contributions to the journal. Both Seligman and Mann spent time developing new editors, who were initially called “associate editors” until they proved their worth in soliciting good papers and applying judicious editing. Both shared a belief that authors from developing countries should be given encouragement, and they spent considerable time editing grammar as well as technical content.

Mann took a more focused look at ARI journal matters and had in some ways a more academic approach. He encouraged his staff, colleagues, and collaborators to submit articles to the journal (but that did not spare them from his wit and red pen when it came time to edit their papers).

<http://dx.doi.org/10.1016/j.apradiso.2016.10.013>

# Editorial

THE contributions of radioactive isotopes, used both as tracers and as sources of radiation, are already acknowledged in the pure and applied sciences. In medical diagnosis and therapy, in agricultural development, and particularly in industrial research and process control, tremendous strides have been made in the last decade through the use of radioactive methods.

Large fluxes of radiation, from radioactive sources and from particle accelerators, are now being used for such purposes as sterilization, the production and study of genetic mutations, and the initiation of chemical reactions.

The versatility of radioactive and radiation techniques has led to their use in a variety of specialist fields. Isotope methods, potentially of wide application, have tended to be published in a large number of scattered specialist journals where the results, rather than the method employed, have been emphasized.

It was evident at the recent International Conference on the Peaceful Uses of Atomic Energy that, in this as in other fields, much work had been duplicated in different parts of the world, through difficulties in keeping in touch with current developments.

This journal is intended to provide a forum for the publication and discussion of these techniques, for the reporting of news of general interest in the field, and for the promotion of international co-operation.

Thus it is hoped that the journal will stimulate progress in the science and technology of applied radioactivity and radiations, whose contributions to the welfare of mankind may well prove as far-reaching as those of nuclear power itself.

J. D. COCKCROFT

**Fig. 1.** Preface to volume 1 of ARI by Sir John Cockcroft, 1951 Nobel Prize in Physics.

Seligman and Mann worked together as Editors-in-Chief, but their very different approaches are apparent in that Mann had 38 citations for contributions in the journal over these three decades while Seligman had only two. Upon Seligman's death in 1993, his long-time protégé David M. Taylor from the UK, replaced him on the masthead as EIC. Taylor, a radiobiologist, had an illustrious career in Heidelberg and Karlsruhe in Germany and in Sutton in the UK. Taylor made valuable contributions to ARI over a period of 51 years until his death in 2015. Mann retired as EIC North America in 1988, and his replacement was his colleague, William L. McLaughlin, the world renowned expert on radiation dosimetry for high-dose applications (see [McLaughlin et al. \(1989\)](#)).

Over the past six decades ARI has published about 15,000 articles. It is difficult to assign an exact number because in the early years articles were accepted as Technical Notes as well as full articles. The editors made a decision as to whether the work warranted a full article, and sometimes authors were instructed to shorten their manuscript such that it could be acceptable as a Technical Note. This was sometimes painful to the authors but was probably necessary at the time to keep the page size for the issue in line with the production schedule and price of publication. Other counts of articles note “conference proceedings” as distinct from articles. Up until the 1980s it was sometimes negotiated with conferences that the entire proceedings would be published in one issue of ARI. The guest editors were responsible for refereeing and editing all contributions, and providing the typescript of the entire issue to the publisher. A member of the ARI Editorial Board was selected to oversee the entire process. This worked well when the guest editors did a conscientious job of editing, but the typescript usually did not look as good as galley proofs from the publisher. In addition, too many special issues had the effect of delaying publication for submitted manuscripts.

ARI was intended from the outset to be an “international journal.” It is remarkable that at the height of the Cold War a scientific journal was accepting papers from the USSR and the Western World. Mann's first article in the journal included abstracts in French, German, and Russian as well as English. Many early articles in the journal were published in French, German, and Russian, although today the journal is primarily in English.

ROOM 103, U.S.A.E.C. ADMINISTRATION BUILDING

Oak Ridge, Tennessee  
October 21, 1955.Dr. Wilfred Mann  
Radioactivity Section  
National Bureau of Standards  
Department of Commerce  
Washington, D.C.

