



The INTERNATIONAL HELIOPHYSICAL YEAR (IHY)

Heliophysical: A broadening of the concept "geophysical," extending the connections from the Earth to the Sun & interplanetary space. On the 50th anniversary of the International Geophysical Year, the 2007 IHY activities will build on the success of IGY 1957 by continuing its legacy of system-wide studies of the extended heliophysical domain

*Peter Fox (NCAR),
Adapted from a presentation by Joseph Davila, Barbara
Thompson, Nat Gopalswamy
NASA-Goddard Space Flight Center*

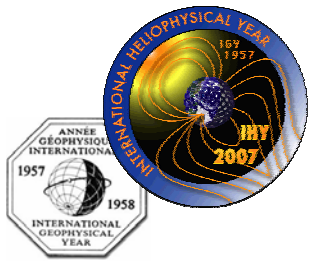
CODATA2006



Pedigree for International Science Years

Program	Start	Years After
1st International Polar Year	1882	
2nd International Polar Year	1932	50
International Geophysical Year	1957	25
International Quiet Sun Year	1964	7
International M'spheric Study	1976	12
Solar-Terr. Energy Program	1990	14
International Heliophysical Year	2007	50 [17]

Slide taken from presentation by George Siscoe at First IHY Planning Workshop, NSO,
Sacramento Peak, NM



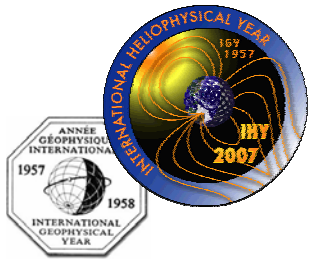
IPY 1 (1882-1883) Justification



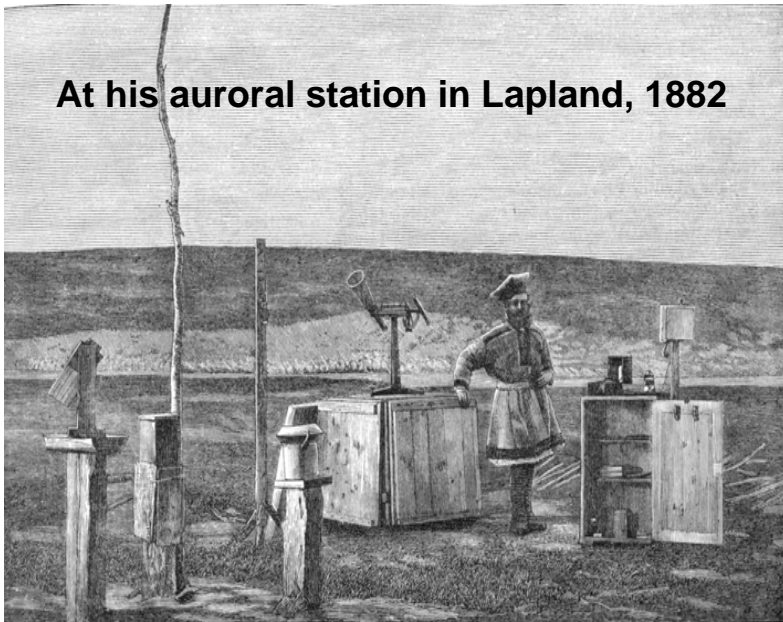
- Polar expeditions should be driven by scientific research instead of exploration.
- Establish network of circumpolar stations.
- Synoptic studies of geomagnetism, auroras, atmospheric electricity, and meteorology.
- **Common data format for recording observations.**

Slide taken from presentation by George Siscoe at First IHY Planning Workshop, NSO, Sacramento Peak, NM

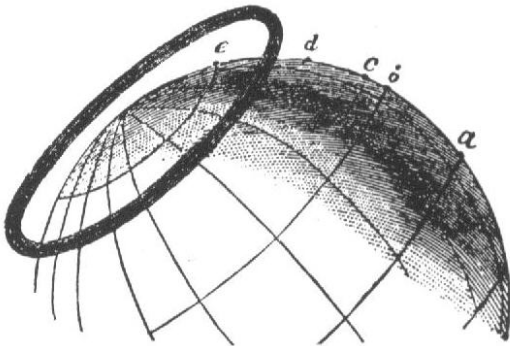
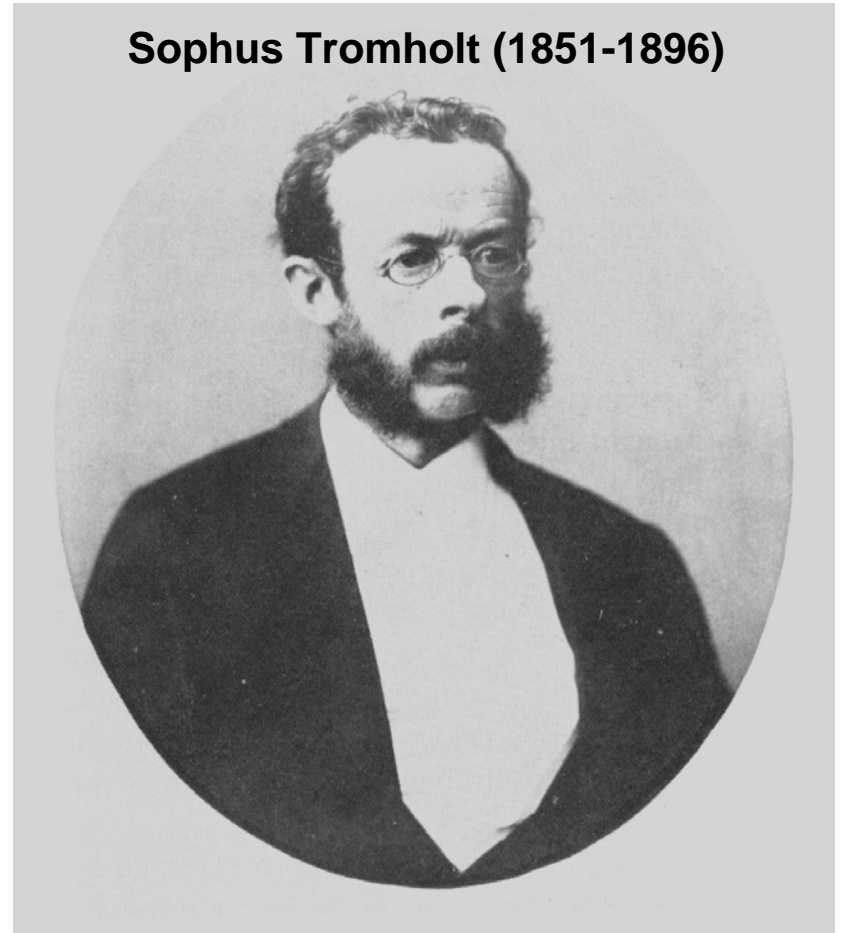
Evolution in Understanding the Auroral Oval



