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Cosmic Ray investigations on peak Musala in Bulgaria: A memoir

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Abstract

A very brief historical description of the Bulgarian Cosmic Ray investigations, in the Cosmic Ray Station on peak Musala (2925 m.a.s.l.) is presented. Difficulties of the high mountain measurements that time are mentioned, together with the hard emotional and successful work done by a small staff of young Bulgarian cosmic ray scientists.

Keywords: Peak Musala; Multidirectional muon telescope; Neutron monitor

1. Introduction

1957. Just 50 years ago... Two young physicists: B. Betev and S. Kavlakov received their Masters in atomic physics. Their University teacher Dr. L. Mitrani invited them to organize a new laboratory for Cosmic Ray investigations, as a small part of the Institute of Physics of the Bulgarian Academy of Sciences.

Now it is very difficult, even for me, to reproduce the situation in this small East European country. The communists were on full power. In Hungary the insurrection of November 1956 was just suppressed. The leaders in Bulgaria were uneasy. Every wrong word, every connection with the "Decaying West" was suspicious. Not even speaking about the free discussions and change of minds or scientific literature.

That was the time, when we decided to begin with the creation of our own Cosmic Ray Detectors. We needed calibrated tubes and tungsten wires. We needed suitable electronics and relatively stable measuring apparatuses. But generally all that was produced in the "West".

2. Collaboration and first steps

We understood that all that we could not overcome alone. So we tried a successful step: cooperation with the Hungarian Academy of Science. Why Hungary?

Because: That time the President of the Hungarian Academy of Sciences became Prof. Layos Janossy, well known as scientist, who had made his Cosmic Ray investigations far before the World War II.

Because: The Hungarian colleagues already had a well organized Cosmic Ray Department.

Because: They had better experience in electronics.

Soon we realized how important that cooperation was. From our Hungarian colleagues we received two big boxes of suitable tubes. In a small workshop we successfully converted them in Geiger–Muller counters for the first Bulgarian muon telescope, measuring coming muons under 45° toward the zenith in East and West direction.

Could you imagine the data registration in 1958? Mechanical counter, photographed every hour, signals from pendulum clock, film developing, reading and writing on paper the records.

Could you imagine now electronics based on 1000 radio tubes, changing their characteristics with time?

Could you imagine how often they have to be checked and changed?

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3. On the highest peak in Balkan Peninsula

We understood that with its 450 m above sea level, Sofia was not suitable for continuous cosmic ray measurements. Only 60 km, to the South we had a wonderful peak nearly 3000 ms above sea level with a more wonderful name: Stalin.

Maybe because of that,

Maybe because of the high level connections of Prof. Janossy,

Maybe because in Hungary there are no mountains, and surely because of our enormous enthusiasm, our Cosmic Ray Station was built only for one season on the highest peak on the Balkan Peninsula (Fig. 1).

So at the beginning of 1960 we had a 100 m^2 laboratory surface, under an 8 gr/cm^2 roof, situated at nearly 3000 m above sea level. We had enough electric power. We had two new technicians. We had a wonderful mountain overview (Fig. 2).

But to reach peak Musala we had to walk on foot 20 km. There was no road, and even no path to this place. Only in summer time an old type lift could supply materials and foods. And on the peak, the winter is a real one (Fig. 3).

The temperature: −10 to −30°C. The pressure: 695–710 mb. The wind: 10–30 m/s. The average snow: 3 m.

The maximum measured snow after the storm on May 14, 1965 was 8.5 m.

To get on Musala in winter time was risky; it needed enormous efforts.

To go downhill by ski alone on the 70% slope was very dangerous.

On January 14, 1966 one of our technicians was killed by an avalanche. Every one of us had at least ten minor, or not so minor, injuries.

But we were young. And we did not wait even for the walls to dry and the snow to melt; we began the work on Musala Cosmic Ray Station on the first days of January 1960.

4. First organized Cosmic Ray meetings

Well, we did it. The measurements on the peak were in progress. And we were already noticed. We were eager to exchange experience with other colleagues, to show them our new High Mountain Cosmic Ray Station. So in September 1961 we organized in Sofia the Seventh East European (and First Bulgarian) Cosmic Ray Conference.

Still there were no results from the peak. But we presented two talks, based on our basic measurements in Sofia (Kavlakov et al., 1960; Mitrani et al., 1960). Our presentations were in English Language, highly appreciated by our Hungarian colleagues, but in contradiction with the official Bulgarian rules in those years.

That conference was a success for us – the beginners in science, younger than 30 years, honored with the presence of all known cosmic ray specialists from Eastern Europe and from the Soviet Union.

Fig. 1. Bulgarian Cosmic Ray Station on peak MUSALA (2925 m above sea level) is just built.

Fig. 2. Panoramic view from peak MUSALA to the mountains in the South.

Fig. 3. On the peak the winter is a real one.

In the next years we organized four such Cosmic Ray meetings. They were attended by:

- Prof. E. Fenyves and Prof. A. Somogy from Hungary.
- Prof. Ginzburg (Nobel Prize) Prof. N. Dobrotin and Prof. Feinberg from USSR.
- Prof, Zavadsky and Prof. Miessovich from Poland.
- Prof. Lanius from East Germany.
- Prof. Friedlander and Dr. M. Spirchez from Romania.
- Prof. Dubinsky from Czechoslovakia.

Many of them visited our Cosmic Ray Station, covering the 22 km long and steep mountain path on foot (see Fig. 4).

In Hungary we had a stable partner – Cosmic Ray Department of the Institute of Physics in the frame of the Hungarian Academy of Sciences. They had a separate electronic department. In Sofia we had a small Geiger–Muller counter department. But the low salaries and the difficult conditions kept only for short periods the technicians on the peak. All the money for our department was not enough to support transportation to the peak not to speak about new experiments.

