

*Welcome to*

ONLINE **ICRC 2021**  
THE ASTROPARTICLE PHYSICS CONFERENCE  
Berlin | Germany



37<sup>th</sup> International  
Cosmic Ray Conference  
12–23 July 2021

**12-23 July 2021**

# ICRC 2021

## Opening & Welcome Addresses:

- **Johannes Knapp**                      **Chairman, Local Organizing Committee,  
DESY, Zeuthen, Germany**
- 
- 
- **Sunil Gupta**                              **Chairman, IUPAP Commission C4,  
Tata Institute of Fundamental Research, India**

## Awards & Prizes:

- **IUPAP-Locus.sh Young Scientist Awards (2 Awards)**
- **Shakti P. Duggal Award**
- **O’Ceallaigh Medal**
- **Yodh Prize**
- **IUPAP-TIFR Homi Bhabha Medal and Locus.sh Prize**

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- **Johannes Knapp**                      **Chair, Local Organizing Committee, DESY, Zeuthen, Germany**
- **Anja Karliczek**                      **Federal Minister for Education and Research, Germany**
- **Christian Stegmann**                **Director, Astroparticle Physics at DESY, Zeuthen, Germany**
- **Uli Katz**                                **Chair, Committee for Astroparticle Physics, Erlanger, Germany**
- **Michel Spiro**                         **President, International Union of Pure & Applied Physics (IUPAP), France**
- **Sunil Gupta**                         **Chair of the IUPAP Commission C4, Tata Institute of Fundamental Research, India**

# ICRC 2021

## International Union of Pure and Applied Physics



### Message from the President, IUPAP

On behalf of the International Union of Pure and Applied Physics (IUPAP), I welcome you to the 37<sup>th</sup> International Cosmic Ray Conference. This conference is being organised under the auspices of the IUPAP Commission C4 on Astroparticle Physics. A major part of the mission of IUPAP is to foster international cooperation in physics. Sponsoring international conferences and assisting organising committees are some of the ways that IUPAP carries out this part of its mission. And there is no better example of this than the large number of collaborations that are characteristic of your field of cosmic rays.

I am happy to note that the C4 was one of the earliest Commissions to be constituted by the IUPAP in 1947 and that the IUPAP has been sponsoring the ICRC from its very first edition in 1947. I would like to bring to your notice that in 2022, we would be celebrating the centenary of the IUPAP. We have set up a special centenary committee to celebrate this even by hosting the centenary symposium next year in Geneva as well as several satellite meetings are being organised in different parts of the world. I invite you to take part in these centenary celebrations which incidentally would also coincide with the 75<sup>th</sup> anniversary of the C4. I hope that despite its virtual nature this conference will be a stimulating, informative and enjoyable experience for all the participants.



Prof. Michel Spiro  
IN2P3, France  
President, IUPAP

Michel Spiro  
President, IUPAP

## The IUPAP Mission:

- **To stimulate and promote international cooperation in physics**
- **To foster free circulation of scientists**
- **To foster the preparation and the publication of tables of physical constants**
- **To promote international agreements on other use of symbols, units, nomenclature and standards**
- **To encourage research and education**
- **To help in the application of physics toward solving problems of concern to humanity**
- **To sponsor suitable international meetings and to assist organizing committees**