Subject: INTERNATIONAL JOURNAL OF APPLIED RADIATION AND ISOTOPEs

Dear Dr. Mann:

At the time of the recent International Conference on the Peaceful Uses of Atomic Energy in Geneva, an independent meeting was held by leaders in isotope utilization to consider establishing an International Journal of Applied Radiation and Isotopes. The Pergamon Press, Ltd., 4 Fitzroy Square, London, W.1., agreed to publish and promote this new Journal. They plan to publish it quarterly on an international basis, with papers being accepted in English, French, German, and Russian. Abstracts of the papers will appear in the four languages and translations of any article will be provided by the press to subscribers on request.

An Editorial Board has been set up and consists of the following persons

U.K.	-- H. Seligman, W. V. Mayneord, J.L. Putman
U.S.	-- P.C. Aebersold, J.C. Bugher, H. R. Nelson
U.S.S.R.	-- K. Kursanov
France	-- J. Coursaget, M. Magat
Holland	-- A.H.W. Aten

In addition, an Advisory Board of scientists of international repute is being established by the Pergamon Press. The "Scope and Aims" of the Journal are summarized on the attached sheet.

The Press proposes to publish the first issue by March 1, 1956. It is planned that this issue will contain about 140 printed pages of which approximately 40 pages of U.S. contributions are requested. It was asked that this be split up into 3 or 4 articles. That would mean articles of 4,000 to 7,000 words each.

As a member of the Editorial Board, I have been asked to coordinate U.S. contributions for the Journal. The purpose of this letter is

Dr. Wilfred Mann

-2-

October 21, 1955.

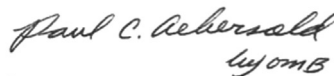
to inform you of this publication and to invite a contribution from you for possible inclusion in the first or second issue.

Because of your experience and excellent work in this field I feel sure that you will be able to make a very worthwhile contribution to this new International Journal. There is much interest in and general need for latest information on methods for standardizing the activity of radioisotopes. Would you give me an appropriate title of a paper on this subject and its approximate length (4,000 -7,000 words desired).

It should be both a recognition of your work and an international service to contribute to this Journal. The time for submission is not fixed yet but should be sometime in January 1956.

We sincerely hope you will furnish a contribution. I would appreciate hearing from you as soon as possible.

Very truly yours,



Paul C. Aebersold

Enclosure:  
Scope and Aims of the Journal

Fig. 2. 1955 invitation letter from Paul Aebersold to Wilfrid Mann.





Fig. 3. Henry Seligman, one of the founding editors of ARI. Courtesy International Atomic Energy Agency.

## 2. Scope and directions of ARI

The founders recognized that authors had other choices of journals in the broad fields of radiation and isotopes. Papers on accelerator engineering and solid-state radiation detectors usually went to *Nuclear Instruments and Methods Parts A and B*. Carbon-14 dating was such an important specialty that the journal *Radiocarbon* was established for papers on isotopic dating. Two important parallel journals from Pergamon Press were *Radiation Physics and Chemistry* (RPC) introduced in 1969 and *Nuclear Medicine and Biology* (NMB) in 1973. Brian Cox, the manager of sales for Pergamon Press has described Maxwell's strategy at the time of introducing new titles and using revenue from existing journals to support them until they developed a subscription base (Cox, 1998). In a move to increase subscribers, Maxwell and Cox decided in 1985 to re-brand the journals under the umbrella of the:

- International Journal of Radiation Applications and Instrumentation*
- Part A. Applied Radiation and Isotopes*
- Part B. Nuclear Medicine and Biology*
- Part C. Radiation Physics and Chemistry*
- Part D. Nuclear Tracks and Radiation Measurements*

The designs and color schemes of the covers were changed to give the journals the same look and feel. ARI remained yellow and blue, and the other journals had color covers from a similar palette. The newly renamed journals were published from 1986, although fortunately the volume

**Table 1**  
Editors in chief of the journal Applied Radiation and Isotopes 1956, to present.

Editor-in chief	Editor-in-chief North America
Henry Seligman Physical chemist Founder of board 1956 EIC 1973–1993	Wilfrid Mann Nuclear physicist Joined board 1965 EIC-NA 1976–1988
David Taylor Radiobiologist Joined board 1964 EIC 1993–2004	William McLaughlin Radiation physicist Joined board 1976 EIC-NA 1988–1998
David Bradley Medical physicist Joined board 1993 EIC 2004–2009	Bert Coursey Physical chemist Joined board 1977 EIC-NA 1998–2005
Richard Hugtenburg Medical physicist Joined board 2005 EIC 2009 – present	Brian Zimmerman Radiochemist Joined board 2003 EIC-NA 2005 - present