5. Change and successes

During this time our leader Dr. Mitrani, being on a Conference in East Berlin, "permits" himself to visit for several hours the West part of the town. The East German "STASI" communicates that to their Bulgarian "colleagues" and immediately Dr. Mitrani was expelled from the Bulgarian Academy of Sciences. We remained under the leadership of a weak theoretician, inexperienced organizer, but a good party member.

I remember well the difficulties, caused by the irregular material supply, unorganized lift transportation, insufficient technical support. To build alone the first multidirectional muon telescope with electronics, based on radio tubes was a real challenge for me (Fig. 5).

Fig. 4. Prof. E. Fenyves (second from the left) and Prof. L. Janossy, (third from the left) with colleagues on peak Musala.

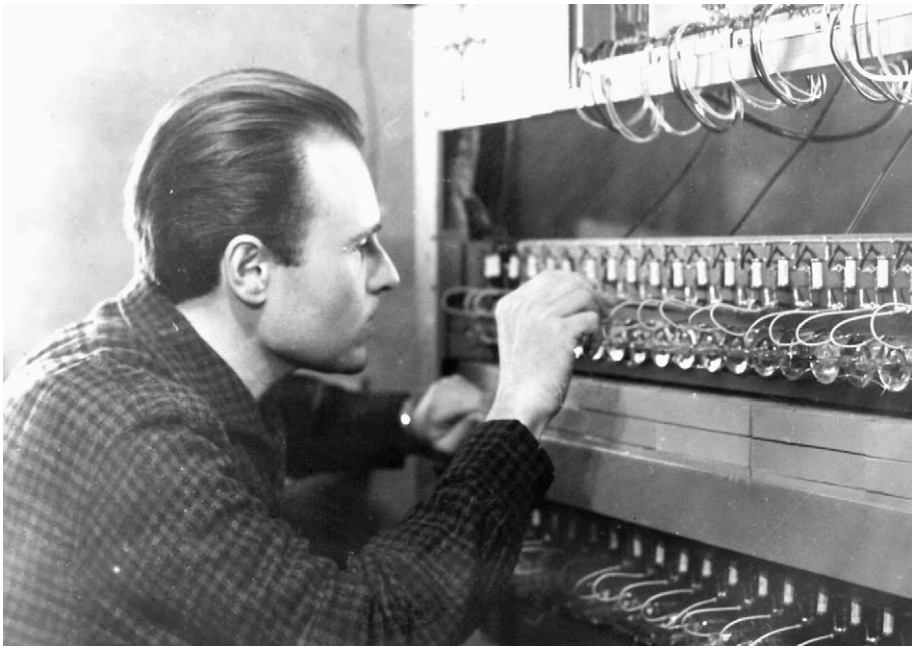

Fig. 5. The author (S. Kavlakov) checking the connections in the multidirectional muon telescope.

That time my colleagues built a new Simpson type Neutron monitor. The detecting tubes they received from Russia. New people came to work with us.

The peak took again its old name MUSALA.

The work on the peak continued. We had already transistors. Together with Hungarian colleagues we built the first in Eastern Europe EAS arrangement. A year after we put in operation a special huge apparatus, measuring high energetic neutrons cross section.

At the 11th ICRC in Budapest in 1969 we were the first to report the rise of neutron cross section with energy. Our contribution (Bozoki et al., 1970) appeared two months before the announcement of similar results, obtained from Prof. Grigorov's (USSR) group, based on measurements on the heaviest that time Satellite PROTON.

After that all the apparatuses were reconstructed. All electronic parts were based on transistors. And a lot of work was done just to overcome small trivial difficulties. Our basic investigation on high energetic particles was published in NATURE (Gombosi et al., 1975). More than 100 scientific papers, covering wide range of cosmic ray properties, were published on the basis of peak Musala measurements.

It came our turn to host the world's 15th International Cosmic Ray Conference (ICRC). Our very limited staff organized it in Plovdiv, August 1977 with success, acknowledged internationally. We met our western colleagues and they met, with interest, our papers.

After that we received a lot of official invitations for work with our West European, American and Japanese colleagues. All these invitations were withdrawn by the ruling party. We were not permitted to collaborate with them.

6. The disaster

A decision was taken to install one of the largest Neutron Monitor with evaluated rate of about 5,000,000

Fig. 6. But for all of us it is still up there... It is still in our hearts.

counts per hour. 60 tons of lead and 8 tons of paraffin were delivered on the peak. Modern electronics were prepared by our Hungarian colleagues.

We decided to celebrate the 24 years CR station on peak Musala on January 1, 1984 with a new first class experiment.

All was prepared... but...

On Saturday, October 29, 1983, late afternoon a short circuit inflamed the wooden part of the upper floor. Only one technician has been there. And only about 100 l of water. But a lot of paraffin and dry wooden walls and furniture.

The result: A frozen lake of lead with remainders of the iron parts from our apparatuses.

And our hopes went with it...

Five long years we tried to persuade the building of a new modern Cosmic Ray Station on Musala. But that time the party had his own problems. In 1989 the communists block collapsed.

After that more of us from our Bulgarian Cosmic Ray Group gradually moved to new countries beginning new collaborations with our old friends from the Cosmic Ray Community. Now many of us are taking part in prestigious Cosmic Ray experiments and teaching as professors in leading Universities throughout the World. Some of our colleagues from Hungary did the same.

But for all of us our Musala Cosmic Ray Station remained in our hearts. It remains together with our memories of our young nice and difficult years up on the high peak (Fig. 6).

Acknowledgments

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