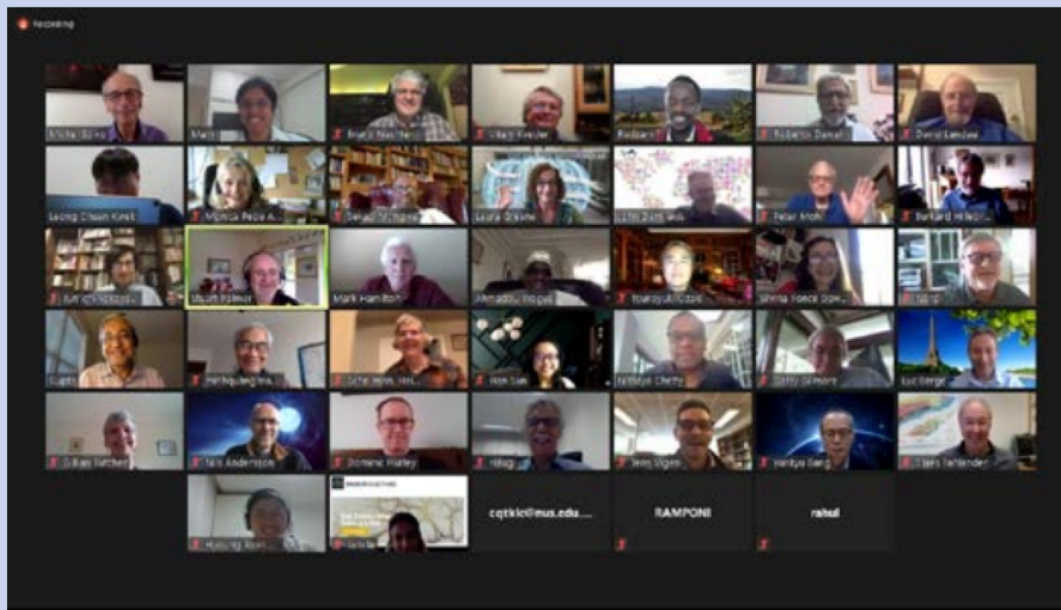
# Newsletter

DECEMBER  
2020

President: **Michel Spiro** • Editor-in-Chief: **Kok Khoo Phua** • Editors: **Maitri Bobba; Judy Yeo**  
IUPAP Office hosted & supported by: **NANYANG TECHNOLOGICAL UNIVERSITY, SINGAPORE**

Web: <http://iupap.org/newsletter>

## PRESIDENTS' NOTE



We are coming to the end of a very unusual year. In spite of the numerous difficulties that we have faced this year, we have made progress on several issues.

### Remote Council and Commission Chairs meeting

We held our annual IUPAP Council and Commission Chairs meeting in October 2020. The meeting was remote and spanned four days over two consecutive weeks. This allowed us the ability to define time windows of no more than three hours, which could accommodate the time differences between regions and to allow participants to digest the outcome of each session before entering into a new one. The format was found to be adequate and fruitful; while attendance was a success (more than 40). We had observers from Physics Societies representing different regions, with the idea of implementing joint activities (i.e. teaching Physics in Africa, America, Asia and Europe). The International Association of Physics Students was represented and could soon become an Affiliated Commission of IUPAP.

Newsletter has been designed by World Scientific Publishing in Singapore as well. The agreement ends at the end of 2020. We would like to use this opportunity to change the model. We are looking for different, hopefully, permanent locations for the Office, the bank account and legal entity, the website host as well as the organization in charge of the Newsletter. The changes should occur during the year 2021, while we are hosted temporarily by a different institution in Singapore. This would make IUPAP more stable and in a better position to organize matters and stay global if the different locations are well-distributed.

We now have good contacts with a company in India to host the website. Given the advantages of having the financial office in a major international financial centre, it is likely that the financial office will move to Geneva or remain in Singapore. We are currently seeking a new institution to host the administrative office. Publication matters may still

## IUPAP Commissions

- C1: Commission on Finance
- C2: Commission on Symbols, Units, Nomenclature, Atomic masses and Fundamental Constants
- C3: Statistical Physics
- **C4: Astroparticle Physics**
- C5: Low Temperature Physics
- C6: Biological Physics
- C8: Semiconductors
- C9: Magnetism
- C10: Structure and Dynamics of Condensed Matter
- C11: Particles and Fields
- C12: Nuclear Physics
- C13: Physics for Development
- C14: Physics Education
- C15: Atomic, Molecular, and Optical Physics
- C16: Plasma Physics
- C17: Laser Physics and Photonics
- C18: Mathematical Physics
- C19: Astrophysics
- C20: Computational Physics

Previously known as the Commission on Cosmic Rays established by the IUPAP in 1947 to promote the exchange of information and views among the members of the international scientific community in the general field of Astroparticle Physics.

Astroparticle physics is a new multidisciplinary field of research that deals with the study of particles coming from the Universe.

