KJF, prof. Juraj Dubinský a rozvoj OKF ÚEF SAV Košice

Karel Kudela

3.12.2014

Začiatky kozmického výskumu (experimenty v kozme) na československých pracoviskách:

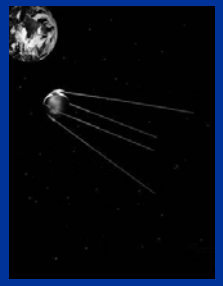
Interkozmos 1970

– kozmická biológia, medicína (aj na UPJŠ v Košiciach)

Ahlers I, Misurova E, Praslicka M, Tigranyan RA. Biochemical changes in rats flown on board the Cosmos 690 biosatellite. Life Sci Space Res. 1976;14 185-188. PubMed PMID: 11977276

– kozmická fyzika (aj ÚEF SAV, TU Košice, PF UPJŠ, LVN)

– diaľkový prieskum Zeme (aj v KE v 80-90 r.)



Sputnik 1

http://www.amnh.org/explore/news-blogs/on-exhibit-posts/back-to-the-start-of-space-race-in-beyond-planet-earth

Prof. Juraj Dubinský

prvý vedúci oddelenia kozmického žiarenia a prvý riaditeľ ÚEF SAV

1969-1979

ГЕОМАГНИТНЫЙ ЭФФЕКТ ШИРОКИХ ЛИВНЕЙ КОСМИЧЕСКИХ ЛУЧЕЙ

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В работе изучается влияние магнитного поля земли на распределение плотности широких ливней космических лучей (употребим в дальнейшем обозначение КЛ.). Ствол ливня определялся счетчиками, экранированными свинцом, и измерялись совпадения этих счетчиков с набором счетчиков, который поочередно помещался на одинаковом расстоянии в южном или западном направлениях. Измерения показали, что на расстоянии $D = 30$ м плотность в западном направлении на 40% больше, чем в южном; на расстоянии $D = 50$ м это различие увеличится даже до 60%. Приведенные различия лежат далеко за границей статистических ошибок.

ВВЕДЕНИЕ

В работе изучается распределение плотностей широких ливней КЛ, вызванных в атмосфере земли первичной компонентой КЛ, энергия которых больше 10^8 *эв*. Взаимодействие частицы с большой энергией первичной компоненты КЛ с атомами атмосферы вызывает, во-первых, ядерный каскад, образующий так называемый ствол широкого ливня, во-вторых, ряд электронофотонных каскадов, постепенно образующихся вокруг ствола широкого ливня КЛ [1—3].

В результате взаимодействия частиц ливня, с одной стороны, с атомными ядрами, с другой стороны — с атомной оболочкой, широкий ливень распространяется как в вертикальном, так и в горизонтальном направлениях. Горизонтальное распространение обусловлено отчасти кулоновским рассеянием частиц, которое имеет в этом процессе преимущественное значение, отчасти, и в меньшей мере, — рассеянием отдельных частиц под большими углами. Все прежние экспериментальные и теоретические работы, которые занимались распределением широких ливней КЛ, учитывали лишь указанные два фактора [4—10].

В этих работах, предполагающих всегда сферически симметричное распределение широких ливней КЛ, найдена зависимость плотности ϱ (т. е. числа частиц/м²) от расстояния r от ствола ливня вида

$$\varrho \sim \frac{1}{r^{2-s}}$$

где s — параметр, зависящий от высоты над поверхностью земли. В каскадном максимуме ливня $s = 1$.

Только в этом году Коккони [11], [12] заметил, что магнитное поле земли должно вызвать определенную асимметрию в распределении плотности частиц широкого ливня КЛ тем, что оно искривляет траектории заряженных частиц. Эта асимметрия проявляется в том, что широкий ливень КЛ не сферически симметричен, а удлинен в западно-восточном направлении; сечение ливня поэтому не круговое, а эллиптическое. В своей первой работе [11] Коккони оценил, что главная ось эллипса в западно-восточном направлении в два раза длинее, чем главная ось в северо-южном направлении. В следующей работе [12] он сбавил свою оценку асимметрии широкого ливня на уровне моря на 2%.

ON THE LUNAR VARIATION OF COSMIC RADIATION

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The paper investigates the lunar variation of the intensity of cosmic radiation as assumed by E. Bagge and O. Binder. By evaluating the data of two stations on the same meridian circle (Rome and Makapuu Point) we reach the conclusion that this lunar variation is only apparent. The result obtained by E. Bagge and O. Binder could be caused by a small difference between the diurnal period and the assumed lunar variation. This statement is demonstrated by searching for variations with periods 22, 23, 24, 25 and 26 hours which also differ little from the 24-hour period of the diurnal variation. For these calculations the data of the station Mt. Norikura were used.

О ЛУНАРНОЙ ВАРИАЦИИ КОСМИЧЕСКОГО ИЗЛУЧЕНИЯ

В работе изучается лунарная вариация интенсивности космического излучения, которую предполагали Э. Багге и О. Биндер. Обработав данные двух станций, лежащих на меридианной окружности (Рим и Макапуу Пойнт), мы пришли к заключению, что указанная лунарная вариация является только кажущейся. Результат, который получили Э. Багге и О. Биндер, может быть обусловлен небольшой разницей в периоде дневной и предполагаемой лунарной вариации. Это наше утверждение мы демонстрируем поисками вариации с периодами 22, 23, 24, 25 и 26 часов, также мало отличающимися от 24 часового периода дневной вариации. Для этих расчетов мы использовали данные станции Мт. Норикура.

INTRODUCTION

At the conference on cosmic radiation in Moscow 1959, E. Bagge and O. Binder [1] reported a variation of cosmic radiation with a period of one lunar day. By harmonic analysis of the data obtained by a cubical telescope they obtained a wave with an amplitude of about 0·2% with a maximum about 15 to 20 hours after the upper culmination of the Moon. For the variation of the neutron component, a preliminary analysis led to a value of about 0·4%. Considering that the amplitude of this wave is about as large as the amplitude of the diurnal wave of cosmic radiation [2], the interference of the two periodic variations should be considered and the present concept of the diurnal variation would have to be corrected. Moreover, the diurnal variation would periodically vary with a period of one lunar month (i.e. 29 days 19 hours), which is an interval near the period of the 27-day variation of solar origin.

As the entire effect is greater for the neutron component and as for this component no temperature correction [3] is necessary, we have in this paper used the data obtained from detectors of the neutron component at different stations. We have used these data in the form as given by the World Centre

Od pozemních měření kosmického záření k měřením na družicích

Měření kosmického záření v Tatrách se datuje od r. 1958. Příspěvek československých fyziků k IGY (International Geophysical Year).

Dnes pracuje na Lomnickém štítě neutronový monitor spojitě měřící kosmické záření s vysokou statistickou přesností (1.6. 10^6 /hod).

Měření v reálnem čase jsou dostupná na http://neutronmonitor.ta3.sk .

Začátek 70. let 20. stol. – možnost měření na družicích (i nižší energie). Prof. J. Dubinský – ředitel ÚEF SAV.

Merania KŽ vo Vysokých Tatrách. Lomnický štít.

In 1950's: for Czechoslovak CR physicists High Tatras were natural place for experiments. After start in Prague – works developed there.

Nature **168**, 1004 (08 December 1951); doi:10.1038/1681004a0

Determination of the Mean Life-time of μ-Mesons

J. PERNEGR
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THE photographic emulsion method has been applied to the determination of the mean life-time of μ-mesons from their anomalous absorption. Ilford *C*2 plates with emulsion thicknesses 140 μ, 150 μ and 185 μ were exposed to cosmic radiation under controlled conditions for 42 days during the winter of 1950 in the High Tatra Mountains. One batch of plates was exposed without any absorber at Skalnaté Pleso (1,780 m.) and another one was placed on the top of Lomnický Štít (2,640 m.) under 12 cm. of lead absorber, corresponding in stopping power to the layer of air, 85 gm./cm.2, between the two stations. The plates were developed by the freezing method of C. C. Dilworth.

Nature **168**, 1005 (08 December 1951); doi:10.1038/1681005b0

Transition Effect of the Star-producing Radiation, L. TOMÁŠKOVÁ

MESON SHOWERS AND ACCOMPANYING DISINTEGRATIONS

(Мезонные ливни и связанные с ними распад ядер)

An investigation of the production of mesons and heavy particles during the collision of high energy cosmic ray particles ($E \sim 10^{11}$ eV) with atomic nuclei furnishes experimental data on the multiplicity of the production of new particles and the localization of the field energy of the nucleon [1]. The disintegration of the nucleus which occurs during such collisions, provides the means for verifying the applicability of various models of the nucleus.

An attempt is made to contribute to a solution of the question in which energy region the plural production of mesons predominantly occurs and at which limiting energy the multiple process predominates (terminology according to [2]); in addition an attempt is made on the basis of new experimental material to obtain data on the mechanism of the disintegration process which was investigated in an earlier paper [3]. For this purpose Ilford G 5 nuclear plates irradiated both in the stratosphere and on Lomnický Štít were used.