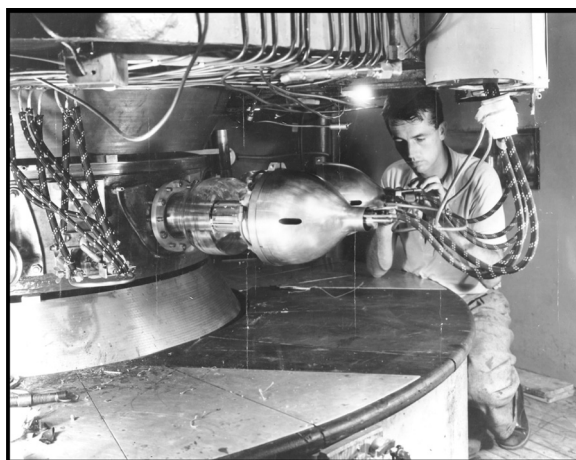


Fig. 4. Wilfrid Basil Mann in 1937 working with cyclotron in E.O. Lawrence's Radiation Laboratory in Berkeley.

numbering was retained from previous issues. The close partnerships of the four journals were strengthened by having editors and editors-in-chief serving on two or more journals. William Eckelman from the US National Institutes of Health took over as EIC of *Nuclear Medicine and Biology*, and Wilfrid Mann and Bert Coursey were added to the NMB editorial board. Mann prepared an exhaustive guideline for authors submitting papers to the four journals that was published in NMB (Mann, 1986). In addition to the usual admonishments to use the *Systemé International* (SI units of measurements) and IUPAC conventions, he included instructions intended to prevent authors from making all the errors he routinely corrected in English grammar, use of hyphens, and misuses of the word radioisotope. It was agreed (at least on the US side) that papers dealing with *in vivo* behavior of radiopharmaceuticals would go to NMB and those with *in vitro* applications could go to ARI. This was not uniformly adopted by all editors as some continued (as they do today) to accept nuclear medicine papers for ARI.

On the radiation physics and chemistry side, there was good coordination from the beginning as William McLaughlin (US), Arne Miller (Denmark), and John Hubbell (US) were frequent collaborators, with McLaughlin and Hubbell serving on the boards of RPC and ARI. When Pergamon Press was acquired by Elsevier B.V. in 1993, the first three journals reverted to their former names. Part D became *Radiation Measurements* in 1994. Current papers in that journal deal with radiation physics and solid-state dosimetry, and thus have some overlap with the scope of RPC.

### 3. ARI: the journal responds to evolving needs in applications for radiation and isotopes

Applications of radiations and isotopes have undergone tremendous change in the 60 years covered by the journal. Not all of the groundbreaking new applications have been published first in ARI. In most cases emerging applications have been published first in leading journals such as *Science*, *Nature* and *Physical Review Part C*. But ARI has often been fortunate to attract the follow-up papers which provide greater detail for the specialists.

The scope of the journal is so broad that papers span topics from radon concentrations in spa waters to treatment planning for radiation oncology. Still there are some disciplines, that use applications in radiations and isotopes that look first to ARI to present their work. Table 2 contains a listing of keywords and search results obtained using the PubMed search engine (National Institutes of Health, 2016). This is by no means an all-inclusive listing, and searches on keywords have obvious shortcomings; choices of keywords by authors have changed over six decades. Because of the name change in 1986, one has to search under the title *International Journal of Applied Radiation and Isotopes* for the first 30 years and simply *Applied Radiation and Isotopes* for the last 30 years. This turns out to be convenient, however, as we can see something of the trends in contributions to the journal in terms of the interests of the authors. There is also a nice correlation between Tables 1 and 2, in that we can see evidence of how the Editorial Board has had some success in steering the journal over the years.

The top three disciplines in Table 2 are dosimetry, radiopharmaceuticals, and radioactivity standards. These three communities of users consider ARI to present their papers, to organize scientific conferences, and to publish Special Issues devoted to specific topics. A good example of this is the McLaughlin special issue on dosimetry in 1982 (McLaughlin, 1982). This Special Issue was essentially a textbook on dosimetry, with chapters by the world experts in dosimetry from many fields. This was followed later by a Special Issue on electron-spin-resonance (ESR) dosimetry (Desrosiers and Skinner, 1993), which has evolved in recent decades from a research tool to a mainstay of industrial high-dose dosimetry.

