



The 2024 ICFA Instrumentation Awards

Ian Shipsey

Oxford University

*(Chair, ICFA Instrumentation, Innovation and Development Panel
of the International Committee for Future Accelerators of IUPAP)*



ICFA Instrumentation Awards exist to celebrate the fundamental role of instrumentation and the instrumentation community in the discovery science of particle physics and the allied fields of particle astrophysics, cosmology and nuclear physics



The Opportunities for Discovery

We seek to understand the fundamental constituents of the Universe and the forces between them and to apply that knowledge to understand the birth, evolution and fate of the Universe

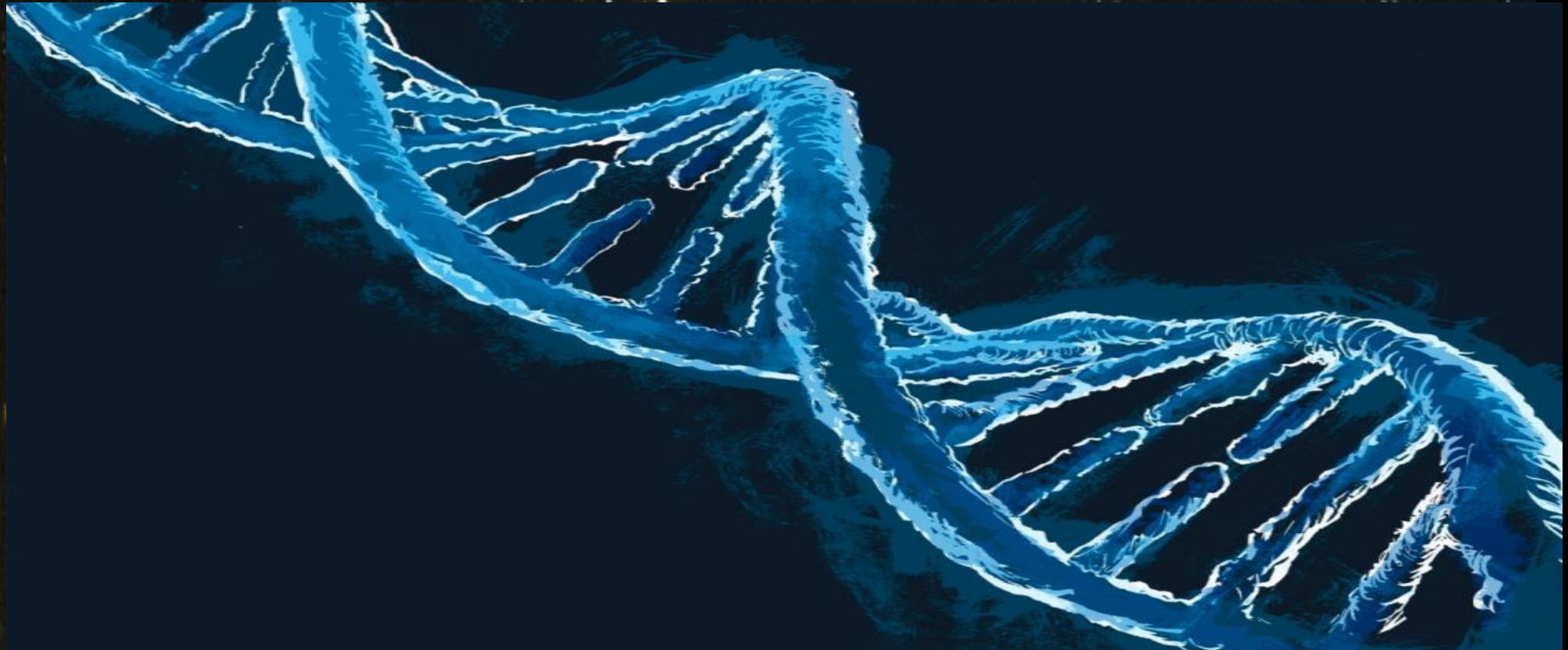
The Opportunities for Discovery

The background of the slide is a composite image. On the left, there is a complex, web-like structure of purple and orange filaments, resembling a cosmic web or a neural network. In the center, there is a lens-like shape with a gradient from yellow to orange. On the right, there is a field of colorful galaxies, including spiral and elliptical galaxies, in shades of blue, purple, and orange.