- Cosmic rays
- Gamma rays
- Solar and heliospheric physics
- Neutrinos
- Dark matter
- Multi-messenger

## IUPAP Commissions & Working Groups

- C1: Commission on Finance
  - C2: Commission on Symbols, Units, Nomenclature, Atomic masses and Fundamental Constants
  - C3: Statistical Physics
  - **C4: Astroparticle Physics**
  - C5: Low Temperature Physics
  - C6: Biological Physics
  - C8: Semiconductor Physics
  - C9: Magnetism
  - C10: Structure and Properties of Matter
  - C11: Particles and Nuclear Physics
  - C12: Nuclear Physics
  - C13: Physics for Development
  - C14: Physics Education
  - C15: Atomic, Molecular and Optical Physics
  - C16: Plasma Physics
  - C17: Laser Physics
  - C18: Mathematical Physics
  - C19: Astrophysics
  - C20: Computational Physics
- AC.1: International Commission for Optics
  - AC.2: International Commission for General Relativity and Gravitation
  - AC.3: International Commission on Acoustics
  - AC.4: International Commission on Medical Physics
  - WG.1: International Committee for Future Accelerators
  - WG.2: Communication in Physics
  - WG.5: Women in Physics
  - WG.7: International Committee on Ultrahigh Intensity Lasers
  - WG.9: International Cooperation in Nuclear Physics (ICNP)
  - **WG.10: Astroparticle Physics International Committee (ApPIC)**
  - WG.11: Gravitational Wave International Committee (GWIC)
  - WG.12: Energy



# ICRC 2021



## **C4 Mandate**

To promote the exchange of information and views among the members of the international scientific community in the general field of Cosmic Ray Physics including:

- The nature and characteristics of the electromagnetic, particle and other radiation present in the cosmos;
- The theory and models concerning the origin of this radiation;
- Non-accelerator high energy physics;
- The specialized technologies necessary in the field and their application

## **IUPAP C4 Commission (2018-2021) (Int. Advisory Committee for ICRC)**

Sunil K. Gupta (Chair)  
Adri Burger (Vice-Chair)  
Jörg R. Hörandel (Secretary)

Zhen Cao  
Yoshitaka Itow  
Ralph Engel  
Late Mikhail Panasyuk  
Ilya Usoskin  
Joakim Edsjö  
Christina M. Cohen  
Fiorenza Donato  
Veronique Van Elewyck  
Seon-Hee Seo  
Michael Kachelriess

### **Associate members:**

Imre Bartos  
Steven Barwick  
Takaaki Kajita

## The ICRC is the main conference organized and supported by C4

Further international conferences with C4 support:

TAUP, IDM, ISVHECRI, TeVPA, VLVnT, ...

Topics: cosmic rays, gamma rays, neutrinos, solar & heliosphere, dark matter, underground experiments, ...

Proceedings to all previous ICRCs will be available electronically on ADS this year, see [http://adsabs.harvard.edu/abs\\_doc/conferences1.html#](http://adsabs.harvard.edu/abs_doc/conferences1.html#) and at

<http://particle.astro.ru.nl/icrc/>

Thanks to the efforts of C4, especially Jörg Hörandel

# ICRC 2021

## Some statistics on ICRC 2021

- 1687 Registered delegates
- 1361 Abstracts received
- 51 Plenary talks
- +1 Public lecture
- Five parallel sessions

**International**      **Scientific**      **Program**  
**Committees**      tasked      with      the  
responsibility to recommend (1) plenary  
topics including speakers for highlight,  
review and rapporteur talks, (2) oral /  
poster presentations etc.