The analysis of the meson showers was carried out in nine cases of jets (at least five shower particles and at most three slow particles), seven of which were caused by primary protons and two by neutral particles. The energy of the primary particles γ_c was determined in the usual way from the angular distribution of the shower particles [$\gamma_c = (\tan \vartheta_f \tan \vartheta_{1-f})^{-\frac{1}{2}}$ where γ_c is the primary energy in units of rest-energy, ϑ_f and ϑ_{1-f} are the half-widths of the angles which in the laboratory coordinate system contain the fraction f or $1 - f$ respectively of shower particles. The measured distributions of momenta were then transformed into the centre of gravity system; the expected isotropy was ascertained within the limits of statistical errors. If $\log \frac{f}{1-f}$ is plotted as a function of $\log (\gamma_c \tan \vartheta)$ according to [4], the points lie approximately on a line with slope 2, which is a further confirmation of the isotropy. Inconsistent data has meanwhile been obtained on the coefficient of inelasticity K of the collision, defined as the ratio of the total energy of ejected mesons to the kinetic energy of the primary particle in the centre of gravity system on the assumption that all mesons in the shower are π mesons (a third of these neutral mesons) and that the energy of all ejected mesons is approximately identical:

$$K = \frac{1.5n \pm \gamma_c \sin \vartheta_L}{2\mu(\gamma_c - 1)},$$

where n is the number of charged mesons in the shower, ϑ_L is the limiting angle of the shower in the laboratory system, μ is the ratio of the mass of nucleon and π meson. For K we obtained the values 0.2; 0.22; 0.3; 0.42; 0.65; 0.73; 0.87; 0.88; 0.91. From these data it follows that in the region of interaction energy above 10^{11} eV the multiple process of meson production predominates. We further measured meson showers accompanied by considerable oscillation or evaporation of the nucleus (more than 4 slow particles N_h, leaving grey and black tracks); altogether 46 cases of such showers were measured. The angular distribution of the shower particles is practically identical for stars containing different numbers of slow particles N_h and shows marked collimation of the shower particles and at the same time, however, a considerable number of particles in the reverse direction. It seems, therefore, that these less energetic interactions are accompanied by the plural production of mesons. Marked collimation was also ascertained with α particles ejected during the disintegration of the nucleus accompanying the meson shower. This collimation of α particles was also observed, however, with stars not containing shower particles; an analysis was carried out on 1250 stars in emulsions from the stratosphere and from Lomnický Štít. The measured data can either be explained on the basis of an earlier assumption of the emission of α particles from the point of local over-heating of the nucleus during the collision [3] or on the assumption that during the collision the nucleus first splits into two fragments the lighter of which disintegrates into α particles while the heavier evaporates. A systematic and detailed analysis of the results of these measurements will be carried out on more comprehensive material and published in a future paper.

Received 14. 7. 1955.

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Institute of Physics, Charles University, Prague

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Pernegr,J.

Pernegr,J.,
Chaloupka, P.

ВОСТОЧНО-ЗАПАДНАЯ АСИММЕТРИЯ НА 48 °N ГЕОМАГНИТНОЙ ШИРОТЫ

(East-West Asymmetry on the 48 °N of the Geomagnetic Latitude)

Измерения влияния магнитного поля земли на заряженные первичные частицы космического излучения производились до сих пор в основном вблизи геомагнитного экватора, где перевес частиц, попадающих на поверхность земли с запада, проявляется наиболее ярко [1]. Величины восточно-западной асимметрии, измеренные разными авторами на более высоких геомагнитных широтах [2], отличаются довольно сильно друг от друга; поэтому оценки относительного количества отрицательных частиц в первичной компоненте космического излучения, полученные из этих измерений, также значительно различаются. Мы сочли поэтому целесообразным измерить распределение частиц в различных направлениях на Ломницком Щите (2640 *м* над уровнем моря, геомагнитная широта 48 °N).

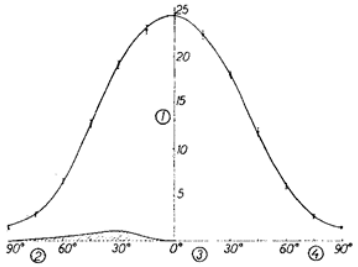

Рис. 1. 1 - количество двойных совпадений в мин; 2 - запад; 3 - зенитный угол; 4 - восток 90°.

Таблица 1.

Зенит. угол	Двойные совпадения		Тройные совпадения		Продолжительность измерения
	Z	V	Z	V	
0	2818	2818	483	483	115
15	2613	2580	483	460	115
30	3408	3244	602	580	180
45	2306	2161	440	428	180
60	1170	1080	212	215	180
75	348	324	64	52	120
90	110	112	17	18	70
Всего	12773	12319	2301	2236	960

Мы применили обычное телескопическое приспособление со счетчиками Гейгера-Мюллера [3], производства Тесла, с диаметром 30 *мм*, длиной 300 *мм*. Двойные и тройные совпадения регистрировались двумя независимыми схемами совпадения. Для устранения электроно-фотоной слагающей между счетчиками, включенными в схему двойных совпаденый, помещался свинцовый (10 *см*) поглотитель, между счетчиками, включенными в схему двойных и тройных совпадений помещался дальнейший слой 20 *см* свинца, так что тройные совпадения соответствовали только таким частицам, которые прошли свинцовым поглотителем толщиной в 30 *см*. Весь телескоп из счетчиков можно было вращать вокруг горизонтальной и вертикальной осей, чтобы иметь возможность измерять интенсивность частиц в различных азимутальных и зенитных направлениях.

THREE VARIATIONS IN THE INTENSITY OF COSMIC RADIATION IN THE FIRST HALF OF 1958

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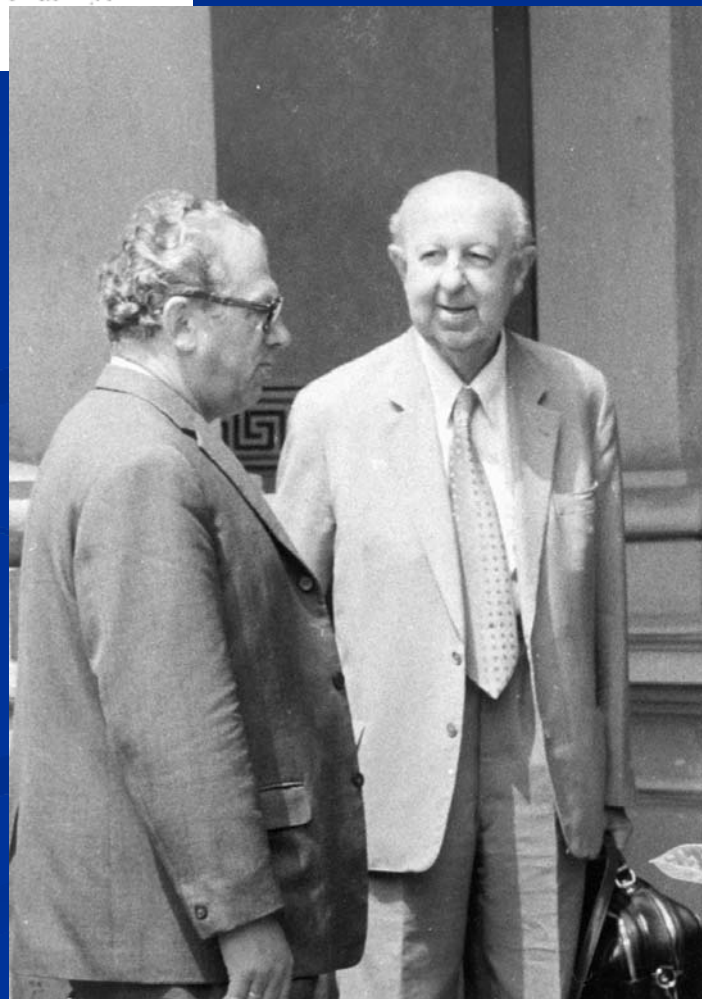
The time courses are given of three variations in the intensity of cosmic radiation, which occurred in the first half of 1958. The measuring apparatus is described and the energies of the particles recorded a reestimated. The paper is the partial result of systematic measurements of the intensity of cosmic radiation carried out in Czechoslovakia in the International Geophysical Year.

MATEMATICKO-FYZIKÁLNY ČASOPIS SAV, X, 4-1960

PRIEBEH INTENZITY KOZMICKÉHO ŽIARENIA V ROKOCH 1958—1959

JURAJ DUBINSKÝ, PAVEL CHALOUPKA, TADEUSZ KOWALSKI

Prof. Petržílka
Prof. Dubinský



Dr. Pavel Chaloupka

Vol. 30 (1979), No. 6 339

SOLAR PROTON EVENT OF MAY 7, 1978 RECORDED AT LOMNICKÝ ŠTÍT

† *J. Ilenčík*, Institute of Experimental Physics of the Slovak Academy of Sciences, Lomnický štít
J. Dubinský, Institute of Experimental Physics of the Slovak Academy of Sciences, Košice

Received 17 January 1979

Солнечное протонное образование 7-го мая 1978 г. регистрированное в обсерватории Ломницкий штит

Статья содержит краткую информацию о необыкновенном росте солнечного космического излучения 7-го мая 1978 г. регистрированном нейтронным супермонитором 4 — NM — 64 установленным в институте экспериментальной физики САН на Ломницком штите.

This is a short report on the unique increase of solar cosmic radiation recorded on May 7, 1978 by the neutron 4-NM-64 supermonitor, located at the establishment of the Institute of Experimental Physics of the SAV at Lomnický štít

The 4-NM-64 neutron supermonitor, located at Lomnický štít (49·20 °N, 20·22 °E) at 2632 m mean sea level with a vertical threshold rigidity R_c = = 4·0 GV (Shea et al., 1968) recorded an increase in the number frequency of the neutron component of cosmic radiation relative to the normal level on May 7, 1978. This increase was due to an increase in the solar particle flux, generated on the Sun. Together with the events of Sept. 19 and 24, 1977 (McKinnon, 1978) and Nov. 22, 1977 (Dubinský et al., 1978) it is the fourth case of solar GeV energy particles being recorded by ground-based experimental instruments in the 21st cycle of solar activity. In comparison with the time variations of the number frequency of the neutron component of cosmic radiation in preceding cases, this increase was the largest in amplitude since May 4, 1960 (Ilenčík, 1978).