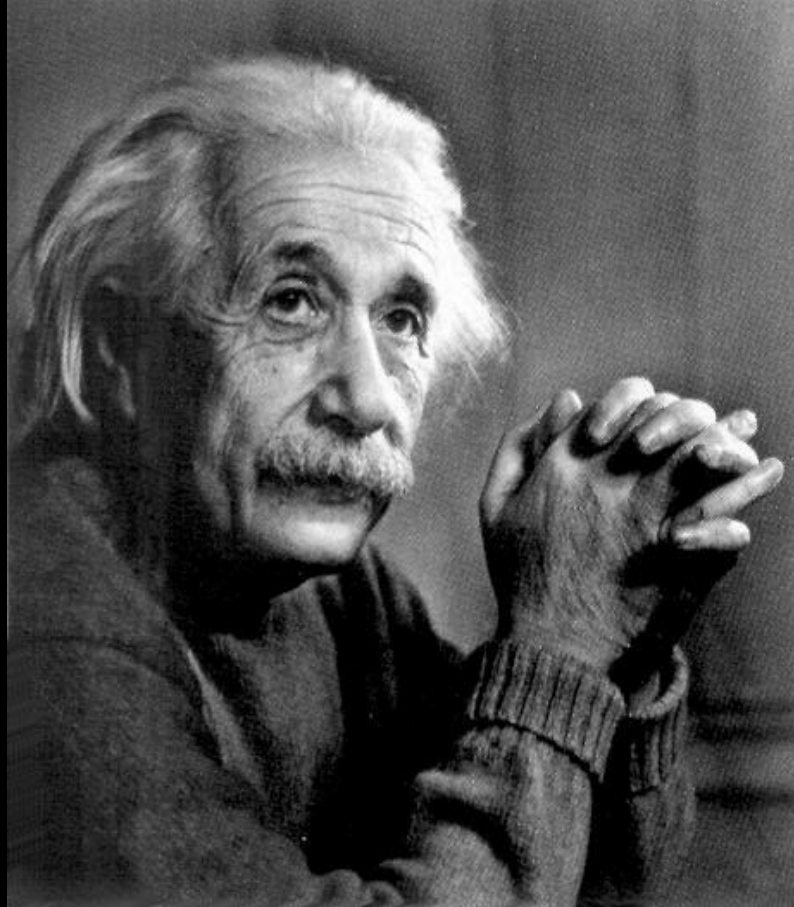
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BUILDING AN UNDERSTANDING OF THE UNIVERSE: A WORK A CENTURY IN THE MAKING