At his auroral station in Lapland, 1882

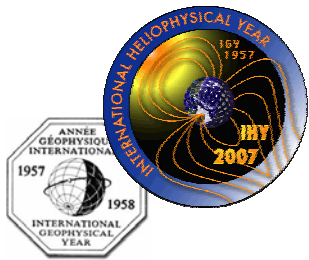


Sophus Tromholt (1851-1896)

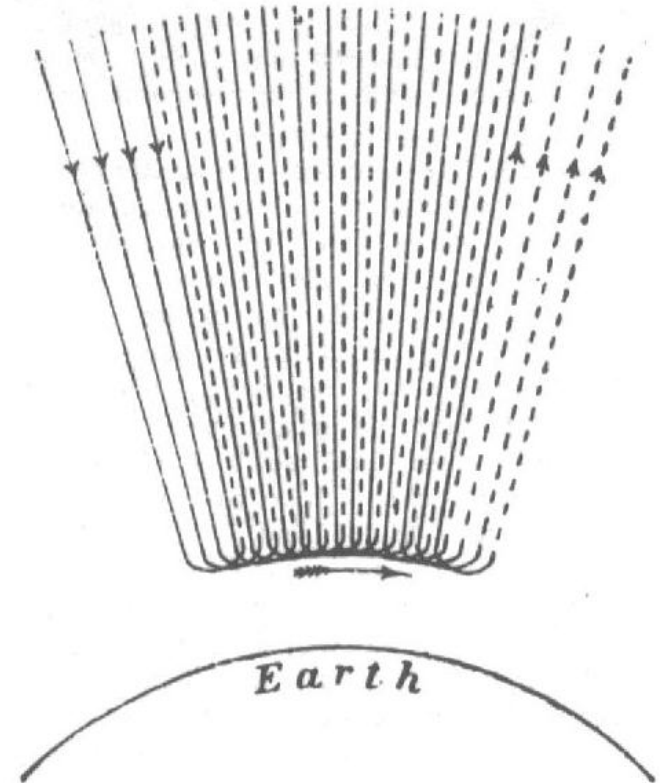
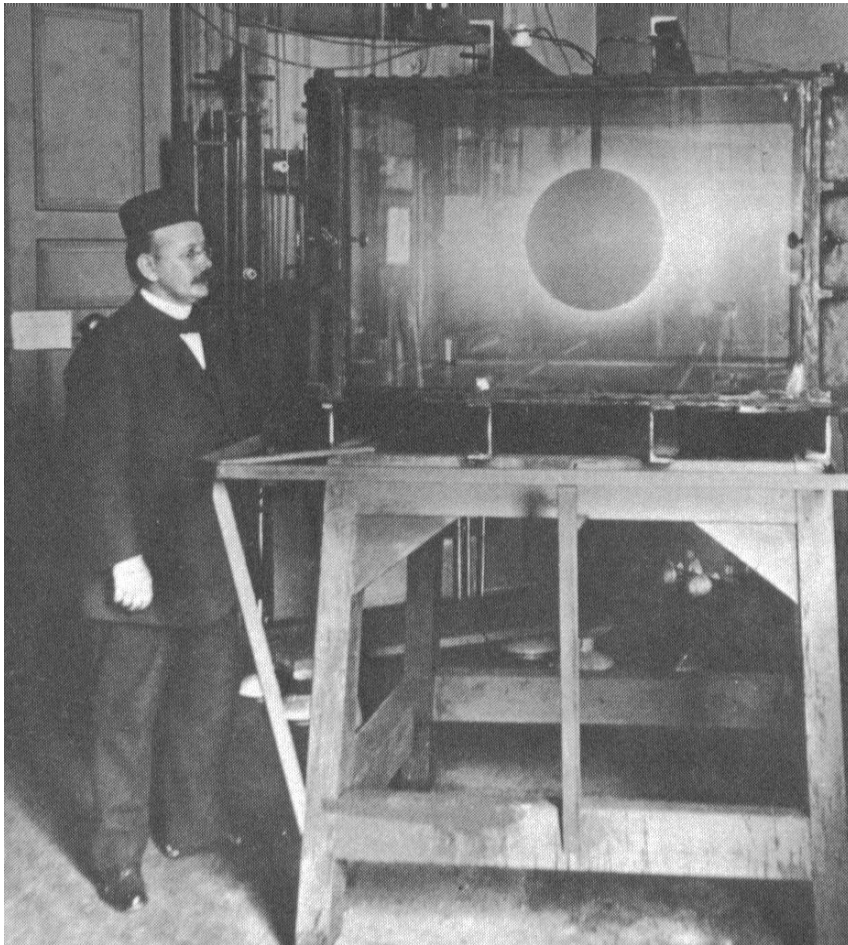


IHY (<http://ihy2007.org>)

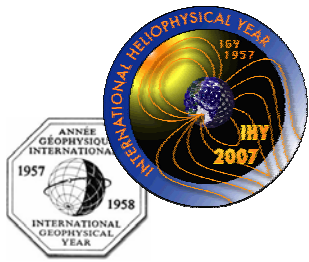
Slide taken from presentation by George Siscoe at First IHY Planning Workshop, NSO, Sacramento Peak, NM



Birkeland Connects Auroras to Space



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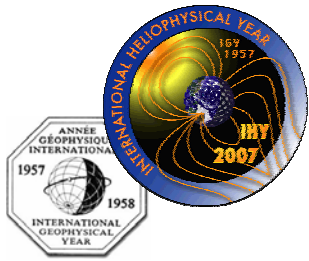
IPY 2 (1932-1933) Justification

Statement of the IMO

“...magnetic, auroral and meteorological observations at a network of stations in the Arctic and Antarctic would materially advance present knowledge and understanding (of geomagnetic, auroral, and meteorological phenomena) not only within polar regions but in general...This increased knowledge will be of practical application to problems connected with terrestrial magnetism, marine and aerial navigation, wireless telegraphy and weather forecasting.”

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i.e. synoptic studies



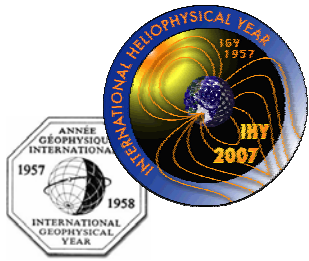
IPY 2 Instrumentation

Appleton



- Magnetometer network (here a station in Hudson Bay)
- Kite radiosondes
- Balloon radiosondes
- Ionosondes (here at Tromso)

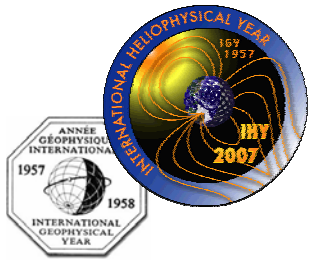
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Innovations and Concepts Associated with IPY 2

- **International polar observing network**
- **New instrumentation (radiosondes and ionosondes)**
- **Rapid run magnetometers**
- **Simultaneous measurements at multiple stations**
- **Global current pattern for specific magnetic disturbance (magnetic bays)**
- **i.e. Synoptic data in the third dimension**
- **Higher spatial and temporal resolution**
- **More evidence of global connectedness**