One of the pioneers of nuclear medicine, Marcel Brucer from Oak Ridge, was on the ARI Board from the beginning. He was joined by David

Table 2

Number of citations identified by keywords in *Applied Radiation and Isotopes* using the PubMed search engine (NIH, 2016). Of the 15,000 contributions to the journal, 25% were published in the first 30 years and 75% in the last 30 years.

Keywords	1956–1985	1986–2016
Dosimetry	593	2080
Electron spin resonance	5	213
Medical physics	6	199
Radiopharmaceuticals	105	811
Positron emission tomography	17	331
Radioisotope production	72	388
Radionuclide standards	22	412
Environmental radioactivity	7	188

Taylor in 1964. The fields of nuclear medicine and biology include supporting technologies related to production of radionuclides, synthesis of pharmaceuticals, and the *in vivo* behavior of radiolabelled compounds. Brucer and Taylor took the lead in bringing these communities under the ARI umbrella. Taylor was the lead editor, with Michael J. Welch as Guest Editor, for the 1977 Special Issue on radiopharmaceuticals (Welch, 1977). At intervals of a few years, ARI has published a series of Special Issues dealing with specific radionuclides or applications; the most recent of these by the EIC North America, Brian Zimmerman, on gallium-68 calibrations for PET imaging systems (Mourtada and Zimmerman, 2013). One can see from Table 2 the effect of the technology that allowed more widespread use of PET imaging systems, and, correspondingly, more research papers related to radiopharmaceuticals for PET applications.

Wilfrid Mann was one of the founders of the *International Committee for Radionuclide Metrology* (ICRM), a worldwide organization for those interested in accurate measurements of radioactivity. ICRM is the forum for the world's radioactivity standards laboratories. From the early 1980s, Mann steered the working groups and conference organizers for ICRM to ARI to publish their proceedings. This has led radionuclide metrologists around the world to look first to ARI to present their work on standardization techniques for radionuclides. In addition to the proceedings of the biennial conferences of the ICRM, such as the Geel, Belgium meeting in 1983 (Coursey and McLaughlin, 1983), ICRM working groups in sub-disciplines, such as low-level counting and environmental radioactivity, have published in ARI (Mann, 1992). This accounts for some of the increase in papers in low-level counting in the past decades.

Medical physics is another major discipline that has turned to ARI in the past two decades. This has come about as a direct result of the EICs in the UK, David Bradley and Richard Hugtenburg. Before their tenure on the Board of ARI, papers dealing with radiation-therapy machines, treatment planning, and dosimetry were usually published in journals such as *Medical Physics* in the US and *Physics in Medicine and Biology* in the UK. Bradley was awarded the 6th JARI Medal for his scientific and editorial activities in medical physics in 2009. One can see from Table 2 that their work is having a pronounced effect on contributions from that very large segment of the research community.

#### 4. Summary

Those readers who have a library with the first bound copies of ARI may find it enjoyable to compare Volume 1, No.1 from 1956 with an issue from Volume 118 in 2016. The range of applications has shifted away from agricultural and industrial uses of radiation and isotopes to current topics such as PET, Boron Neutron Capture Therapy (BNCT), and Intensity Modulated Radiation Therapy (IMRT). But, one is immediately struck by the high quality of the science and technology, and the rigor in the presentation of results, which have been hallmarks of the journal for 60 years. With continued efforts from our authors and the Editorial Board, we can anticipate several more decades of excellence for ARI.

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Bert M. Coursey  
Gaithersburg, MD, USA  
E-mail address: bert.coursey@nist.gov

## Calendar - 2017

11 – 16 June, 2017

**RAD 2017**

**The Fifth International Conference on Radiation and Applications in Various Fields of Research**

**Slovenska Plaža, Budva, Montenegro**

*Further information and web contact details in Conferences below*

*Abstract submission date now commences 31 December, 2016*

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10 – 12 July, 2017

**IRRMA-X**

**10<sup>th</sup> International Topical Meeting on Industrial Radiation and Radioisotope Measurement Applications**

**Swissotel, Chicago, IL, USA**

*Further information and web contact details in Conferences on the following page of this Bulletin*