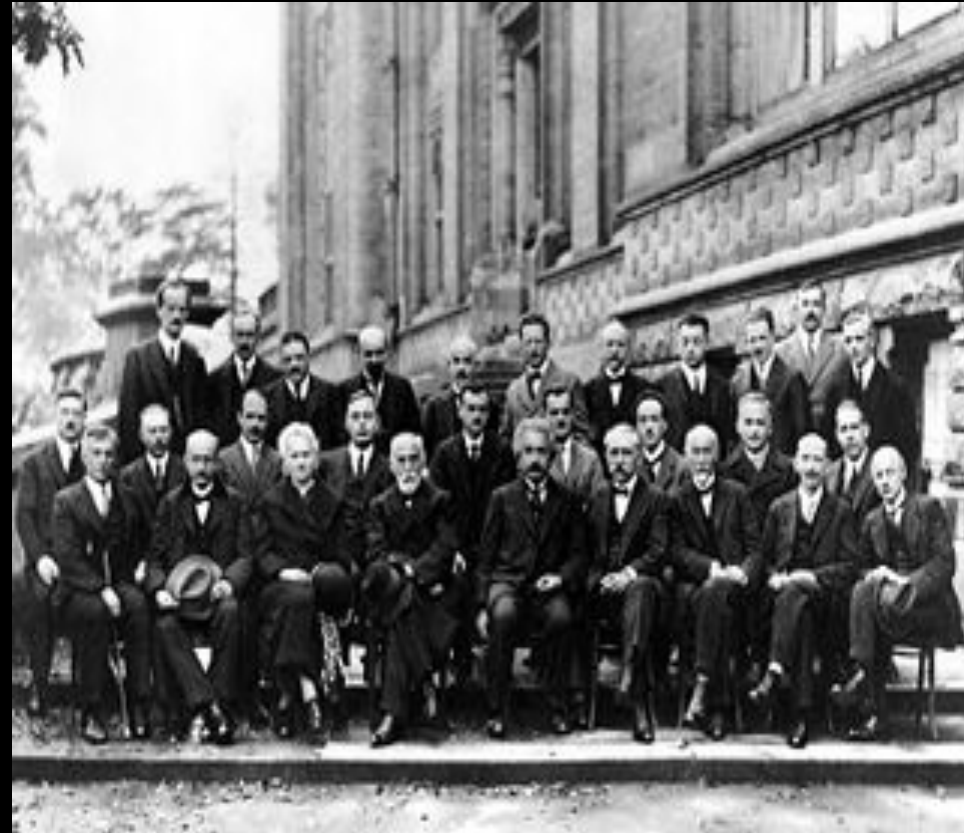
Physics has revolutionized human understanding of the Universe
– its underlying code, structure and evolution



BUILDING AN UNDERSTANDING OF THE UNIVERSE: A WORK A CENTURY IN THE MAKING



General Relativity

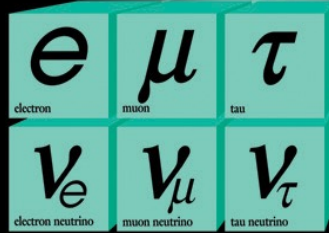
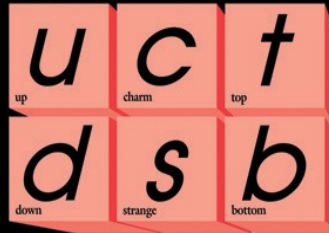