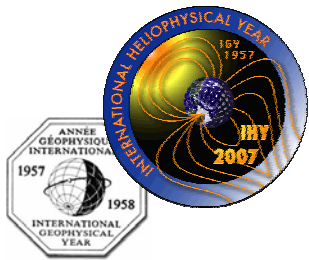
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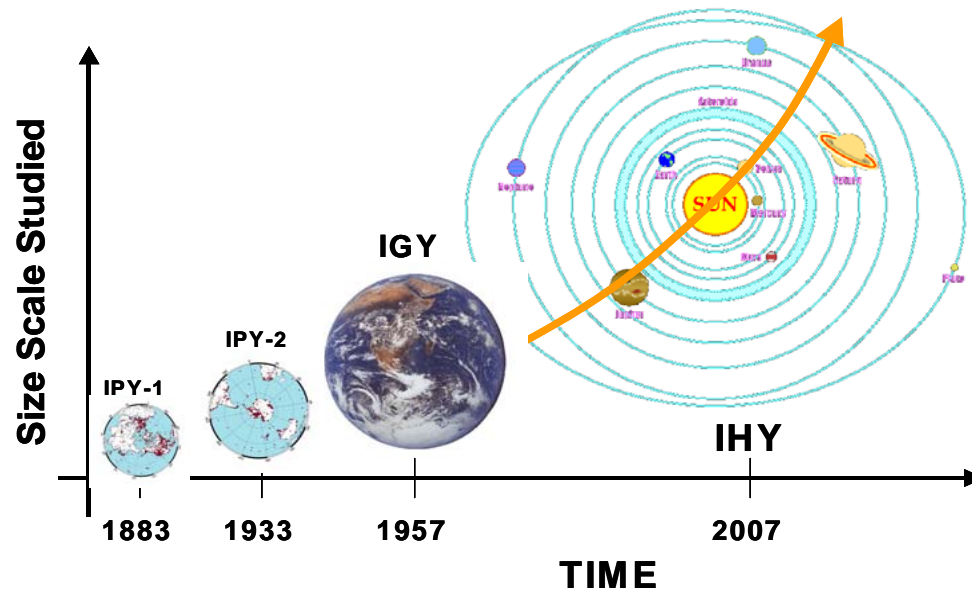
New Concepts Associated with IGY

- **Inter-hemispheric network of polar stations**
- **New instrumentation (all-sky cameras, satellites)**
- **Major discovery (radiation belts)**
- **New concepts (the magnetosphere, substorms)**
- **Exploration of space**
- **Global 3D synoptic data**
- **Evidence of time-dependent global dynamics**

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IHY is Natural Evolution of IGY



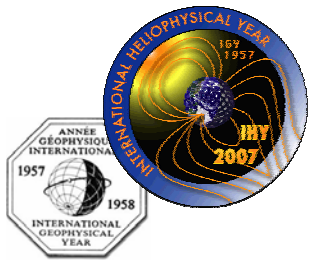
- Approach: Synoptic observations and Global processes on solar system scale

- Instruments:
 - *Unprecedented international fleet of spacecraft located throughout the heliosphere*
 - *Networks of sophisticated ground based observatories*
- New Concepts: ...?

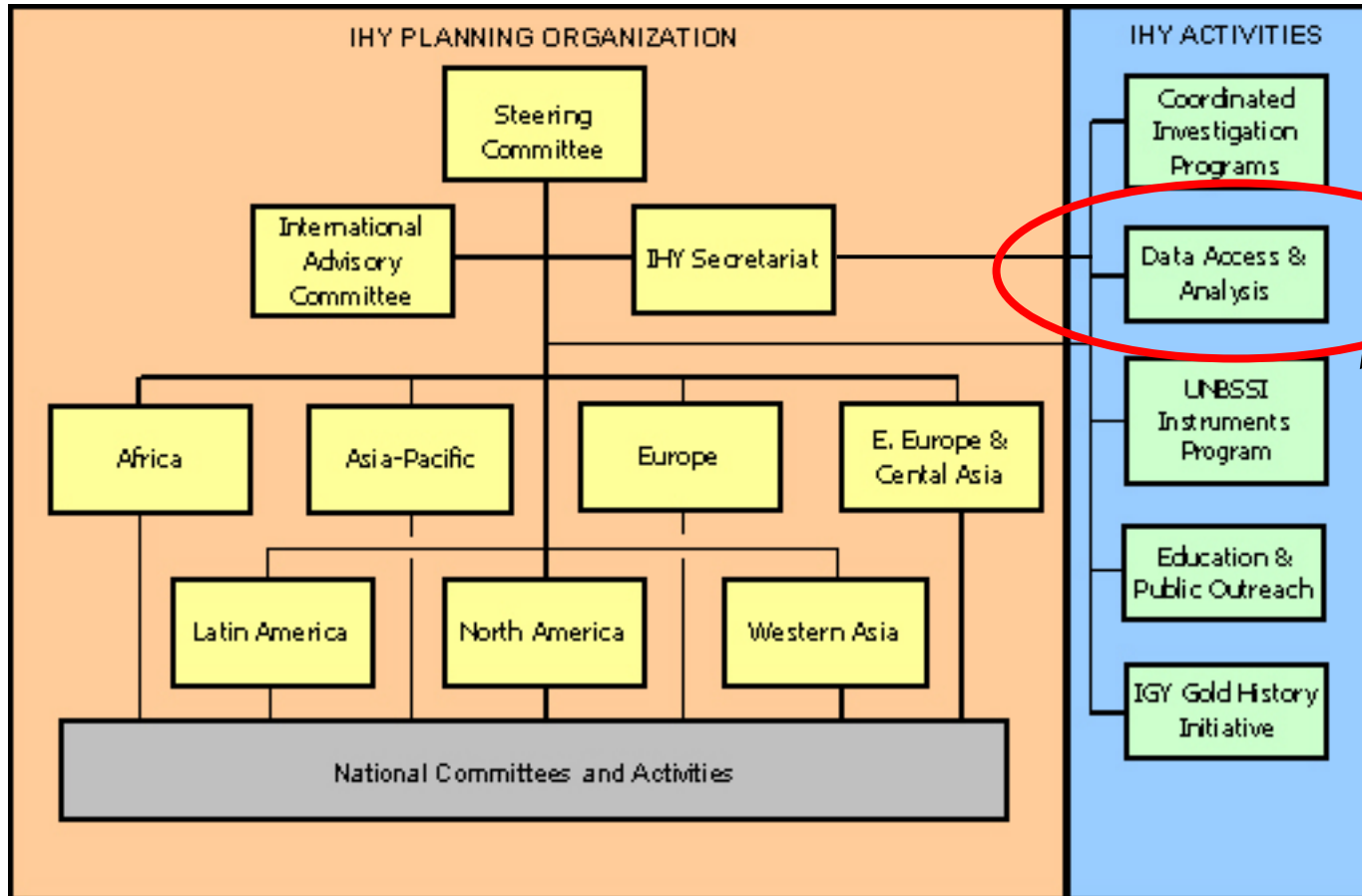


Objectives

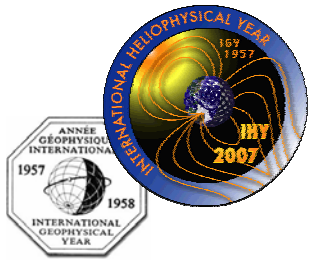
- Develop the basic science of heliophysics through cross-disciplinary studies of universal processes.
- Determine the response of terrestrial and planetary magnetospheres and atmospheres to external drivers.
- Promote research on the Sun-heliosphere system outward to the local interstellar medium - the new frontier.
- Foster international scientific cooperation in the study of heliophysical phenomena now and in the future.
- Preserve the history and legacy of the IGY on its 50th Anniversary.
- Communicate unique IHY results to the scientific community and the general public.