**First fully virtual ICRC**

# ICRC 2021

## International Scientific Program Committee (ISPC)

### **Luigi Tibaldo | GAD Chair**

Sara Buson  
Alessandra Corsi  
Jamie Holder  
Manuel Meyer  
Stefan Ohm  
Elena Orlando  
Roberta Zanin

### **Jim Hinton | GAI Chair**

Ulisses Barres de Almeida  
Eduardo de la Fuente  
Dominik Elsässer  
Reshmi Mukherjee  
Emma de Oña Wilhelmi  
Mohamed Rameez  
Brian Reville

### **Elena Amato | CRD Chair**

Xiao-Jun Bi  
Stephane Coutu  
Henning Gast  
Vladimir Ptuskin  
Pasquale Serpico  
Shoji Torii

### **Karl-Heinz Kampert | CRI Chair**

Stijn Buitink  
Ralph Engel  
Thomas Gaisser  
Hongbo Hu  
Kumiko Kotera  
Pravata Mohanty  
Hiroyuki Sagawa

### **Subir Sarkar | NU Chair**

Jenni Adams  
Joao R. T. de Mello Neto  
Dorothea Samtleben  
Sunny Seo  
Gregory Sullivan  
Christopher Wiebusch  
Stephanie Wissel  
Donglian Xu

### **Ilya Usoskin | SH Chair**

Veronica Bindi  
Eric Christian  
Stefan Ferreira  
Bernd Heber  
Toshiyuki Nonaka  
Gang Qin

### **Michael Kachelriess | MM Chair**

David Berge  
Ke Fang  
Kohta Murase  
Maria Petropoulou

### **Fiorenza Donato | DM Chair**

James Buckley  
Manfred Lindner  
Masaki Yamashita

### **Sabine Hemmer | O&E Chair**

### **Carla Aramo | O&E Chair**

Alba Fernández-Barral  
Carolin Schwerdt  
Julian Rautenberg  
Megan Grunewald

**ISPCs 8 committees, 56 members, 17 countries**

# ICRC 2021

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Johannes Knapp | DESY | Chair  
David Berge | DESY | Co-Chair

Sara Buson | UW  
Julia Eckert | DESY  
Ralph Engel | KIT  
Laura Fabbietti | TUM  
Anna Franckowiak | RUB  
Stefan Funk | FAU  
Henning Gast | RWTH  
Andreas Haungs | KIT  
Bernd Heber | CAU  
Jim Hinton | MPIK  
Karl-Heinz Kampert | BUW  
Alexander Kappes | WWU  
Uli Katz | FAU



Bianca Keilhauer | KIT  
Katrin Link | KIT  
Manfred Lindner | MPIK  
Thomas Lohse | HU  
Johannes Marquardt | CAU  
Razmik Mirzoyan | MPP  
Anna Nelles | DESY  
Martin Pohl | UP  
Elisa Resconi | TUM  
Markus Roth | KIT  
Marc Schumann | UF  
Ulli Schwanke | HU  
Masahiro Teshima | MPP  
Christian Weinheimer | WWU  
Christopher Wiebusch | RWTH

# ICRC 2021

On behalf of the participants and C4, I thank the members of the ISPC and LOC for managing a very tough and complex task very efficiently

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## Awards & Prizes

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- Shakti P. Duggal Award
- O'Ceallaigh Medal
- Yodh Prize
- IUPAP-TIFR Homi Bhabha Medal and Locus.sh Prize

**Once again a number of exceptional nominations were received !**

# ICRC 2021

## IUPAP-Locus.sh Young Scientist Award

... to recognize the research by young scientists  
in a field of interest of the IUPAP C4 Commission  
(max 8 yrs of research experience after PhD, excl. career interruptions)

**Dr. Carlos Arguelles Delgado, Harvard University, Cambridge**

for "fundamental experimental and  
phenomenological contributions to  
neutrino physics through IceCube"

Honors: Janet Conrad

Presenter: Sunil Gupta

Acceptance: Carlos Arguelles





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in a field of interest of the IUPAP C4 Commission  
(max 8 yrs of research experience after PhD, excl. career interruptions)

**Dr. Francesca Calore, LAPTh, CNRS, Annecy**

for “Outstanding contributions to the  
phenomenology of dark matter”