Quantum Mechanics

BUILDING AN UNDERSTANDING OF THE UNIVERSE: A WORK A CENTURY IN THE MAKING

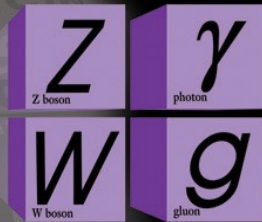
Particle Standard Model

Quarks

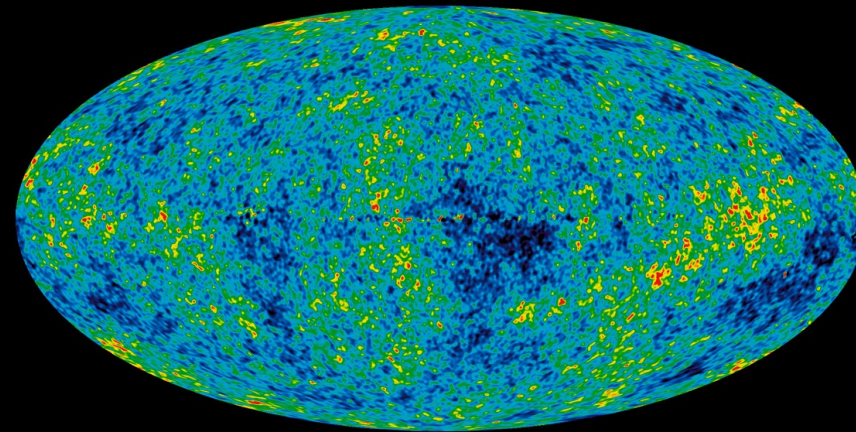


Leptons

Forces



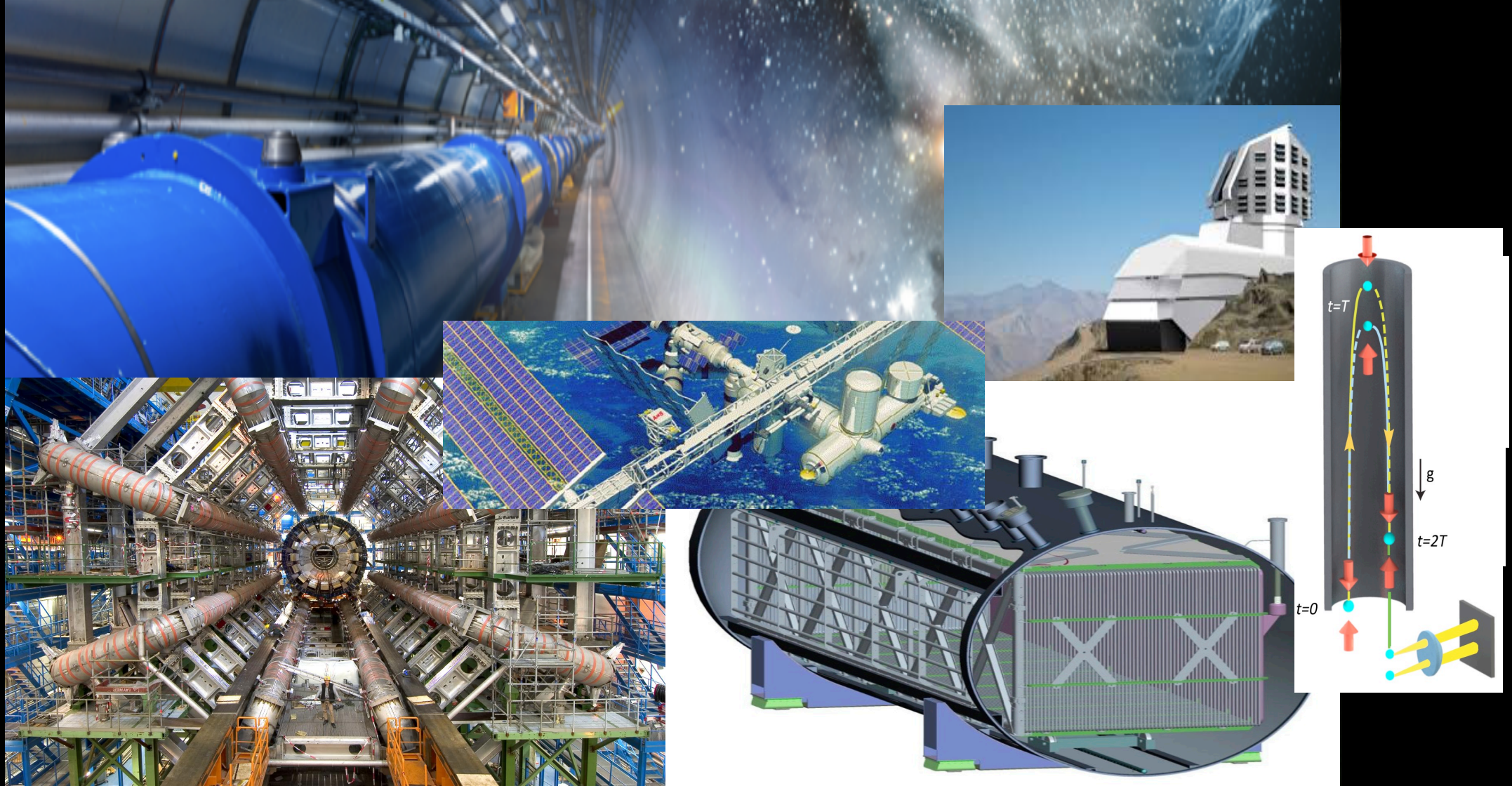
Cosmology Standard Model



Λ_{CDM}

.....enabled by instrumentation

APPEC
ECFA
NuPECC



Our scope is broad and we deploy many tools; accelerator, non-accelerator, astrophysical & cosmological observations all have a critical role to play