Organization Chart

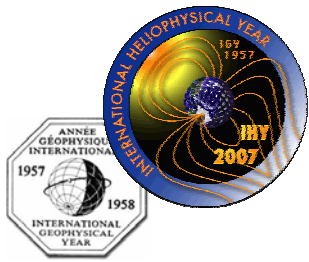


eGY
and
VSO

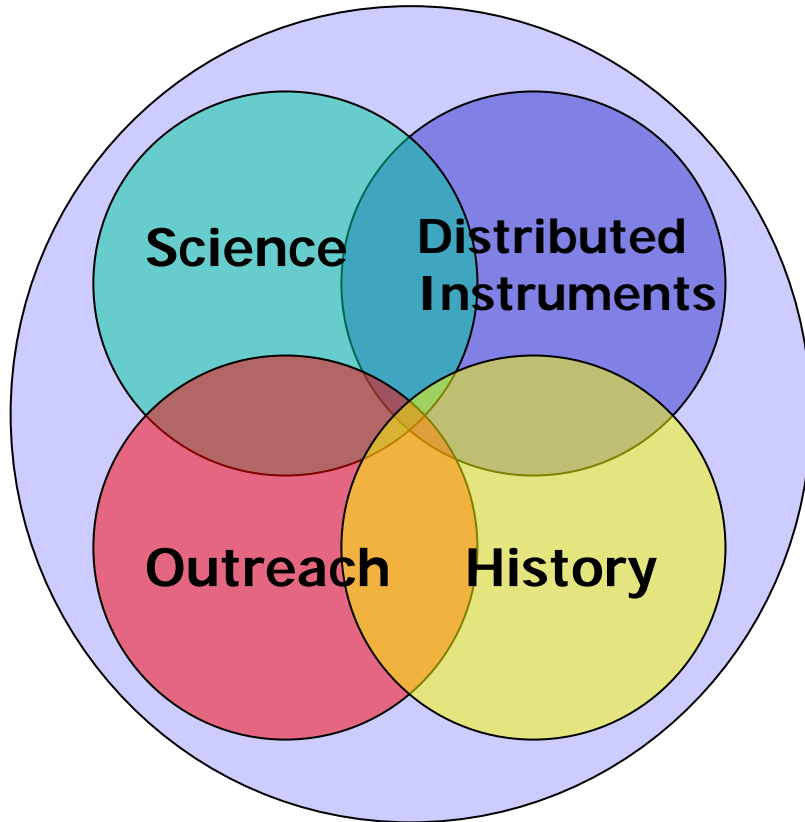


IHY Overall Schedule

- **2004:** Regional coordination meetings, campaigns begin to be defined, synergy/coordination discussions with professional organizations
- **2005:** Synthesis from regional to international, merging of science working groups and campaigns, identifying missing initiatives
- **2006:** Prototyping year, preliminary work, review and finalize campaign proposals, proposals to national funding agencies
- **2007:** IHY campaigns
- **2008-9:** Workshops, publications, archives