The increase in solar cosmic radiation of May 7, 1978 was observed during the increasing phase of a large Forbush decrease of the intensity of galactic cosmic radiation which began on May 1, 1978 at 08 38 UT (Fig. 1). Figure 2 shows the time variation of the 5-minute data from the 4-NM-64 neutron supermonitor at Lomnický štít. The data have been corrected for pressure relative to the mean value of atmospheric pressure of 550 mm Hg with a barometric coefficient of 1·024% per mm Hg. The absorption path of the solar particles in passing through the Earth's atmosphere has been taken into account.

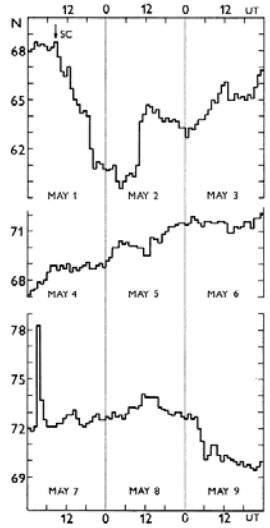


Fig. 1. Values of the abundance of the neutron component of cosmic radiation, corrected for pressure, recorded at Lomnický štít May 1—9, 1978.

Fyzikálny časopis 19 (1969), No. 4

THE ENERGY SPECTRUM OF THE COSMIC RAY EMISSION ON 28 JANUARY 1967

PAVEL CHALOUPKA, JOZEF ILENČÍK, Košice

On the 28th of January 1967 there occured an emission of cosmic rays from the Sun. In this article we deal with the time dependence of the particles emitted from the Sun on the exponent of the energy spectrum. We used data obtained at 16 stations, the list of which is given in Table 1.

The values of the neutron component intensity were plotted against those of the cutoff rigidity R on the basis of obtained data. The values of R used here have been calculated by Finch and Leaton [1]. Figures 1a, b, c give the time dependence of the relative changes of the intensity of the neutron component on 28th and 29th January 1967 at *Alert*, *Leeds* and *Pic du Midi*.

The dependence of the maximum amplitude of the variation $\left|\frac{\delta N}{N}\right|_{max.}$ (in per cents) of the neutron component on the cutoff rigidity is shown in Fig. 2. (The stations are denoted according to Table 1.)

Table 1

		geo-graphic lattitude	geo-graphic longitude	altitude above see level [m]	cutoff rigidity [GV]
1. *Alert*	(Canada)	82,50	— 62.33	66	0.05
2. *Churchill*	(Canada)	58.75	— 94.09	39	0.21
3. *Dallas*	(USA)	32.78	— 96.80	208	4.35
4. *Deep River*	(Canada)	46.10	— 77.50	145	1.02
5. *Denver*	(USA)	39.75	—105.00	0	2.91
6. *Goose Bay*	(Canada)	53.33	— 60.42	46	0.52
7. *Inuvik*	(Canada)	68.35	—133.73	21	0.18
8. *Ottava*	(Canada)	45.40	— 75.60	0	1.08
9. *Kiel*	(Germany)	54.33	10.13	0	2.29
10. *Leeds*	(England)	53.82	— 1.55	100	2.20
11. *Lomnický štít*	(Czechoslovakia)	49.20	20.22	2634	4.00
12. *London*	(England)	51.53	— 0.09	45	2.73
13. *Roma*	(Italy)	41.90	12.52	60	6.31
14. *Oulu*	(Finland)	65.01	25.30	0	0.81
15. *Uppsala*	(Sweden)	59.85	17.92	0	1.43
16. *Pic du Midi*	(France)	42.93	0.25	2860	5.36

OKŽ (neskôr OKF) - začiatky po r. 1970:

Jozef Ilenčík (od založenia ÚEF 1969)

Ladislav Just (od založenia ÚEF 1969)

Mikuláš Bánó (od r. 1971)

Karel Kudela (od r. 1971)

Marián Slivka (od r. 1974)

Milan Stehlík (od r. 1975?)

Prof. J. Dubinský viedol (okrem prác OFVE) práce v oddelení, nachádzal nové kontakty, orientoval mladých na spoluprácu.

Viacerí pracovníci oddelenia pôsobili/pôsobia aj na KJF – prednášky, cvičenia, postgraduálne štúdium pre učiteľov (pod jeho gesciou), tiež diplomové práce – od r. 1974

Oddelenie (košická časť) profitovala : (a) z toho, že sme mohli používať priestory katedry (a používam(e) aj teraz), (b) z kontaktov so študentami, ich odborný rast cez KJF ap.

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4. **Bulharská ul. 2** ⟷ ↕

Lomnický štít a viacnásobné sťahovanie skupinky v Tatrách.

octa phys. slov. 27. (1977), No. 4

STUDYING HIGH ENERGY COSMIC RAYS BY USING EMULSION STACK CONNECTED WITH IONISATION CALORIMETER

ИЗУЧЕНИЕ КОСМИЧЕСКИХ ЛУЧЕЙ ВЫСОКОЙ ЭНЕРГИИ ПРИ ПОМОЩИ ЭМУЛЬЗИОННОГО БЛОКА, СОЕДИНЁННОГО С ИОНИЗАЦИОННЫМ КАЛОРИМЕТРОМ

J. DUBINSKÝ, L. JUST, Košice*
A. J. SOMOGYI, Budapest**
S. SUGAR, B. CHADRA, Ulan Batar***
B. BAICAN, M. HAIDUC, S. NEAGU, T. VISKY, Bucharest****
Y. BASINA, S. BRIKKER, N. GRIGOROV, M. KONDRATYEVA, L. MISHCHENKO, R. NYMMIK, L. PAPINA, A. PODGURSKAYA, L. POPEREKOVA, I. RAPOPORT, V. SOKOLOV, V. SOBINYAKOV, Ch. TRETYAKOVA, L. CHIKOVA, V. SHESTOPEROV, Zh. SHOPENBERG, Moscow*****

In the paper there are presented results of interactions of nuclei with nuclei at energies $E \geqq 10^{12}$ eV. It is shown that there exists a class of interactions which does not correspond to the superposition of independently interacting nucleons of the impacting nucleus with nucleons of the target nucleus.

On the board of the satellite "Intercosmos-6" there the BFB-S apparatus was placed for studying high energy cosmic rays.

In this apparatus a big emulsion stack was located between two track spark chambers having a good depth discrimination ability. The spark chambers together with the stack were located over the ionization calorimeter of a rather small thickness. Over the upper spark chamber the scintillator detector CC-1 for determining the space angle was placed, in which the particles were registered; it enabled also the crude estimation of the primary particle charge (Fig. 1). The second scintillator CC-2 was located between the stack and ionisation calorimeter and served for the registration of primary particle interaction events in the stack.

The spark chambers were photographed by pairs of photoapparatuses. The following processing of these photographs enabled to obtain the spatial picture of particles passing through the chambers. The whole information about the work of the apparatus was also registered on an X-ray film.

The spark chambers were triggered when in the ionisation calorimeter an energy of not fewer 5×10^{11} eV was registered, then the detector CC-1 was switched on and through the detector CC-2 at least 4 particles were passing.

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acta phys. slov. 27. (1977), No. 2

DETERMINATION OF THE SPECTRAL CHARACTERISTICS OF ELECTRON PULSATIONS ACCORDING TO THE INTERCOSMOS — 5 DATA

MARIÁN SLIVKA*, JURAJ DUBINSKÝ*, ANDREJ FUTÓ*, KAREL KUDELA*, KOŠICE

The paper describes the computational methods of the spectral and Fourier analysis time series and their application for the research of pulsations of electrons according to the Intercosmos — 5 data.

ОПРЕДЕЛЕНИЕ СПЕКТРАЛЬНЫХ ХАРАКТЕРИСТИК ПУЛЬСАЦИИ ЭЛЕКТРОНОВ ПО ДАННЫМ СПУТНИКА ИНТЕРКОСМОС — 5

В статье приведены вычислительные методы спектрального и Фурье анализов временных рядов. Эти методы применены в исследованиях пульсаций электронов по данным спутника ИНТЕРКОСМОС — 5.

I. INTRODUCTION

For the research of magnetospheric processes it is important to study the dynamic processes which develop pulsations of various kinds. The measurements made on board of satellites point to the existence of electron pulsations in the magnetosphere. Among pulsations occurring in the magnetosphere these pulsations have so far not been understood well. No definite mechanism for thier origin has yet been suggested, except a few remarks in papers [1, 2, 3] and [4]. Their dependence on the occurrence of other geophysical phenomena has not been studied in detail either. Some events of fast irregular changes of electron intensity with energies $E_e > 4$ý keV were observed on boards the satellites Intercosmos — 3 Intercosmos — 5. The first results presenting the amplitude characteristics of precipitating and quasitrapped electrons with energies $E_e > 40$ keV according to the Intercosmos — 5 data are in [4].

In this paper the system of programs for computers is described with the application of the Fourier and the spectral analysis. These programs were used for

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acta phys. slov. 26 (1976), No. 4

CURRENT DENSITY AND DIFFUSION COEFFICIENT FOR COSMIC RAY PARTICLES

MILAN STEHLÍK,* JURAJ DUBINSKÝ,* Košice

The expression of current density for cosmic ray particles scattering in the interplanetary turbulent magnetic fields is found in the work. It is shown that the convectional component of the speed of the current particles does not correspond to the solar wind velocity, but it is determined by the "drifting" velocity of the charged particles in the solar wind. A tensor coefficient diffusion is computed in the case of $R \ll L_c$, where R is the Larmour radius. The longitudinal spatial diffusion coefficient and the mean free path are discussed in detail.

ПЛОТНОСТЬ ТОКА И КОЭФФИЦИЕНТ ДИФФУЗИИ ДЛЯ ЧАСТИЦ В КОСМИЧЕСКИХ ЛУЧАХ

В работе найдено выражение для плотности тока частиц в космических лучах, которые рассеиваются в межпланетных турбулентных магнитных полях. Показано, что обычная компонента скорости тока частиц не соответствует скорости солнечного ветра, а определяется скоростью дрейфа заряженных частиц в солнечном ветре. Тензорный коэффициент диффузии расчитан в случае $R \ll L_c$, где R обозначает радиус Лармора. Детально обсуждаются коэффициент продольной пространственной диффузии и средняя длина свободного пробега частиц.