Honors: Fiorenza Donato

Presenter: Sunil Gupta

Acceptance: Francesca Calore



# ICRC 2021

## Shakti P. Duggal Award

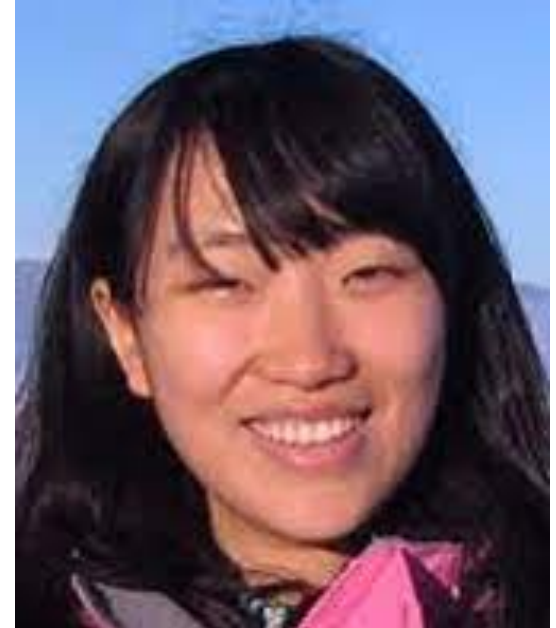
... to recognize outstanding work by a young scientist in the field of Cosmic Ray Physics, including Astroparticle Physics

**Prof. Ke Fang, University of Wisconsin, Madison**

for “pioneering work in the fields of neutrino astrophysics and gamma-ray astronomy”

Honors and Presenter: Jamie Holder

Acceptance: Ke Fang



# ICRC 2021

## O'Ceallaigh Medal

... to recognize significant contributions to the field of Astroparticle Physics over an extended career

**Prof. Paolo Lipari, University of Rome and INFN, La Sapienza**

for “Outstanding contributions to cosmic ray physics including neutrinos, high-energy interactions and by making complex problems accessible to non-experts through pedagogy”

Honors: Ralph Engel

Presenter: Luke Drury

Acceptance: Paolo Lipari



# ICRC 2021

## Yodh Prize

... to recognize a scientist whose research career has made substantial contributions to understanding in the field of Cosmic Rays. The research should have had a major impact in the field

### **Prof. Anthony Bell, University of Oxford**

for “Outstanding contributions to the acceleration of cosmic rays through turbulent magnetic-field amplification”

Honors: Martin Pohl

Presenter: Steve Barwick

Acceptance: Anthony Bell



# ICRC 2021

## Homi Bhabha Medal and Locus.sh Prize

... to an active scientist who has made distinguished contributions in the field of high energy cosmic ray physics and astro-particle physics over an extended academic career

**Prof. Francis Halzen, University of Wisconsin, Madison**

for “Outstanding contributions to Cosmic Ray physics including high energy neutrino physics through the IceCube detector”

Message from Director, TIFR

Honors: Subir Sarkar

Presenter: Sunil Gupta

Acceptance: Francis Halzen



## Message from Prof. S. Ramakrishnan, Director, TIFR, Mumbai

The Bhabha medal and prize commemorates Dr. Homi J. Bhabha, the Founding Director of the Tata Institute of Fundamental Research (TIFR), who had made pioneering contributions to the area of Cosmic Ray research in India, and initiated experimental work in this area at TIFR.

As part of the birth centenary of Dr. Bhabha, the TIFR and the IUPAP (C4 Commission) established the Homi Bhabha Medal and Prize in 2010, to recognize outstanding research in this area of science, and the first prize was awarded during the 32nd ICRC in Beijing in 2011.

We are delighted to note that Prof. Francis Halzen of the University of Wisconsin at Madison, USA has been awarded the Bhabha medal, and prize for his outstanding work on cosmic ray neutrinos with the IceCube detector and that he would receive this award during the 37th ICRC in Berlin. We take this opportunity to invite him to visit India once the pandemic is over. We look forward greatly to his visit and public lectures at TIFR, Mumbai and the Cosmic Ray Laboratory in Ooty.