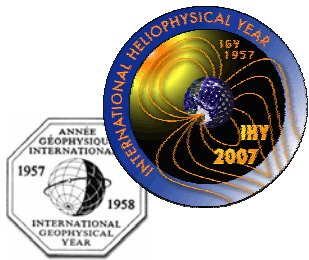


Four Elements of the IHY Program

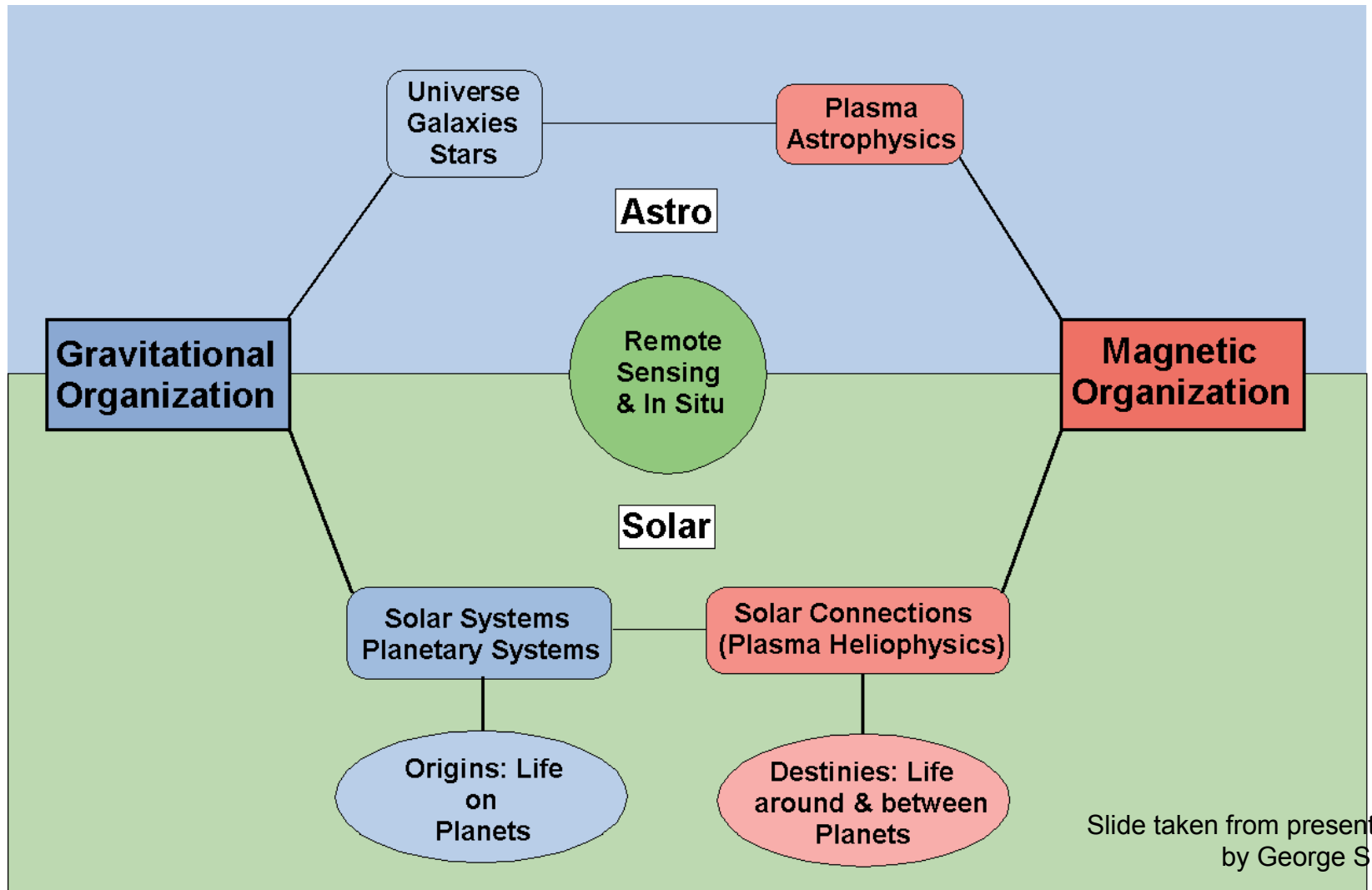


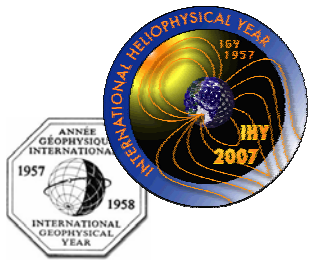
- **Coordinated Investigation Programs (CIPs)**
 - *Scientific Research*
- **Distributed small instrument program**
 - *New observational capability*
- **Education, outreach**
 - *Promoting space science*
- **IGY History preservation**
 - *Preserving the history of space physics*

See website at <http://ihy2007.org> for more information.

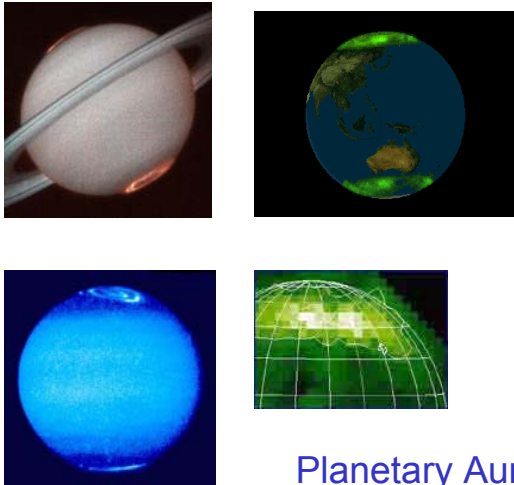


Organization of the Universe

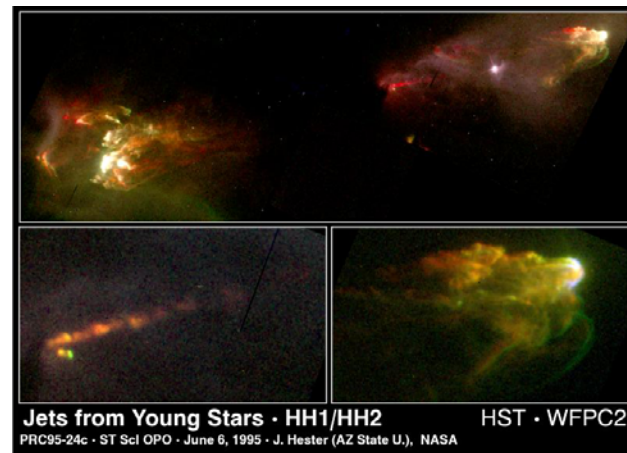
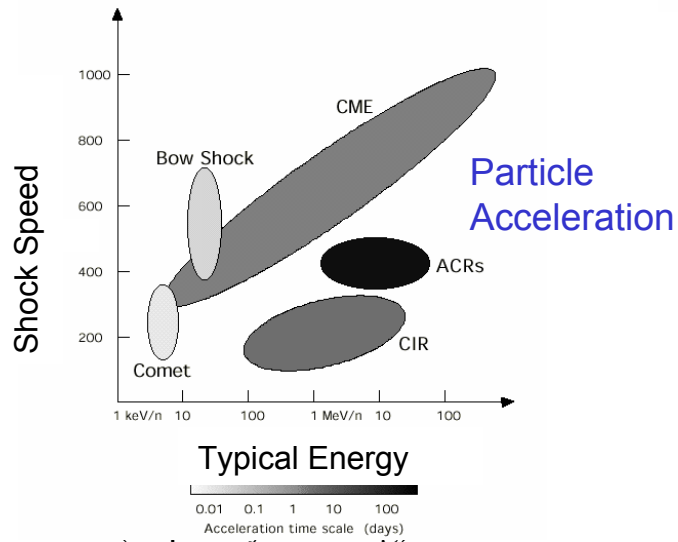
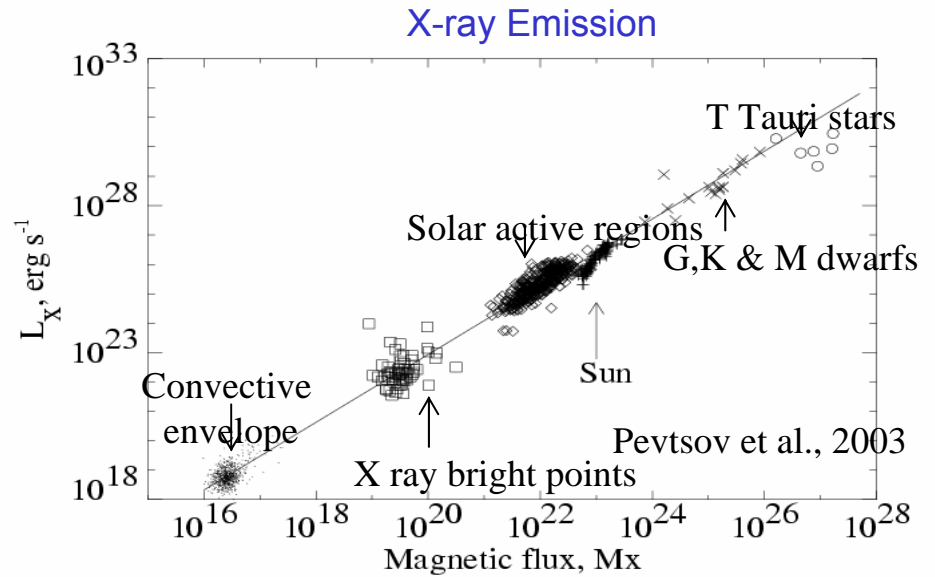