I. INTRODUCTION

In the investigation of the scattering process of cosmic ray particles in an interplanetary irregular magnetic field many authors have been using the ready diffusion equation, resp. the Fokker—Planck equation. It cannot be doubted that in the case of many phenomena, where the mean free path of the cosmic ray particles is larger than the irregularities of the medium [1, 2], the application of a more general equation — the Boltzman kinetic equation for the mean distribution function $F(\boldsymbol{r}, \boldsymbol{p}, t)$ — is necessary. This equation has the form [1]:

$$\left(\frac{\partial}{\partial t} + \hat{L}_0\right) F(\boldsymbol{r}, \boldsymbol{p}, t) = \mathrm{Col}\, F\,,$$

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Marián Slivka, Ján Pavlisko, Ivan Kimák

Milan Stehlík

PITCH - ANGLE DIFFUSION RATE OF GEOMAGNETICALLY TRAPPED ELECTRONS $E_e > 40$ keV ESTIMATED FROM INTERCOSMOS-5 DATA

K. Kudela, J. Matišin, Institute of Experimental Physics, Košice

Received 11 September 1977

Оценка скорости питч-угловой диффузии электронов ($E_e > 40$ keV) захваченных магнитным полем Земли по данным спутника Интеркосмос 5

На основании данных измерений на борту низкоорбитного спутника Интеркосмос 5 определены коэффициенты питч-угловой диффузии электронов с энергией $E_e > 40$ keV, захваченных в магнитном поле земли на $2{\cdot}5 \leqq L \leqq 4{\cdot}0$. Потокиэлектронов интерпретируются в обозначениях питч-углового распределения вблизи конуса потерь. В периоды геомагнитного спокойствия значения D находятся в пределах $10^{-5} - 10^{-3}$ сек$^{-1}$. Во время магнитной бури 16—17 декабря 1971 г. установлено возрастание D особенно на $L \sim 3$, где оно доходит до двух порядков. На более высоких L распределение почти изотропно. Оценки скорости питч-угловой диффузии сравниваются с результатами предыдущих экспериментальных определений D.

The coefficients of pitch-angle diffusion of electrons with energies $E_e > 40$ keV, trapped in the geomagnetic field at $2{\cdot}5 \leqq L \leqq 4{\cdot}0$, are estimated on the basis of low altitude satellite measurements made by Intercosmos-5. The electron fluxes are interpreted in term of pitch-angle distribution near the loss cone. During geomagnetically quiet intervals the values of D are in the interval of 10^{-5}—10^{-3} sec^{-1}. During the magnetic storm of 16—17th December 1971 an increase in D can be seen, especially at $L \simeq 3$, where D increased by as much as two orders of magnitude. For $L \geqq 4$ the distribution was nearly isotropic during this storm. The estimated rates of pitch angle diffusion coefficients are compared with previous values of D determinated experimentally.

1. Introduction

Among processes which are important in the complex of solar-terrestrial relations, there are the dynamical processes of trapped electrons and protons in the Earth's magnetosphere. The dynamics of these particles is influenced by solar and geomagnetic activity.

The equilibrium structure of the spatial distribution of electrons with energies $E_e = 35-560$ keV within the plasmasphere has bean recognized to be the result of the balance between pitch-angle diffusion and radial diffusion from an outer zone source (Lyons and Thorne, 1973; Lyons and Williams, 1975). The pitch-angle diffusion of electrons is connected with the resonant scattering on low-frequency electromagnetic waves (Lyons et al., 1972; Etcheto, 1973). Thus, the pitch-angle diffusion rates, obtained experimentally, are of great importance in the understanding of the dynamics of such electrons.

The measurement of charged particle fluxes by low-altitude satellites in the magnetosphere is a useful tool for studying the dynamics of geomagnetically trapped radiation. At these altitudes we observe the values of electron and proton fluxes near the loss cone and, directly, the precipitation of particles into the atmosphere.

The Intercosmos-5 satellite was launched on December 2, 1971 into an orbit with an apogee of 1200 km, a perigee of 205 km, an inclination of 48·5° to the equatorial plane and an orbiting period of 98 mins. The satellite carried a PG-1-A apparatus (Fischer et al., 1974) for measuring of electron, $E_e > 40$ keV, and proton fluxes, $E_p = 0{\cdot}5-14{\cdot}5$ MeV. The satellite was oriented along a geomagnetic field line and the electron detectors (and proton, too) were placed so that they could measure the flux of particles parallel, antiparallel and perpendicular to the vector of the geomagnetic field intensity $\boldsymbol{B}$.

The important characteristic of trapped radiation is the dependence of the flux on B (height dependence) at constant $L(J = J(B))$. From this we can estimate the pitch-angle diffusion rate (Theodoridis and Paolini, 1967; Fritz, 1974). In the present paper we are going to estimate the pitch-angle coefficients according to the measurements made by the Intercosmos 5 satellite.

2. Observations

The height dependences of the electron flux, $E_e > 40$ keV, were obtained from a large number of satellite passes through a certain region in $L-B$ space. They display a strong variability in time (see Fig. 1), especially in the slot and in the outer radiation belt.

Bull. Astron. Inst. Czechosl. **29** (1978), 229—232.

OUTER-ZONE ELECTRON BOUNDARY ACCORDING TO INTERCOSMOS-13 MEASUREMENTS

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Summary: *The position of the high-latitude boundary for electrons of $E_e > 40$ keV and $E_e > 1$ MeV on a low-altitude satellite is studied. An assymetry of this boundary with respect to magnetic local time has been detected. This assymetry depends on geomagnetic activity. Changes of boundary position are more pronounced for lower energies than for higher. The boundary positions obtained by Intercosmos-13 are compared with those obtained by the OGO-6 and AZUR satellites.*

1. INTRODUCTION

The high-latitude trapping boundary of electrons with energies above several tens of keV has been studied by many autors, in recent years, e.g., in [1, 2]. The structure of this boundary is used to determinate the transition between open and closed magnetic field lines and other magnetospheric features. The position of the boundary is characterized by invariant latitude, at which an intensity cut-off is observed (Λ_c), or background boundary (Λ_{bkg}), where the intensity falls to and remains at the level of the cosmic ray background 10^2 el/(cm^2 s sr) for at least 16 s [3]. For magnetically quiet periods boundary position Λ_{cu} according to [2] is used.

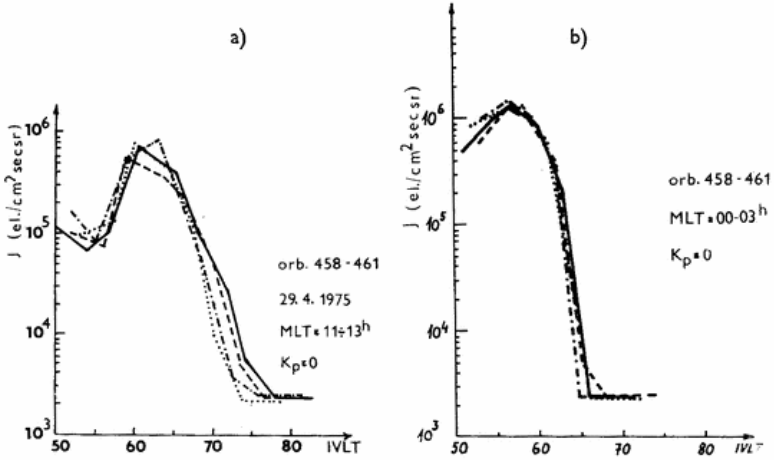

Fig. 1. Flux profile of electrons of $E_e > 40$ keV recorded by the Intercosmos-13 satellite near the outer trapping boundary for quiet periods. Passes on four subsequent orbits were used a) in the noon sector of MLT, b) in the midnight sector.

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QUASITRAPPED PROTONS ($E_p = 1-11$ MeV) NEAR $L = 4$ REGISTERED BY INTERCOSMOS-13 SATELLITE

IVAN KIMÁK, KAREL KUDELA

Institute of Experimental Physics, Slovak Acad. Sci., Košice)*

P. V. VAKULOV

*Institute of Nuclear Research, Moscow State University, Moscow**)*

Summary: *Data obtained from apparatus detecting energetic particles on low altitude polar orbiting satellite Intercosmos-13 show enhancement of quiasitrapped proton flux ($E_p = 1-11$ MeV) near $L = 4$ in comparison with both and lower L. This phenomenon persists during intervals with low level of geomagnetic activity. Possibility of influence of false pulses on the result is discussed.*

1. INTRODUCTION

Measurements from Intercosmos-13 Satellite ($H_{apo} = 1689$ km, $H_{per} = 284$ km, $i = 82{\cdot}9°$) are available from the end of March 1975 until June 1975.

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**) Address: 117 234, Moscow, USSR.

acta phys. slov. 27. (1977), No. 4

Letters to the Editor

EFFICIENCY OF A COSMIC RAY NEUTRON DETECTOR DETERMINED BY THE MONTE-CARLO METHOD

ОПРЕДЕЛЕНИЕ КОЭФФИЦИЕНТА ПОЛЕЗНОГО ДЕЙСТВИЯ ДЕТЕКТОРА МОНТЕ-КАРЛО

KUDELA K.,* PAVLISKO J.,** Košice

For the measurement of the cosmic ray neutron leakage flux and for the estimation of energy spectra of such neutrons the apparatus BANAN was developed [1]. This apparatus was launched on three flights of stratospheric balloons. for the evaluation of the data obtained in these experiments it is necessary to know the dependence of the efficiency of the registration of neutrons on energy. The estimation of the spectra of the neutron flux was provided in the energy range 1—10 MeV.