We remember the colleagues we  
have lost in the past two years  
who have made immense  
contributions to our field and  
have enriched our lives as  
mentors and friends



K.M.V. Appa Rao

1933-2020

Tata Institute of Fundamental Research, India





Bimal Kanti Chatterjee  
1934-2020

Tata Institute of Fundamental Research, India



Arnulfo Zepeda Domínguez  
1943-2020

National Polytechnique Institute, Mexico



Evgenia Eroshenko

1940-2021

IZMIRAN, Moscow Region, Russia



Maria Giller  
1942-2021  
University of Lodz, Poland



Ichiro Kondo

1927-2019

University of Tokyo, Japan



Masatoshi Koshiba

1926-2020

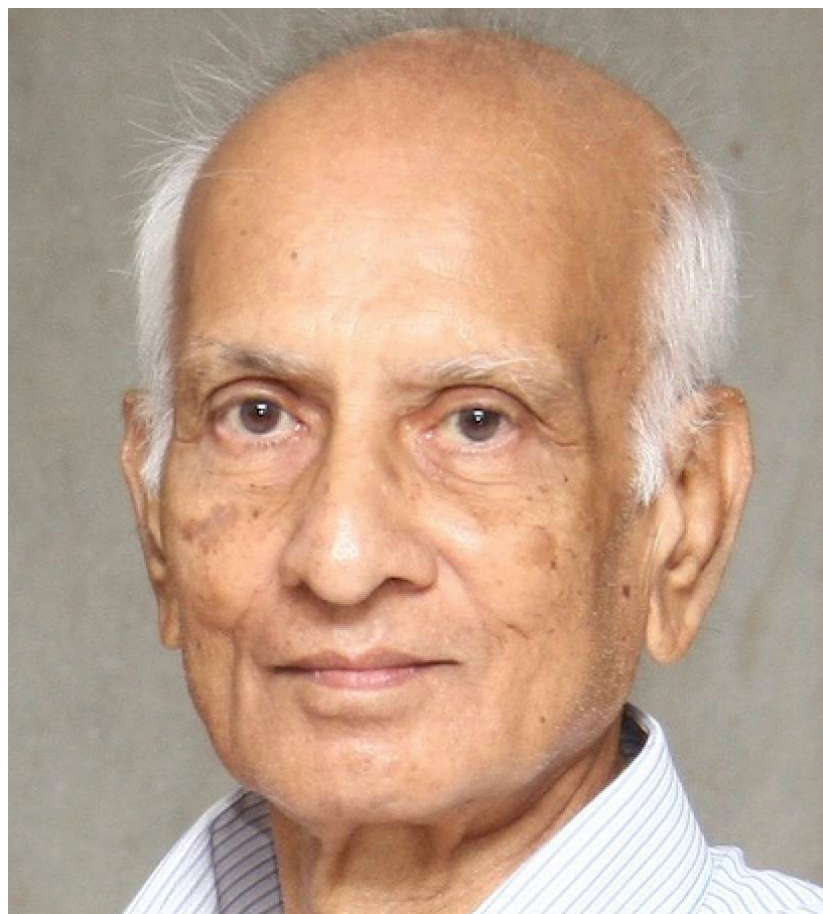
Tokyo University, Japan



Hinrich Meyer