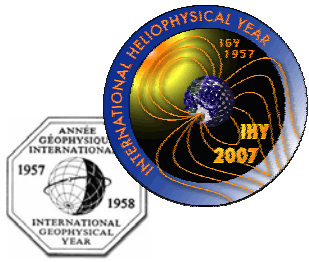
Universal Process Exemplars



Planetary Aurorae

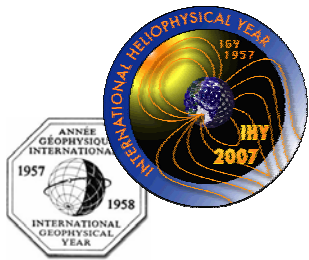


Astronomical Structures



Basic Approach

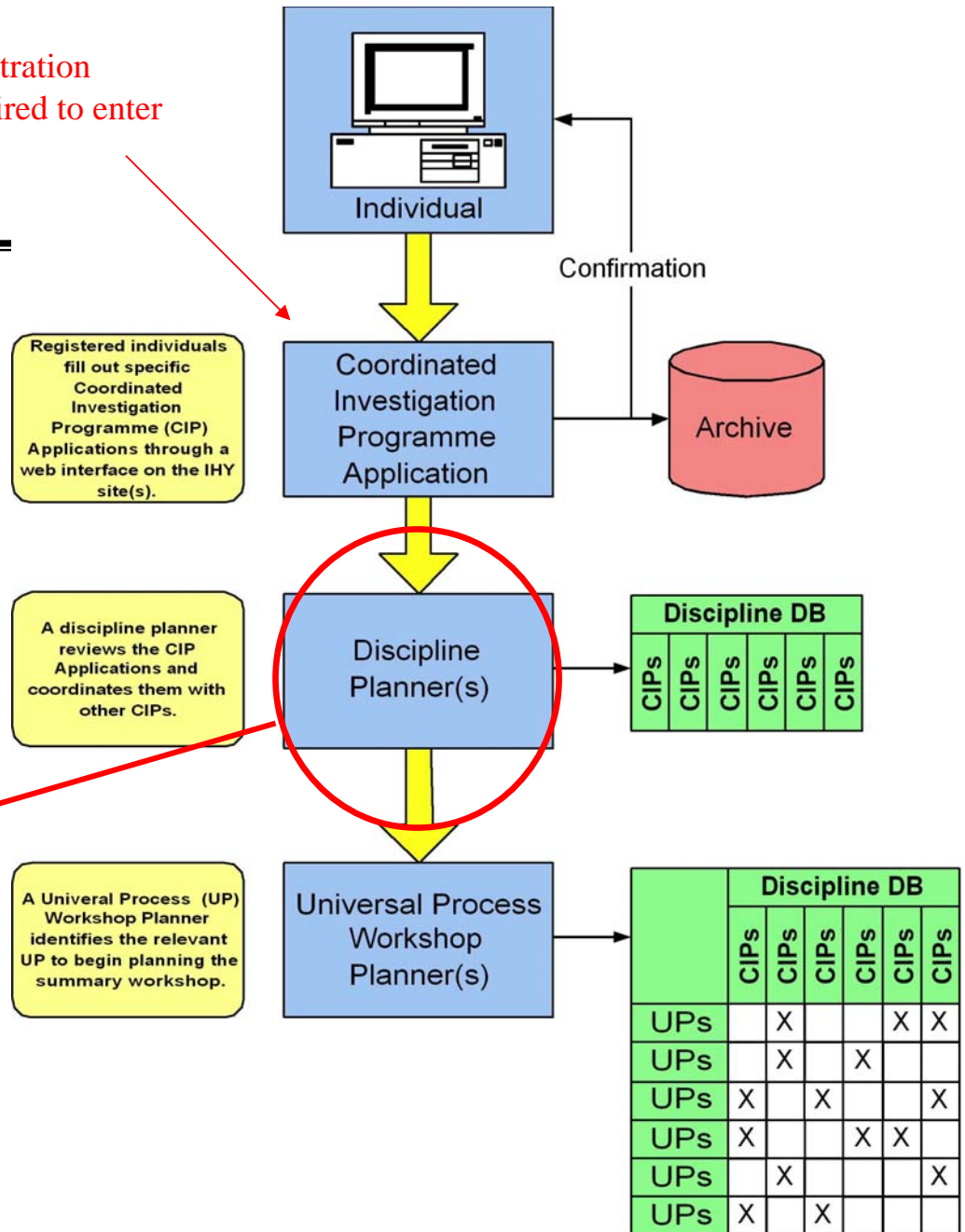
- CIP (Co-ordinated Investigation Program) proposed by individual scientists
- These are organized into observational units
- Scientific results are organized into Universal Processes
- CDAW (**Co-ordinated Data Analysis Workshops**) on Universal Processes

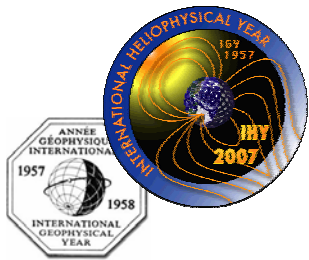


CIPs

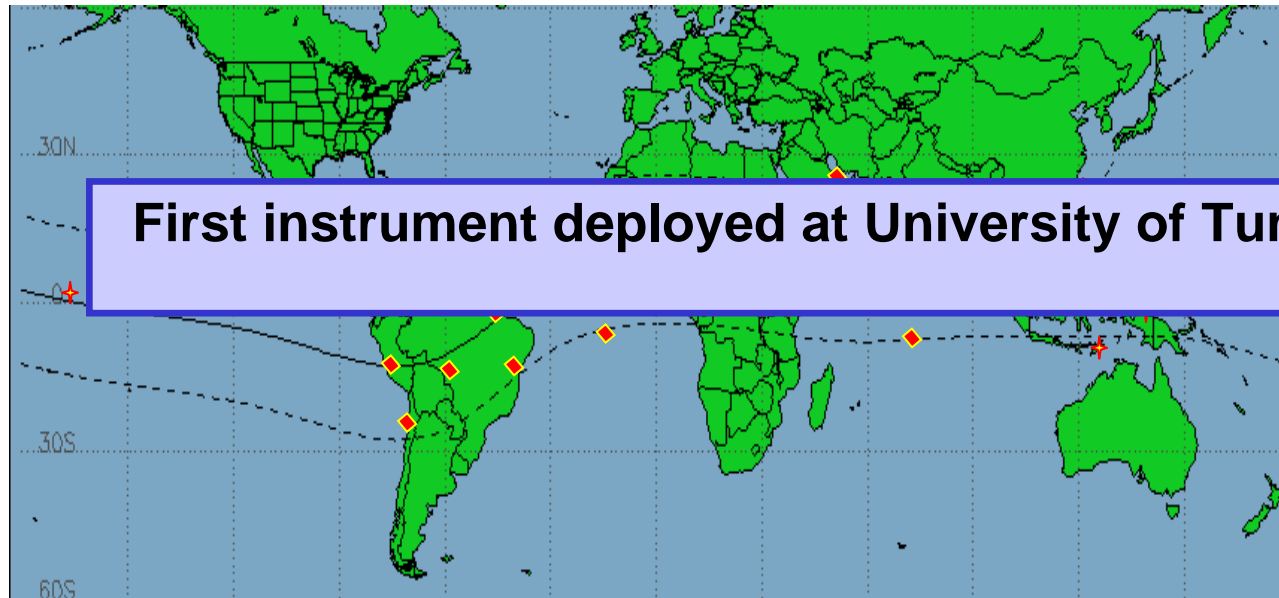
Registration
Required to enter
CIP

- Richard Stamper (RAL) has developed CIP website
- **Regional representatives to nominate Discipline planners in following categories**
 - *Solar*
 - *Heliosphere*
 - *ITM*
 - *Magnetosphere*
 - *Climate*
 - *Heliobiology*
- **Identify CIPs and begin the entry process**





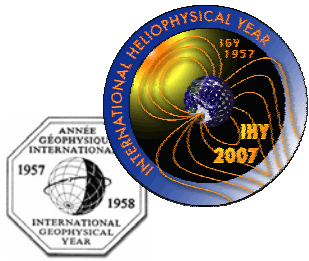
UNBSS Distributed Instrument Program



Existing and proposed SCINDA stations. The magnetic equator and northern and southern magnetic latitudes at 20° are shown by dashed lines. The most intense auroral scintillation events occur during nighttime hours within 20° of the earth's magnetic equator. SCINDA observations in this 20° belt on either side of the magnetic equator are sought. Current plans include expansion of the network to new geographic regions (courtesy: K. Groves).