Opportunities for Discovery

Many mysteries to date go unanswered including:

The mystery of the Higgs boson

The mystery of Neutrinos

The mystery of Dark Matter

The mystery of Dark Energy

The mystery of quarks and charged leptons

The mystery of Matter – anti-Matter asymmetry

The mystery of the Hierarchy Problem

The mystery of the Families of Particles

The mystery of Inflation

The mystery of Gravity

How do quarks and gluons give rise to the properties of nuclei

The mystery of the origin and engine of high energy cosmic particles

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Multiple theoretical solutions – experiment must guide the way

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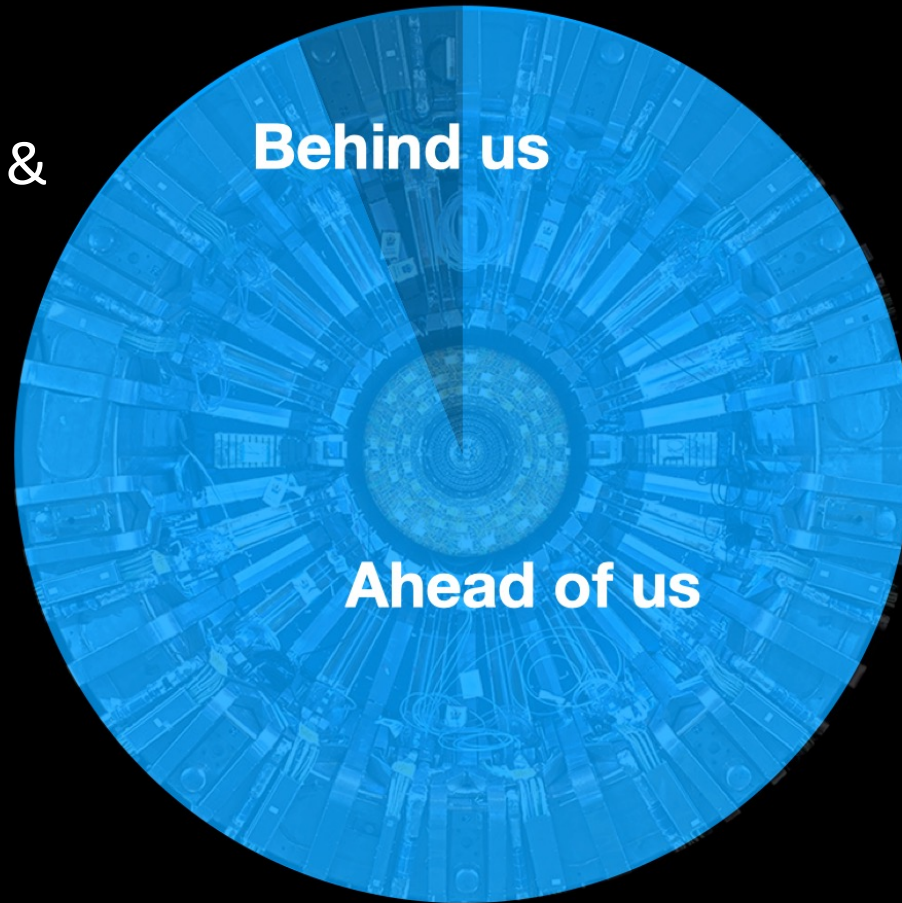
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The mystery of the origin and engine of high energy cosmic particles

Multiple theoretical solutions – experiment must guide the way

We are very much in a data driven era for which we need new tools!