The efficiency of the neutron detector is mainly determined by the efficiency of the organic scintillator, where the neutrons are moderated and the energy deposition of recoil protons (and other charged products of interactions produced by neutrons) is detected by a photomultiplier. For efficiency evaluation the Monte-Carlo method was used, as in similar cases [2, 3]. The difference of our case is that in cosmic ray applications we must assume a nearly isotropic flux of particles incident on the detector. Besides, our geometry (see Fig. 1) does not make it possible to apply algorithms used in the quoted papers.

The simulation of processes connected with the neutron passing through a detector and leading to the detection of the neutron was provided by the method of statistical experiments in the following steps:

1. Generation of the neutron incident point onto the surface of the detector and of the direction cosines of the impacting neutron (isotropic angular distribution).
2. Simulation of the point of interaction according to the formula for the free path $l = -\ln \gamma/\Sigma_T$, Σ_T — total macroscopic cross section, γ — random number from the interval (0,1).
3. Simulation of the type of interaction (from known cross sections for the elastic scattering on C, H, for inelastic scattering on C, and for reactions $^{12}C(n, n')3\alpha$ and $^{12}C(n, \alpha)^9Be$).
4. Simulation of the value of energy of the recoil proton (of the nucleus) or of the charged products of reactions. In this we assume the isotropic angular distribution of these particles in the CMS system.

In step 4 the scattering angle of the neutron after interaction and its new energy were obtained. Then, there followed step 2 to 4 with this neutron. The energy of the charged particles (products of neutron interactions) was according to the formulas in [4] changed into light output S. The neutron was registered if $S > S_{min}$, was the minimal light output, determined by characteristics of the photomultiplier circuit and by conditions of the light collection.

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1975, porada IK 5, Skalnaté Pleso

Začátky – měření na balónech, spolupráce s pražskými pracovišti a s VŠT – katedra rádioelektroniky

Vol. 28 (1977), No. 4 241

APPARATUS FOR BALLOON MEASUREMENTS OF THE NEUTRON FLUX

J. Dubinský, K. Kudela, Institute of Experimental Physics of the Slovak Academy of Sciences, Košice
Yu. E. Efimov, Yu. A. Chichikalyuk, Institute of Technical Physics of the Academy of Sciences of the USSR, Leningrad
L. Michaeli, Electrotechnical Faculty, the Technical University, Košice
T. Vašek, Tesla, Institute for Nuclear Engineering Equipment, Přemyšlení

Received 2 December 1976

An apparatus for measuring the integral flux of neutrons in the energy range from thermal up to 1 MeV and for estimating power spectra in the interval of 1—10 MeV is described. The apparatus is used for measuring the neutron characteristics in the atmosphere on balloons. The detector system, electronic circuits and recording system are described.

Bull. Astron. Inst. Czech., 1977

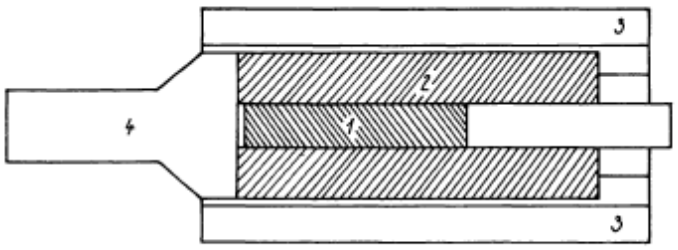


Fig. 1. Block diagram of the detection system. 1 — proportional counter, 2 — plastic scintillator, 3 — Geiger counters, 4 — photomultiplier.

Technologický přístroj – předchůdce přístroje na IK-17.

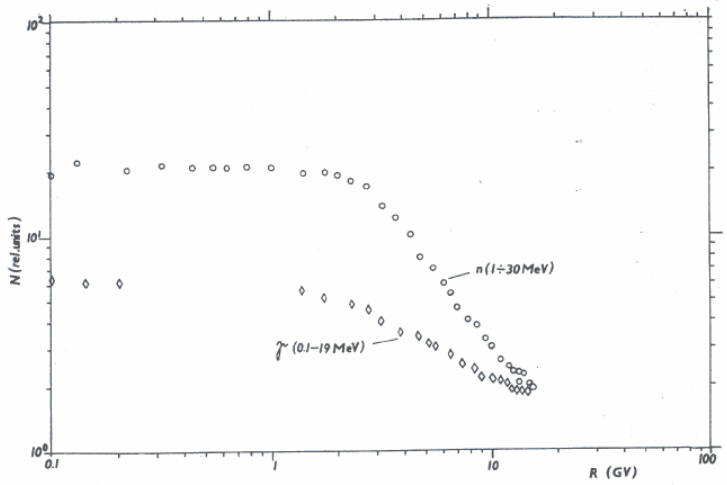


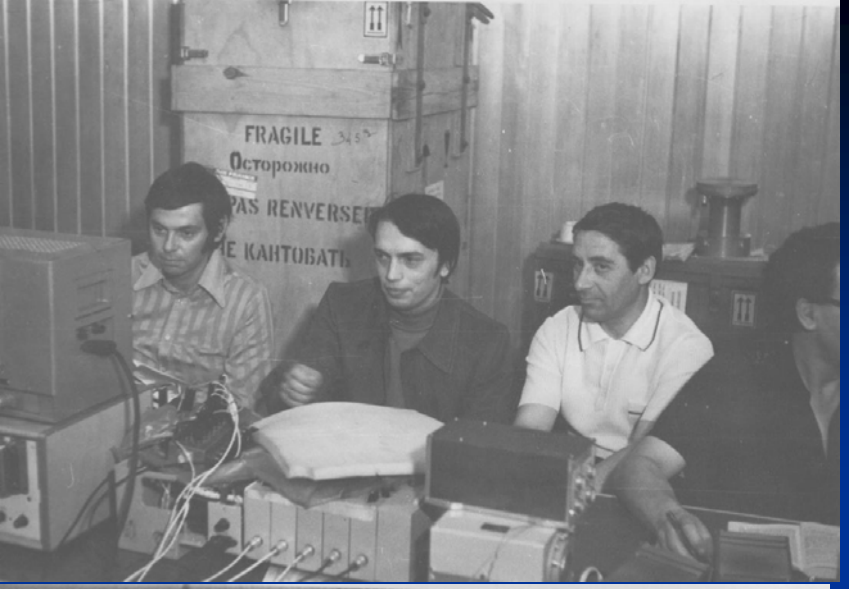
Fig. 1. Dependence of counting rate of neutrons (E_n = 1—30 MeV) and of γ-rays (E_γ = 0·1 to 6 MeV) on vertical cut-off rigidity of cosmic ray protons. The values are in relative units. (19 MeV in figure should read 6 MeV.)

Aparát s označením SK-1. První přístroj, jehož část byla vyvinuta v Košicích a který měřil v kosmu neutrony a gama záření na nízké polární orbitě (IK-17). Detekční část byla vyvinuta v Leningradě.

Elektronická část vyvinuta v ÚEF SAV a na EF VŠT Košice.

Družice vypuštěna v září 1977.

I když sluneční neutrony nebyly detekovány, byl upřesněn tvar šířkové závislosti toku neutronů a záření gama zemského albeda.



István Apáthy, HU

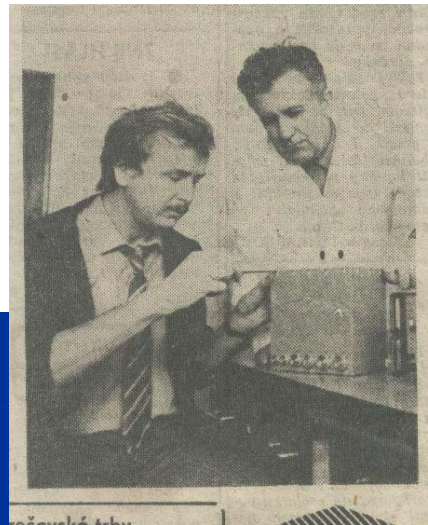
Skúšky aparatur pred štartom (IK13, IK17)

PI Rosetta Lander Magnetometer and Plasma Monitor - Romap

Spolupráca s EF VŠT - vznik elektronickej skupiny po príchode Jozefa Rojku do oddelenia (1975)

Obr. 3. Od roku 1975 viedol elektronické a konštrukčné práce na aparatúrach pre družicové merania energetických častíc Ing. Jozef Rojko, CSc. Na obrázku s kolegami pri práci na aparatúre pre misiu Interball. Išlo o jeden z prvých kozmických projektov, ktorý v magnetosfére Zeme a v blízkom medziplanetárnom prostredí podával informácie o tokoch častíc súčasne vo viacerých bodoch v kozme.

Ing. Jozef Rojko, CSc ako jediný pracovník OKF v doterajšej histórii oddelenia získal Cenu SAV v r. 1995



Podiel košických vedcov na programe Interkozmos

TAJOMSTVÁ VESMÍRU

Nekonečný vesmír. Čo sa tam v tých diaľavách asi skrýva? Existujú aj iné civilizácie? Takéto a veľa podobných otázok si kladú nielen obyčajní ľudia, ale aj vedci na celom svete.

— My sa držíme viac pri „zemi". Naše pozorovania siahajú sotva do výšky 800 kilometrov, — hovorí vedúci oddelenia kozmickej fyziky Ústavu experimentálnej fyziky SAV Ing. Karol Kudela, CSc. — Zameriavame sa hlavne na výskum kozmického žiarenia, ktoré preniká do atmosféry. Protóny a neutróny totiž neustále bombardujú našu modrú planétu Zem. A práve na tieto častice sa sústreďujeme. Ľudia však z nich nemusia mať obavy. Magnetické pole okolo Zeme nás chráni.