## Conferences - 2017



**FIFTH INTERNATIONAL CONFERENCE  
ON RADIATION AND APPLICATIONS IN VARIOUS FIELDS OF RESEARCH**

12. 06. - 16. 06. 2017 | Slovenska Plaža | Budva | Montenegro

The Fifth International Conference on Radiation and Applications in Various Fields of Research (RAD 2017)

will be held at the Slovenska Plaža Complex in Budva,  
which is the most famous place at the Adriatic Sea coast in Montenegro,  
in the period from June 11 to June 16, 2017

Submission of abstracts begins 31 December, 2016

<http://www.rad-conference.org/preRegistration.php>

RAD Conferences gather people from various fields of research (natural science, medicine, environmental protection, engineering, as well as social sciences and humanities), representing the right choice for biologists, chemists, physicists, medical doctors, environmental protection specialists, electrical engineers and many others who are in a way connected with ionizing and non-ionizing



<http://conferences.illinois.edu/irrama2017/>

# IRRMA X

10th International Topical Meeting on Industrial Radiation and Radioisotope Measurement Applications

IRRMA X • JULY 9 -13 , 2017 • CHICAGO, ILLINOIS, USA



## General Information

The International Topical Meeting on Industrial Radiation and Radioisotope Measurement Applications (IRRMA) is a triennial event organized with the purpose of bringing together scientists and engineers from around the world who share an interest in radiation and radioisotope measurement applications. Professor Robin P. Gardner of North Carolina State University was the founder of the IRRMA series of topical meetings and chaired the first and fourth meetings.

IRRMA X is being organized by the Department of Nuclear, Plasma, and Radiological Engineering at the University of Illinois at Urbana-Champaign. It will be held at the **swissôtel CHICAGO** in the heart of downtown Chicago, Illinois, USA from July 9-13, 2017.

It is devoted to current trends and potential future issues involving radiation and radioisotopes. The technical sessions will include invited lectures by leading experts in their fields, contributed oral papers and poster presentations of contributed papers. Attendees will have an opportunity to share ideas on industrial uses of radiation and radioisotopes, and also on research and applications in related fields such as Biomedical Applications of Radiation, Art and Cultural Heritage, Monte Carlo Methods and Models, Radiation in Environmental Sciences, Detection of Threat Material and Contraband, Radiation Protection, Shielding and Dosimetry, Radiation Effects on Materials, Radiation Detection and Measurements, and other topics.

We hope you will join us!

## Key Dates (tentative)

- Call for Abstracts opens: December 1, 2016
- Call for Abstracts closes: February 1, 2017
- Registration opens: February 1, 2017
- Abstracts approved & presenters notified by: April 1, 2017
- Early registration deadline: May 1, 2017
- IRRMA X Meeting: July 9-13, 2017



## **Contacts**



**Items for the Bulletin : Ron Tosh, Larry Hudson**

**Membership Enquiries : Elaine Ryan**

**Layout and distribution of the Bulletin : Shirley McKeown**

**Web Pages : Shirley McKeown**

Contact addresses for the above are listed in the IRPS information on page 2.

Internet Address : <http://www.canberra.edu.au/irps>

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Membership form for new members, and details for payments by cheque for new and renewing members are on the last 2 pages of this journal and information for payment by credit card is below

If you are unsure when your renewal is due, contact

Elaine Ryan

*email: [elaine.ryan@sydney.edu.au](mailto:elaine.ryan@sydney.edu.au)*

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Dr William L. Dunn

Department of Mechanical and Nuclear Engineering

Kansas State University

137 F Ward Hall, Manhattan, KS 66506, USA

*Phone : 785 532 5628*

*email : [dunn@mne.ksu.edu](mailto:dunn@mne.ksu.edu)*

# INTERNATIONAL RADIATION PHYSICS SOCIETY

The primary objective of the International Radiation Physics Society (IRPS) is to promote the global exchange and integration of scientific information pertaining to the interdisciplinary subject of radiation physics, including the promotion of (i) theoretical and **experimental research in radiation physics**, (ii) investigation of physical aspects of interactions of radiations with living systems, (iii) education in radiation physics, and (iv) utilization of radiations for peaceful purposes.