1936-2020

University of Wuppertal, Germany



S. Narayan  
1930-2019

Tata Institute of Fundamental Research, India





Mikhail Panasyuk

1945-2020

SINP, Moscow State University, Russia



K. Roger Pyle  
1941-2020

University of Delaware & Bartol Research Institute,  
USA



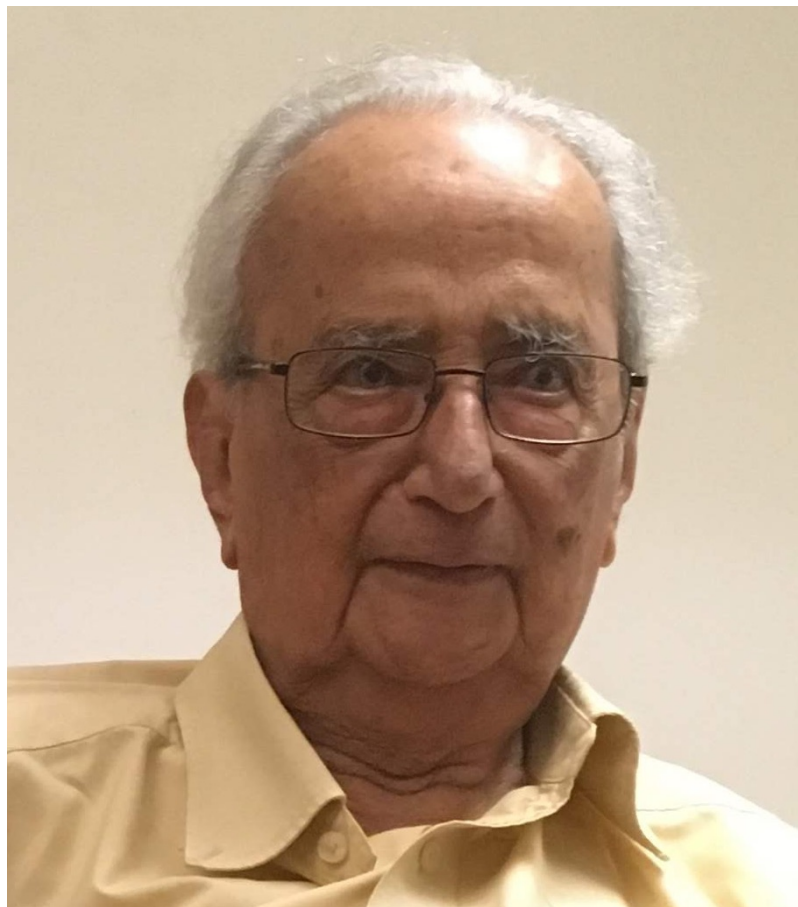
P.V. Ramana Murthy  
1929-2021

Tata Institute of Fundamental Research, India



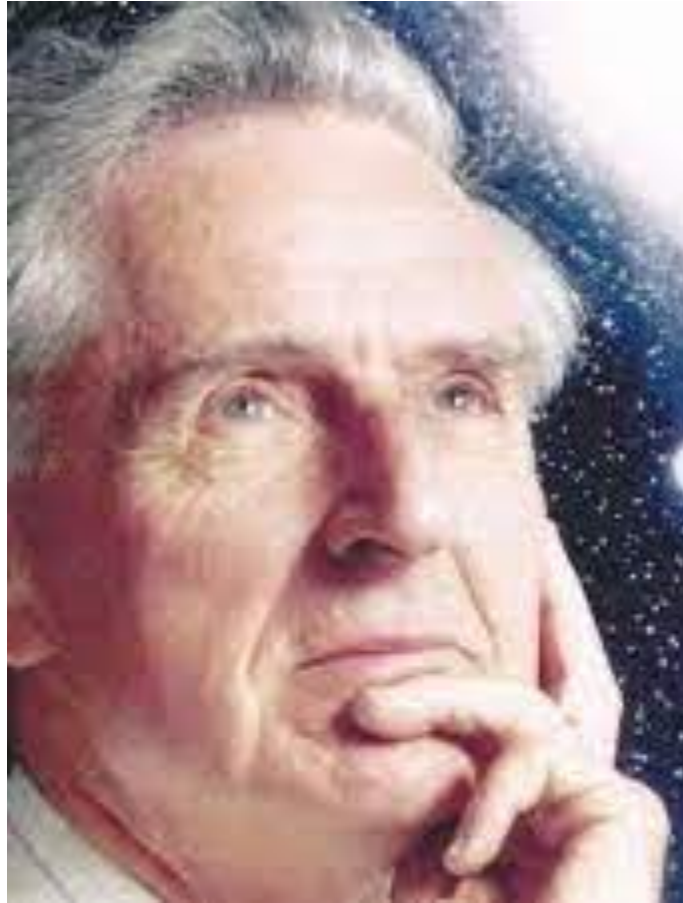
Toru Shibata  
1943-2020

Aoyama Gakuin University, Japan



**B.V. Sreekantan**  
**1925-2019**

**Tata Institute of Fundamental Research, India**



Arnold W. Wolfendale  
1927-2020  
University of Durham, U.K.

# ICRC 2021

# Thank You



DESY Zeuthen