The History of Cosmic Ray Research in Finland

by

Pekka Tanskanen, emeritus prof. University of Oulu, Finland

Selim Lemström (1838-1904)

- The very beginning of Cosmic Ray Research in Finland can be said to have started by Professor Selim Lemström at the University of Helsinki. In this context "Cosmic Rays" includes both particles originating in space or rays observed in the upper atmosphere.
- Who was Selim Lemström, the first modern Finnish physics professor?
- born 1838 in Inkoo approximately 60 km west of Helsinki.
- a teacher in Mathematics and Physics

First Polar year; beginning of international auroral research in Finland

- In 1878 Selim Lemström was appointed professor at the University of Helsinki
- Lemström's interpretation of his auroral observations caused a lot of controversies,
- brought modern physics into Finland by joining Finland as member of the first International Polar Year (IPY) 1881 - 1884, the first in series of coordinated international expeditions to the Polar Regions ever undertaken.

Observatories in N

- Two observatories founded Scandinavia in Finland
- Sodankylä and Kultala

Subsequent Polar Years

- The first International Polar Year, IPY I 1882 1883 served as a model for future international cooperation within cosmic physics researh. Sodankylä observatory was founded and in addition to geomagnetic observations also auroral research was initiated.
- During IPY II 1932 1933 the Earth's magnetic Field, the Atmosphere, Aurorae and Atmospheric Electricity were the center of investigation.

Towards New Challenges

• Even though Lemström's role as a scientist never rose to an internationally meaningful level, it goes without saying that his role as a forerunner in opening Finnish Geosciences to the international science community cannot be disputed.

Ground based Cosmic Research

- The II WW had isolated Finnish scientists and even though after the Peace Treaty in Paris 1947 the country entered a new epoch, financial support for science was very limited.
- In 1948 Lennart Simons professor at the University of Helsinki constructed an apparatus for the registration of beta-gamma as well as gamma-gamma coincidences for "Cosmic Ray Work".
- The apparatus consisted of 2 argon-alcohol filled GM-counters with 0.1 mm glass walls.

Early muon detectors

- Under the supervision of Prof. Väinö Hovi a cosmic ray telescope using Geiger-counters was built in the early sixties in Turku. The aim of the instrument was to measure North-South asymmetries of the cosmic radiation.
- Around the same time, i.e. in 1961 I was fortunate enough to get the support by the Director of the Physics Department, University of Oulu Prof. Pentti Tuomikoski to construct a "duplex" Geiger counter meson telescope. In the years 1963-1967 the instrument was used to study atmospheric effects on the muon component of cosmic rays.

MUSEUM TELESCOPE



GREY OLD BARN



BARN DOOR CLOSES



Neutron Monitor

- In the beginning of 1964 a Neutron Monitor, 9-NM-64 was built in Oulu, using 9 30 liter BF3 proportional counters newly developed by Chalk River Laboratories in Canada.
- 43 years ago, on August 6, 1967 a transportable Neutron monitor, operated by Dr. GiorgioVilloresi and his colleagues from the University of Rome came to Oulu to make coordinated cosmic ray measurements as a part of a program aiming at intercalibration of cosmic ray instruments operated at different locations in Europe.

CR-STATION IN OULU



Hadrons and Air Showers

- By combining a neutron monitor and a muon telescope consisting of plastic and liquid scintillators as well as position sensitive streamer tubes a hadron spectrometer was constructed here in Turku, and measured secondary neutrons and protons in an energy range 1-1000 Gev.
- Before ground based activities ended in Turku in 1994 an array consiting of 18 scintillation counters was constructed to measure air showers caused by high energy cosmic rays in the atmosphere.

In the upper Atmosphere

- SPARMO (Solar Particles and Radiations Monitoring Organization); Founded 1961.
- Coordination of measurements of high energy solar particles using balloon borne instruments; later auroral x-rays included
- Development of long duration balloon experiments
- Development of an early warning system for solar eruptions
- Coordination of balloon-rocket and satellite obs.

BALLOON BORNE INSTR.



Balloon flights in the Auroral Zone

- The first SPARMO balloon flight campaign in the summer of 1965; French-Finnish cooperation;
- 24 balloons launched from Ivalo and Sodankylä
- measurements of x-rays associated with solar eruptions and/or magnetic disturbances
- Balloon activities continued until 1979

Finland aims into Space

- Over 23 years as member of COSPAR Finland becomes an associate member of European Space Agency (ESA) in 1987.
- In 1995 Finland joins ESA as a full member
- Finland participates in the first ESA Cornerstone Prgms SOHO AND CLUSTER
- 2 Finnish instruments ERNE(Turku) and SWAN(FMI) launched Dec 1,1995 on SOHO and Univ of Oulu shares responsibilities in design and construction of 16 identical electric field instr flown on CLUSTER II ,launched on July 16 and Aug 9, 2000.

Concluding remarks

- With a modest start from ground observations of space phenomena Finland has managed to make her way into space, become a full member of an international Space Society with unlimited future challenges for the coming generations.
- Today I wish I was younger to see and experience the results of these challenges!
- THANK YOU ALL. BEST WISHES FOR YOUR FUTURE