The Constitution of the IRPS defines Radiation Physics as "the branch of science which deals with the physical aspects of interactions of radiations (both electromagnetic and particulate) with matter." It thus differs in emphasis both from atomic and nuclear

physics and from radiation biology and medicine, instead focusing on the radiations.

The International Radiation Physics Society (IRPS) was founded in 1985 in Ferrara, Italy at the 3rd International Symposium on Radiation Physics (ISRP-3, 1985), following Symposia in Calcutta, India (ISRP-1, 1974) and in Penang, Malaysia (ISRP-2, 1982). Further Symposia have been held in Sao Paulo, Brazil (ISRP-4, 1988), Dubrovnik, Croatia (ISRP-5, 1991) Rabat, Morocco (ISRP-6, 1994), Jaipur, India (ISRP-7, 1997), Prague, Czech Republic (ISRP-8, 2000), Cape Town, South Africa (ISRP-9, 2003), Coimbra, Portugal (ISRP-10, 2006), Australia (ISRP-11, 2009), Rio de Janeiro, Brazil (ISRP-12, 2012) and Beijing, P.R.China (ISRP-13, 2015) The IRPS also sponsors regional Radiation Physics Symposia.

The IRPS Bulletin is published quarterly and sent to all IRPS members.

The IRPS Secretariat is : Prof. Jorge E Fernandez (IRPS Secretary),  
Laboratory of Montecuccolino, Department of Industrial Engineering (DIN)  
Alma Mater Studiorum University of Bologna  
Via dei Colli, 16 40136 Bologna, Italy  
Phone : +39 051 2087 718 Fax: +39 051 2087 747  
email: jorge.fernandez@unibo.it

**The IRPS welcomes your participation in this "global radiation physics family."**

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## INTERNATIONAL RADIATION PHYSICS SOCIETY

### Membership Registration Form

1. Name : \_\_\_\_\_  
(First) (Initial) (Last)

2. Date and Place of Birth : \_\_\_\_\_

3. Business Address : \_\_\_\_\_

(Post Code) (Country)

Telephone: \_\_\_\_\_ Email: \_\_\_\_\_ Fax: \_\_\_\_\_

4. Current Title or Academic Rank (Please also indicate if Miss, Mrs., or Ms.): \_\_\_\_\_

5. Field(s) of interest in Radiation Physics (Please attach a list of your publications, if any, in the field:

\_\_\_\_\_  
\_\_\_\_\_

6. Please list any national or international organization(s) involved in one or more branches of Radiation Physics, of which you are a member, also your status (e.g., student member, member, fellow, emeritus):

\_\_\_\_\_

../Continued

7. The IRPS has no entrance fee requirement, only triennial (3-year) membership dues. In view of the IRPS unusually low-cost dues, the one-year dues option has been eliminated (by Council action October 1996), commencing January 1, 1997. Also, dues periods will henceforth be by calendar years, to allow annual dues notices. For new members joining prior to July 1 in a given year, their memberships will be considered to be effective January 1 of that year, otherwise January 1 of the following year. For current members, their dues anniversary dates have been similarly shifted to January 1.

Membership dues (stated in US dollars - circle equivalent-amount sent):

Full Voting Member: 3 years	Student Member: 3 years
Developed country \$75.00	Developed country \$25.00
Developing country \$30.00	Developing country \$10.00

Acceptable modes of IRPS membership dues payment, to start or to continue IRPS membership, are listed below. Please check payment-mode used, enter amount (in currency-type used), and follow instructions in item 8 below. (For currency conversion, please consult newspaper financial pages, at the time of payment). All cheques should be made payable to :

**International Radiation Physics Society.**

( For payments via credit card - <http://www.irps.net/registration.html>)

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Amount paid (in U.S. dollars) \_\_\_\_\_

[ ] (in U.K. pounds): Send to Prof. Malcolm J. Cooper, Physics Dept., University of Warwick, Coventry, CV4 7AL, U.K.. Bank transfer details:  
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Eurochecks in U.K. pounds, sent to Prof. Cooper, also acceptable.  
Amount paid (in U.K. pounds) \_\_\_\_\_

8. Send this Membership Registration Form **AND** a copy of your bank transfer receipt (or copy of your cheque) to the Membership Co-ordinator:

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University of Sydney  
75 East Street, (P.O. Box 170)  
Lidcombe, N.S.W. 1825, Australia  
email: elaine.ryan@sydney.edu.au

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*Signature*

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*Date*