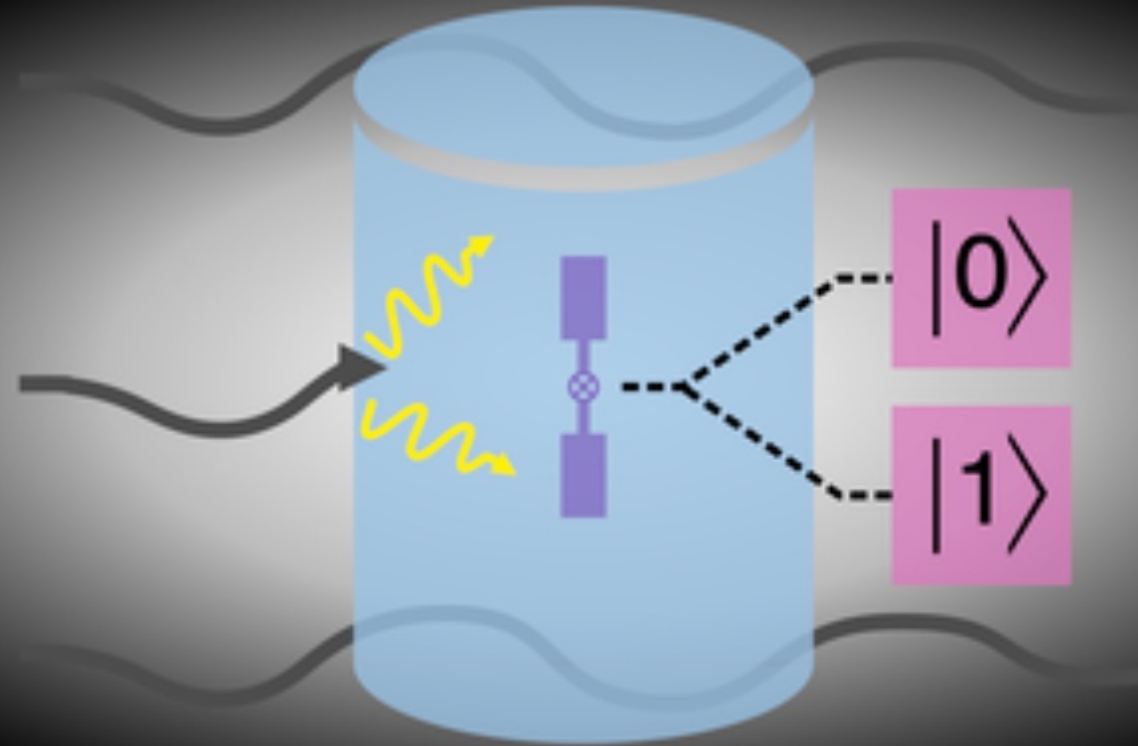
New tools:
e.g. the HL-LHC upgrades &
later FCC-ee/hh etc.




Only ~5% of the complete LHC/ HL-LHC data set
has been delivered to date

There is every reason to be optimistic that
an important discovery could come at any time

New tools e.g. Qubits as cameras





**“New directions in science are launched by new tools
much more often than by new concepts.**

**The effect of a concept-driven revolution is to explain old things in new
ways. The effect of a tool-driven revolution is to discover new things that
have to be explained” (Freeman Dyson)**



**“Measure what is measurable, and
make measurable what is not so” (Galileo Galilei)**

Discoveries in particle physics

Based on an original
slide by S.C.C. Ting

Facility	Original purpose, Expert Opinion	Discovery with Precision Instrument
P.S. CERN (1960)	π N interactions	
AGS BNL (1960)	π N interactions	
FNAL Batavia (1970)	Neutrino Physics	
SLAC Spear (1970)	ep, QED	
ISR CERN (1980)	pp	
PETRA DESY (1980)	top quark	
Super Kamiokande (2000)	Proton Decay	
Telescopes (2000)	SN Cosmology	--