Na sputnikoch i na nízkoorbitálnych družiciach už od roku 1970 boli umiestnené viaceré diagnostické prístroje, ktoré skonštruovali práve vedci z oddelenia kozmickej fyziky ÚEF SAV v Košiciach. V súčasnosti pod vedením Ing. Jozefa Rojka, CSc. pripravuje technická skupina zdokonalený typ spektrometra SPE-1. Je určený na skúmanie fyzikálnych procesov v magnetosfére Zeme. Najnovšie sa zaoberajú výbuchom Supernovy 1987 A. Vladimír ŠVAČ

Jozef Rojko 50

V 70 - 80. rokoch – konferencie v Leningrade, s Prof. J. Dubinským

G. Kocharov, R. Ramaty, E. Chupp ...

Štefan Pintér

Antal Somogyi

ICRC 1977, Plovdiv, Bulharsko

Družicové: zaměření 1. Nabité částice středních energií.

Začátky:

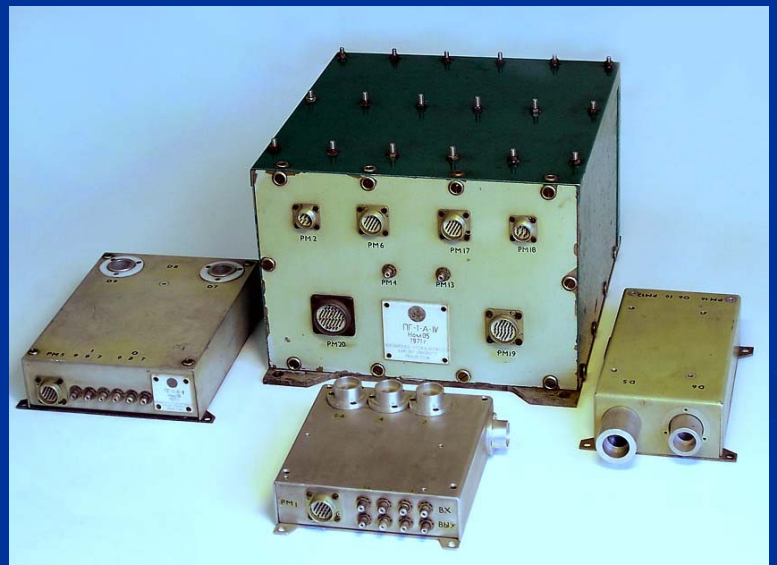
spolupráce s MFF UK Praha, s pracovišti ČSAV v Praze a Ondřejově, aparatury vyvinuty na MFF UK.

Dynamika částic zachycených v radiačních pásech Země

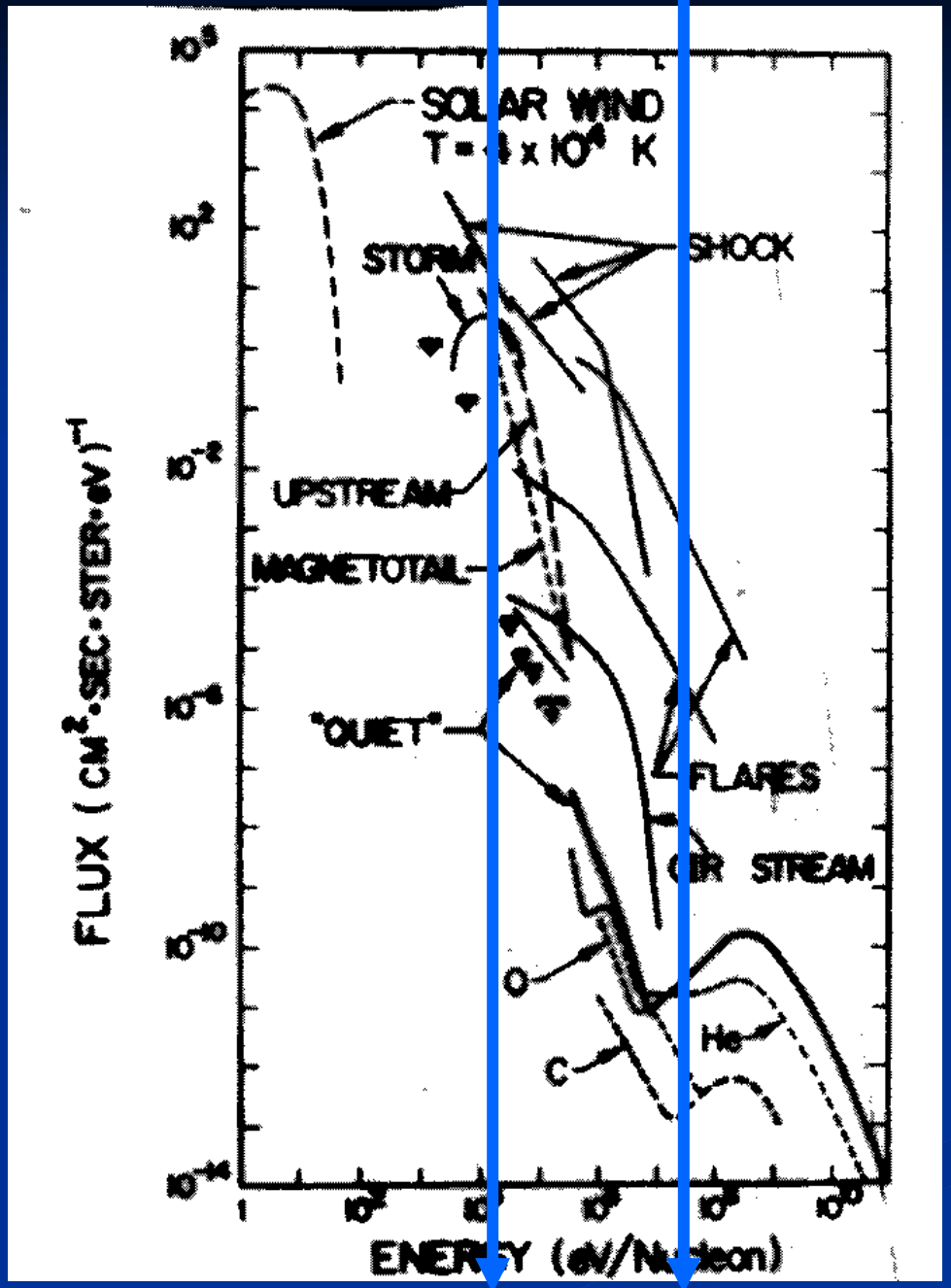
IK-3 (1970, 206 x 1315 km, 48.4°)

IK-5 (1971, 196 x 1202 km, 48.6°)

IK-13 (1975, 278 x 1681 km, 83.5°)



Aparatura PG vyvinutá na MFF UK pro IK-13

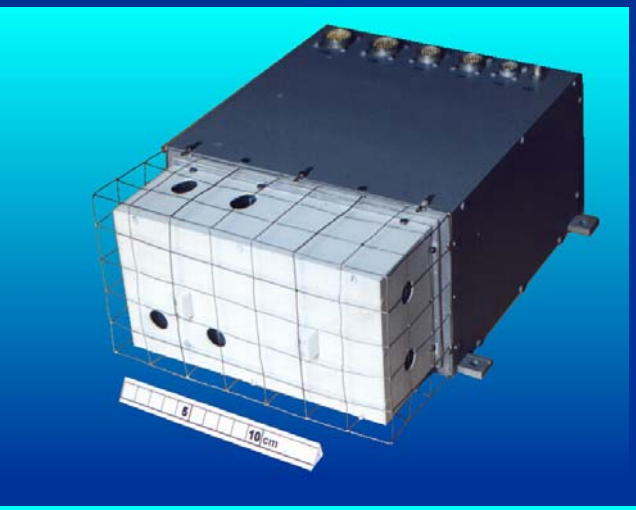


Orientace OKF na oblast „středních" energií (od ~20 keV do ~ 2 MeV) se ukázala vhodná pro relativně jednoduché aparatury monitorovacího typu.

Tato oblast energií je (byla) zajímavá pro celou řadu experimentů zaměřených na studium procesů v magnetosféře Země, v blízkosti jejich hraničních oblastí i v meziplanetárním prostoru.

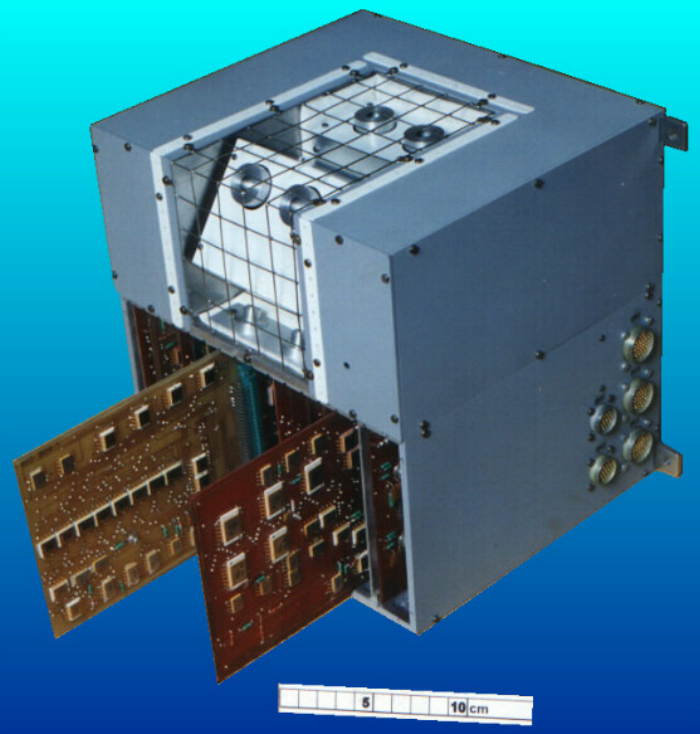
Umožnila účast OKF v řadě kosmických misí.