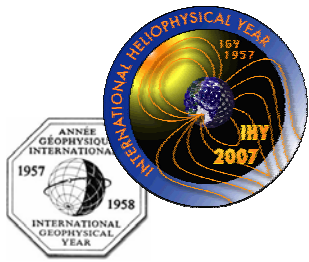
◆ Real-Time ○ Data Logging ★ Proposed Site

- **Placing small inexpensive instruments in new geographical locations can provide new science**
- **Distributed observatories can provide 'legacy' for IHY**
- **UNBSS dedicated to the program at least thru 2009**



Basic Concept

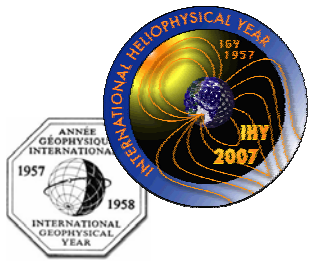
- **The lead scientist or principle investigator will provide instrumentation (or fabrication plans) for the instruments in the array**
- **The host country provides the workforce, facilities, and operational support to obtain data with the instrument typically at a local university.**
- **The Instrument host scientists become part of science team**
- **All data, and data analysis activity is shared with all members of the group**
- **Publications and meetings involve the participation of all team members when possible**



1st Workshop succeeded “...beyond expectations!”

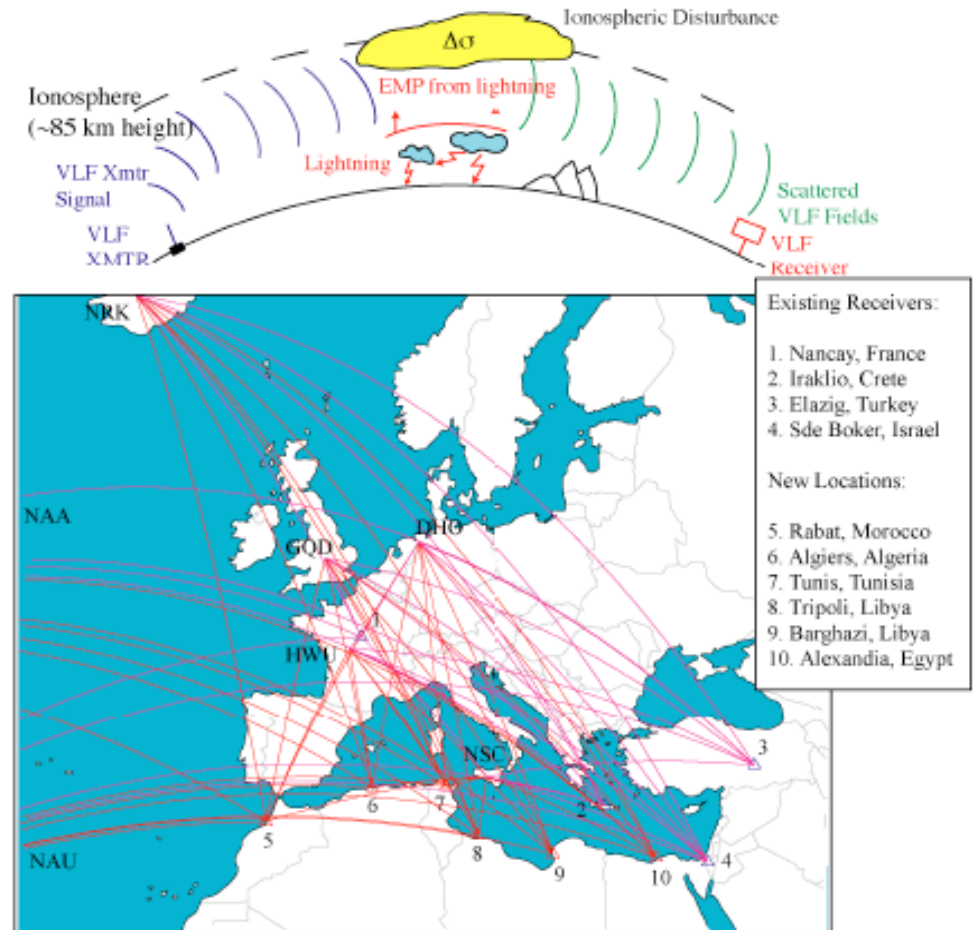
- **UN, ESA, NASA, and UAE Government sponsored**, attendance by His Highness Sheikh Al-Nahayan Minister of Education and the Cancellor of the UAE University
- **Instrument Donors Attending:** USA, Canada, UK, Switzerland, Japan, Brazil
- **Potential Hosts Attending:** Georgia, India, Pakistan, Indonesia, Malaysia, Iraq, Iran, Sudan, Saudi Arabia, Algeria, Egypt, Libya, Cape Verde, Jordan, Ivory Coast, Cameroon, Nigeria, Eritrea, South Africa, ...
- **Numerous contacts made,**
- **Follow-up** Workshop planned for November 2006, in India.





First Deployment !

- **First instrument deployed at University of Tunis**
- **Morocco and Algeria agreement is already negotiated, instruments to be delivered in Spring 2006**
- **Libya and Egyptian contacts made, visit March 2006**

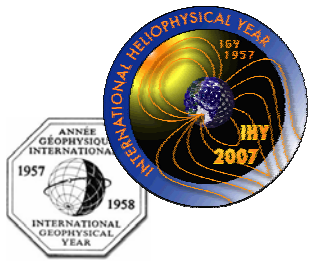




IGY Gold Program

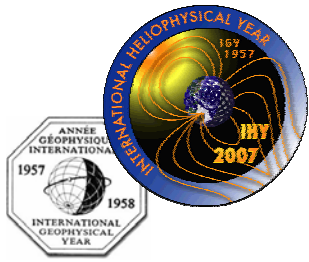
- Sponsored by IUGG
- Managed by IHY for all International Years
 - *Certificates available in IHY, IPY, eGY, and Planet Earth formats*
- Recipient must
 - *Have participated in the IGY in some capacity*
 - *Provide an artifact of historical interest*
 - *Agree to have name made public on website*
- Artifacts will be cataloged and held temporarily at the GSFC library
- History sessions organized for several meetings this spring