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AGS BNL (1960)	π N interactions	Two kinds of neutrinos Time reversal non-symmetry charm quark
FNAL Batavia (1970)	Neutrino Physics	bottom quark top quark
SLAC Spear (1970)	ep, QED	Partons, charm quark tau lepton
ISR CERN (1980)	pp	Increasing pp cross section
PETRA DESY (1980)	top quark	Gluon
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**precision instruments are key to discovery
when exploring new territory**



ICFA, the International Committee for Future Accelerators ...created to facilitate international collaboration in the construction and use of accelerators for high energy physics in 1976 by the International Union of Pure and Applied Physics.

Not pictured:

I. Koop,
V. Obrastov,
G. Gil da Silveira,
& T. Mori



ICFA has six panels
one is for
instrumentation

Current members:

P. Campana, Chair, Italy

T. Schoerner, Secretary, Germany

P. Sphicas, CERN Member States

F. Gianotti, CERN Member States

B. Heinemann, CERN Member States

L. Merminga, USA

S. Dasu, USA

N. Roe, USA

I. Koop, Russia

V. Obrastsov, Russia

Y. Wang, China

U. Egede, Other Countries

G. Gil da Silveira, Other Countries (Latin America)

N.N., Other Countries

T. Nakaya, Japan

M. Yamauchi, Japan

R. Teuscher, Canada

F. Canelli, Chair of the IUPAP Commission on Particle

ICFA: Instrumentation, Innovation and Development Panel

<https://icfa-iid.physics.ox.ac.uk>

The ICFA Instrumentation Innovation and Development Panel stimulates world inclusive involvement in the innovation and development of new instrumentation for experiments at future accelerators. The mission of the Panel is to promote research on and development of instrumentation for use in future particle physics experiments which engages physicists from all parts



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University of Manchester

✉



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Tata Institute of Fundamental Research, Mumbai, India



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Fermilab

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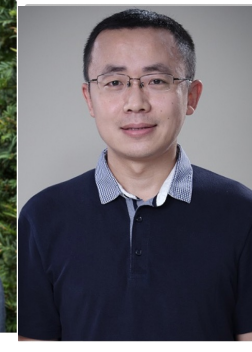
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IHEP

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Instrumentation, Innovation and Development Panel Summary (for ICFA, 4/24)

I.Shipsey (Oxford)

Mission: stimulates world inclusive involvement in innovation & development of new instrumentation for experiments @future accelerators & more broadly.

Excellence in Detector Instrumentation Technology (EDIT) School (major labs)
recent: BNL Oct. 2023, upcoming: FNAL Nov. '24, IHEP Fall '25, CERN Feb. '26



Shijingshan, Beijing



Dongguan, Guangdong



EDIT School 2023 - Excellence in Detector and Instrumentation Technologies
Hosted by Brookhaven National Laboratory, October 10-20, 2023

Locations: BNL (Upton, NY) and Danfords (Port Jefferson, NY)

Numbers: 2 weeks, 48 students (31% female, 63% non-US - all continents), 40+ BNL staff, 7 topics

- Silicon Sensors: Design, Fabrication, and Testing
- Integrated Electronics for Detector Readouts
- Data Acquisition Systems for Quick Prototyping of Detectors Readout and an Experiment
- Liquid Argon Detectors: Physics, Design, and Operation
- Liquid Scintillators: Properties, Fabrication, and Analysis
- RF Cosmology: Techniques, Instrumentation, and Data
- Quantum Network: Concepts, Components, and Capabilities

BNL EDIT Oct. 2023

Brookhaven National Laboratory
<https://www.bnl.gov/icfa-editschool/>



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Status: identifying next two locations for 2025/6



<https://www.tifr.res.in/~icfa2023/>

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Early Career Award
Konstantinos Mavrokoridis
(Liverpool)

Ioannis Giomataris
(CEA Saclay)

Fabio Sauli
(CERN)