DOK-T na Prognoz-8, r. 1981, vysokoapogeová orbita, využití stínu pro snížení šumu detektoru a předzesilovače.



Spektrometr energetických částic DOK-1 na Prognoz-10 (Interšok), 1985

Spektrometr elektronů a protonů středních energií na družici Active (téměř polární dráha 500 x 2500 km, 1988).



Velké množství podrobných měření poskytly částicové aparatury DOK-2 na družicích Interball-1 a 2 (1995-2000). Spolupráce s IKI Moskva A Univerzitou Xanthi, Řecko.

Na vývoji tohoto a dalších experimentů této serie se podílel ing. J. Rojko, CSc s kolegy.

Získaná data a zájem o ně pomohl při navázání širších mezinárodních vědeckých kontaktů po r. 1990.

Zjednodušené varianty monitorů s označením DOK-S měřily i na subdružicích Geofyzikálního ústavu ČSAV Magion-2, Magion-3 (subdužice k Apexu) a později i na Magionu 4 a 5 k družicím Interball-1 a 2.

Magion-2 a 3 boli československé (sub)družice

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Advances in Space Research 49 (2012) 859–871

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ADVANCES IN SPACE RESEARCH (a COSPAR publication)

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Acceleration of energetic particles by whistler waves in active space experiment with charged particle beams injection

Nikolai Baranets [a,*], Yuri Ruzhin [a], Nikolai Erokhin [b], Valeri Afonin [b], Jaroslav Vojta [c], Jan Šmilauer [c], Karel Kudela [d], Jan Matišin [d], Mircea Ciobanu [e]

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[b] *Space Research Institute, Russian Academy of Sciences, Moscow 117997, Russia*

[c] *Institute of Atmospheric Physics, Academy of Sciences of the Czech Republic, 14131 Prague, Czech Republic*

[d] *Institute of Experimental Physics, Slovak Academy of Sciences, 04001 Kosice, Slovakia*

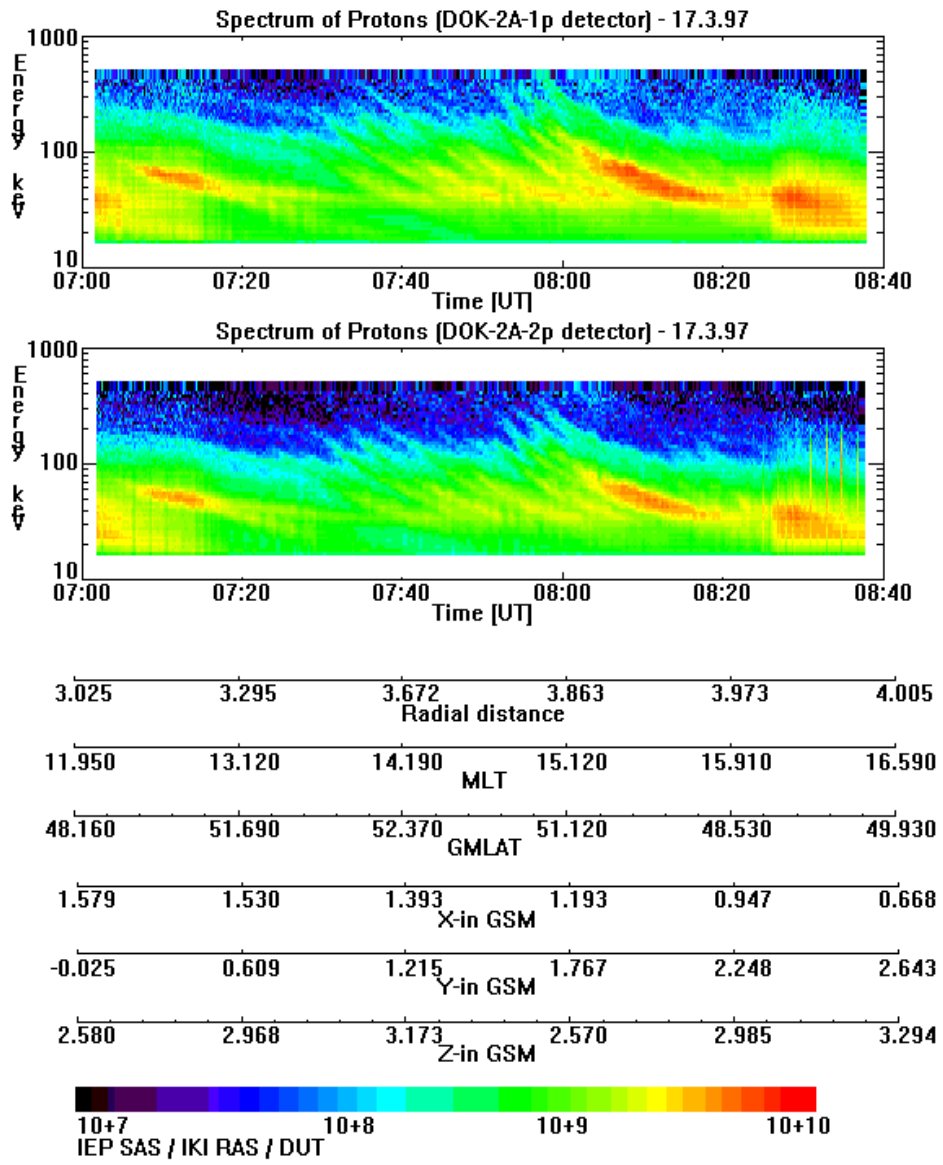
[e] *Institute of Gravitation and Space Sciences, 71111 Bucharest, Romania*

Received 10 September 2010; received in revised form 8 October 2011; accepted 1 December 2011

Available online 9 December 2011

Abstract

In this paper the investigation of wave-particle interaction during simultaneous injection of electron and xenon ion beams from the satellite *Intercosmos-25* (*IK-25*) carried out using the data of the double satellite system with subsatellite *Magion-3* (*APEX*). Results of active space experiment devoted to the beam-plasma instability are partially presented in the paper Baranets et al. (2007). A specific feature of the experiment carried out in orbits 201, 202 was that charged particle flows were injected in the same direction along the magnetic field lines $\mathbf{B}_0$ so the oblique beam-into-beam injection have been produced. Results of the beam-plasma interaction for this configuration were registered by scientific instruments mounted on the station *IK-25* and *Magion-3* subsatellite. Main attention is paid to study the electromagnetic and longitudinal waves excitation in different frequency ranges and the energetic electron fluxes disturbed due to wave-particle interaction with whistler waves. The whistler wave excitation on the 1st electron cyclotron harmonic via normal Doppler effect during electron beam injection in ionospheric plasma are considered.

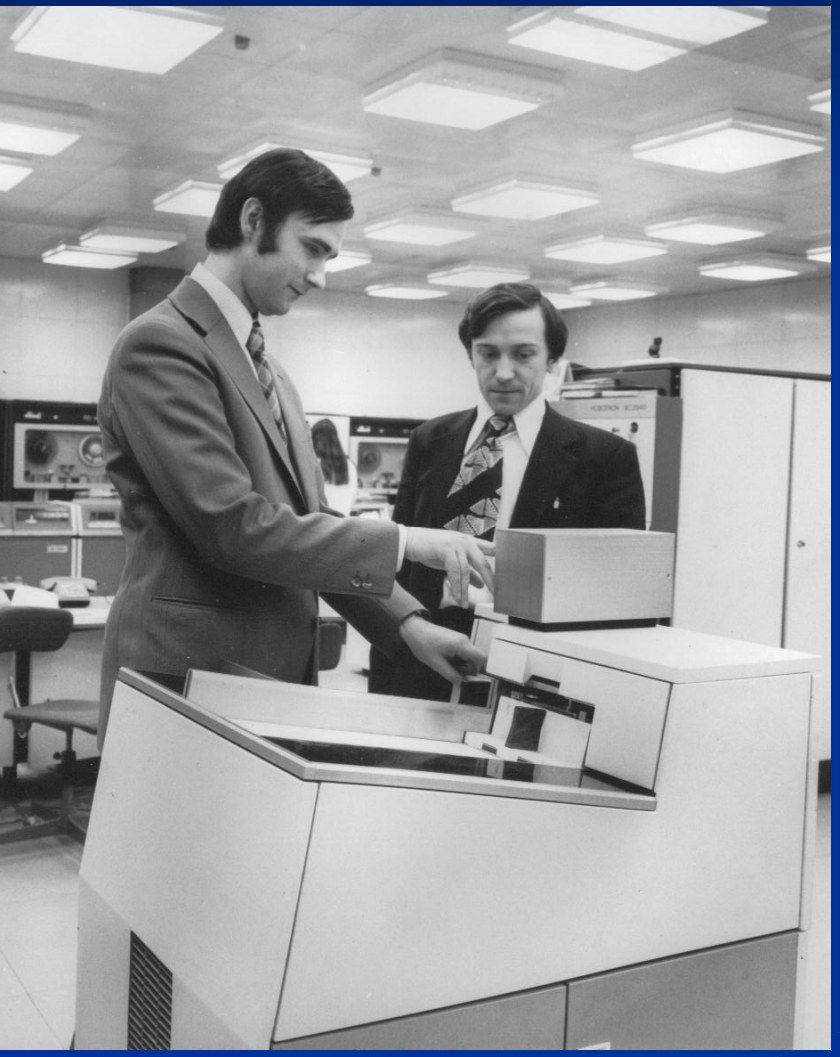


Podrobné spektrum umožnilo pozorovat disperzní jevy energetických iontů ve vnější magnetosféře na odpolední straně přístrojem DOK-2 na Interballu-2. Hodnoty jsou $J(E)*E^3$, kde J(E) je diferenciální intenzita částic v jednotkách (#/cm2.s.ster.keV) a E je kinetická energie v keV.