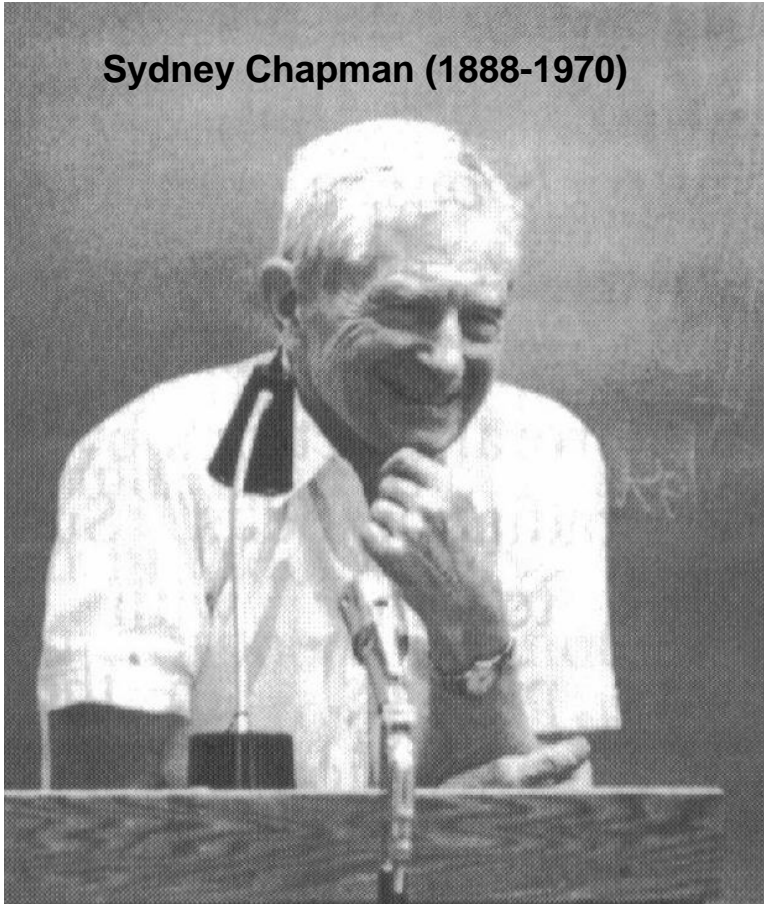
Organizational Activities

- Two US planning workshops held in US
- Website developed (ihy2007.org)
- Additional planning meetings internationally (Italy, China, Croatia, Niger,...)
- Numerous sessions at community meetings
- Secretariat hosted at AGU, Washington DC
- 3-year IHY work-plan adopted by UN
- NASA Research Announcement this year for US



IGY Justification

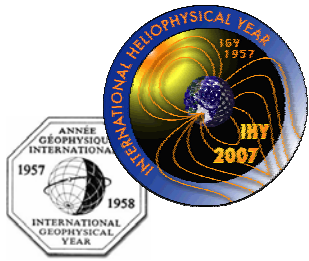
Sydney Chapman (1888-1970)



"The [IGY's] main aim is to learn more about the fluid envelope of our planet—the atmosphere and oceans—over all the earth and at all heights and depths. ... These researches demand widespread *simultaneous* observations." S. Chapman

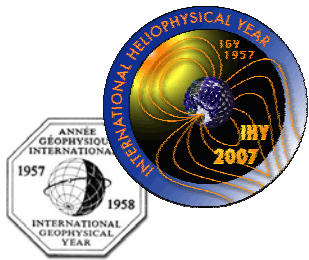
i.e. expanded synoptic studies

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Legacy of the IGY

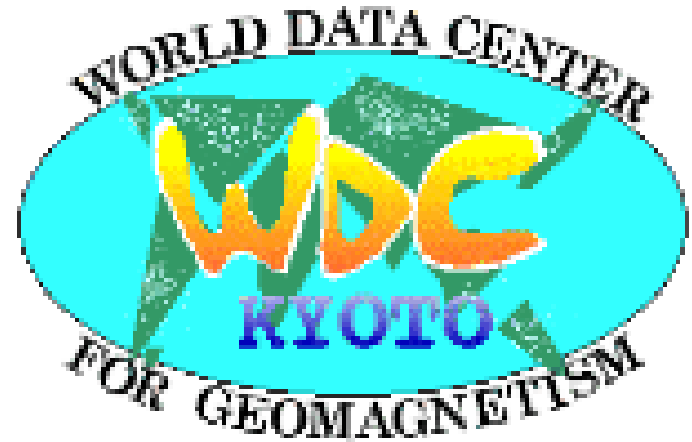
- **International Polar Year** – polar environment, and the polar environment as an indicator of climate, ICESTAR-IHY cluster proposal
- **International Year of Planet Earth** – rational management of natural resources
- **Electronic Geophysical Year** – modern electronic data practices
- **International Heliophysical Year** – space environment



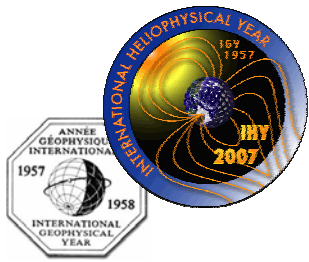
IGY Instrumentation and Innovations



- Antarctic stations
- All-sky cameras
- Scientific satellites
- World Data Centers

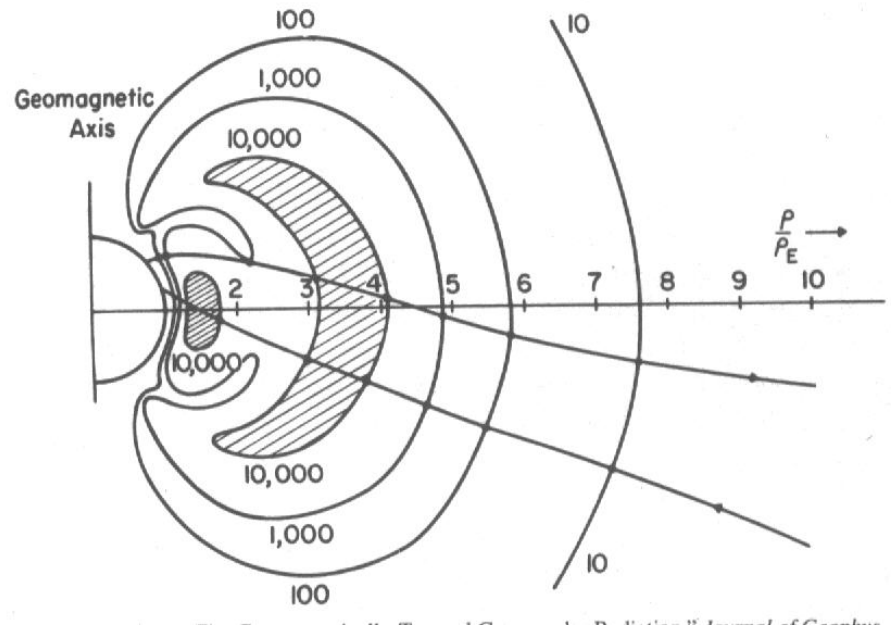


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Famous Result from IGY

From Explorer 1 and its followers, came the Van Allen radiation belts



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