Awards Sept. 2023 Cape Town

Frontier Detectors for Frontier Physics
16th Pisa Meeting on Advanced Detectors
La Biadola - Isola d'Elba - Italy
26 May - 1 June, 2024

VCI
VIENNA CONFERENCE ON INSTRUMENTATION
Feb 17 -

Feb. 2025 Vienna

TIPP 2023
Export to PDF
4-8 SEPTEMBER 2023

May 2024 Elba

Feb. 2025 Vienna



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Instrumentation Studentships: seeking international funding to create a pilot program of studentships partnering national labs & universities globally modelled on CERN Technical & Doctoral Student & US DOE HEP GIRA programs.

See **ICFA-IID Panel Website** <https://icfa-iid.physics.ox.ac.uk>

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La Biodola + Isola d'Elba + Italy
26 May - 1 June, 2024

May 2024 Elba

VCI VIENNA CONFERENCE ON INSTRUMENTATION
Feb 17 -

Feb. 2025 Vienna

TIPP 2023
4 - 8 SEPTEMBER 2023
CTICC CAPE TOWN SOUTH AFRICA

Elisabetta Barberio (AU), Laura Baudis (CH), Rajaa Cherkaoui El Moursli (Morocco), Didier Contardo (FR), Marcel Demarteau (US), Francesco Forti (IT), Kazunori Hanagaki (JP), Miao He (China) Roxanne Guenette (UK), Peter Krizan (Croatia), Ana Amelia Machado (BR), Gobinda Majumbar (IN), Petra Merkel (US), Eugenio Nappi (IT), Fabrice Retiere (CA), Felix Sefkow (D), Ian Shipsey (Chair, UK).



The 2024 ICFA Instrumentation Early Career Award



The 2024 ICFA Instrumentation
Early Career Award

is presented to:

Gabriel Orebi-Gann
(Berkeley)

For pioneering and developing an innovative detector technique to achieve a clear separation between scintillation and Cherenkov photons which has the potential to significantly influence the design of future neutrino experiments.



The 2024 ICFA Instrumentation Award



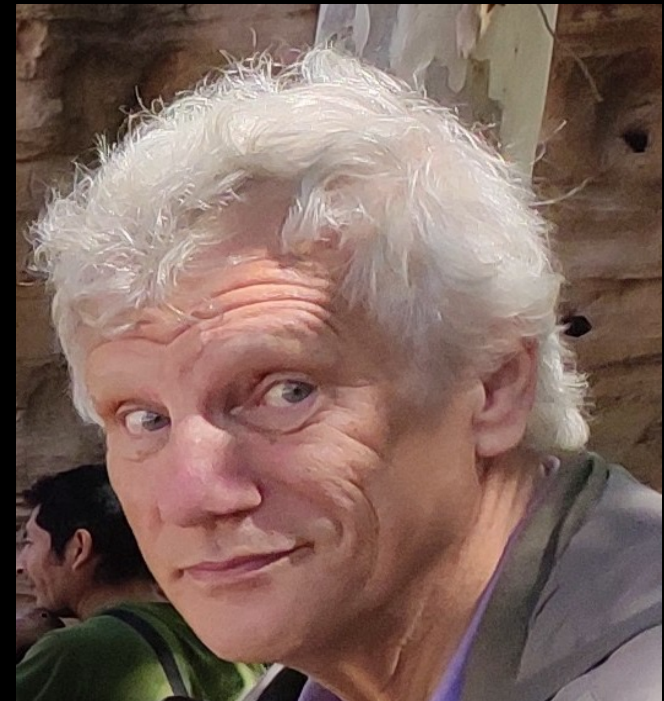
The 2024 ICFA Instrumentation Award is presented jointly to:



Walter Snoeys (CERN)



Renato Turchetta (IMASENIC)



Marc Winter (IJCLab)

For their vision and leadership in the development of low-mass and high-resolution particle physics detectors, based on commercial CMOS technology, the Monolithic Active Pixel Sensors (MAPS)



End