Na analýze dat se podílí dr. M. Slivka, CSc.

Tyto jevy ukazují na injekci částic na noční straně magnetosféry a z tvaru křivek a modelu magnetického pole lze odhadnout dobu a místo injekce.

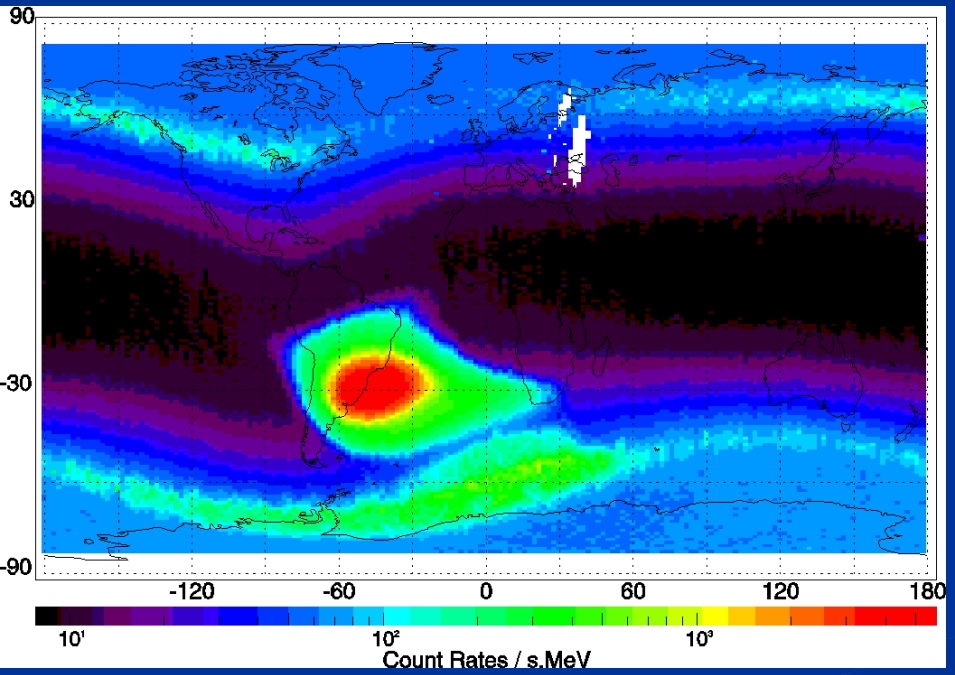
M. Slivka a J. Pavlisko na výpočtovom stredisku.



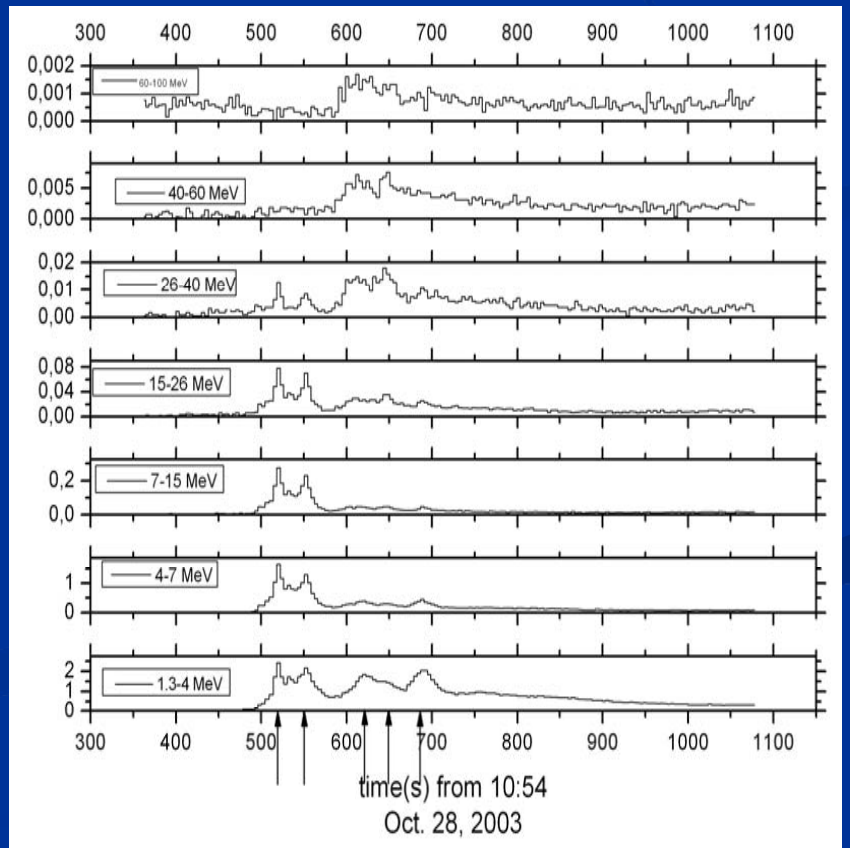
Analýza nameraných údajov si v minulosti vyžadovala inú techniku než dnes. J. Semanová s kolegyňou M. Bagiovou (vpravo).

Zaměření 2: K problematice **vysokoenergetických slunečních neutrálních emisí** na družicích se OKF (oddělení kosmické fyziky ÚEF SAV) vrátilo v r. 1994 (CORONAS-I) a v r. 2001 (CORONAS-F). Spolupráce s MSU Moskva. Přístroj SONG.

Podrobná mapa toku gama záření na výšce 500 km (R. Bučík, PhD práce, Košice 2003) podle CORONAS-I



V době extrémní sluneční erupce 28.10.2003 byly na CORONASE-F zaznamenány toky gama záření vysokých energií



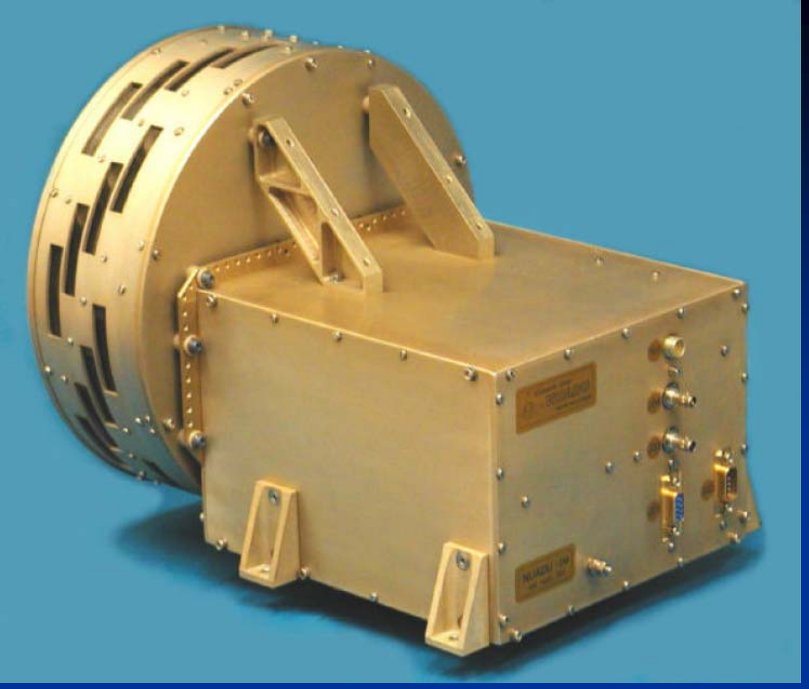
Dr. Volt N. Lutsenko

Prof. Sergey N. Kuznetsov
Moscow State U.
(1940 – 2007)

Prof. Susan McKenna-Lawlor –
Medzinárodná Cena SAV, 2005

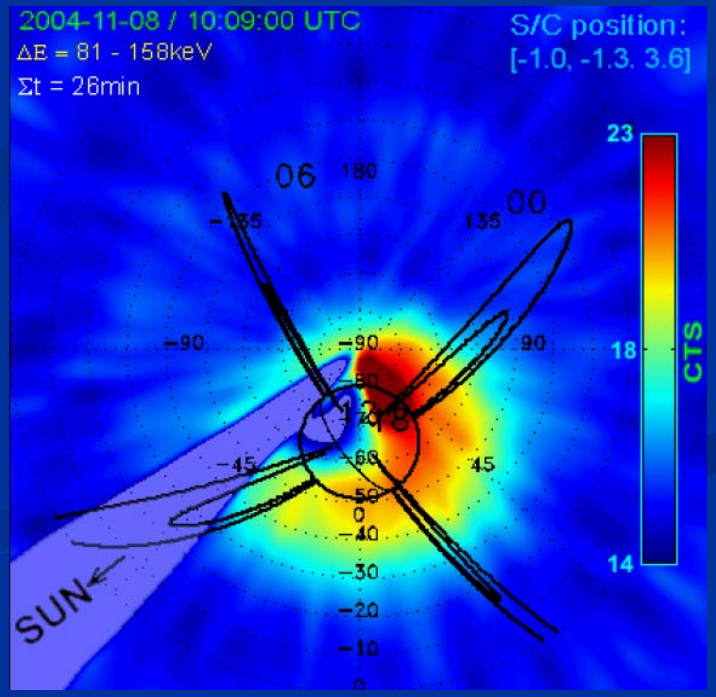
Prof. Leonid
L. Lazutin

Moscow
State U.



Detekce energetických neutrálních atomů na evropsko-čínské družici Double Star TC2 prováděna přístrojem NUADU (PI Prof. S. McKenna-Lawlor,Irsko), který byl z podstatné části vyvinut na ÚEF SAV v Košicích.

Přístroj provádí 3D „dálkový průzkum" toku energetických částic při jejich nábojové výměně v geokoróně.



Intenzita energetických neutrálních atomů pozorovaná přístrojem NUADU v době geomagnetické bouře 8. listopadu 2004.

Na vývoji přístroje na OKF se podílel hlavně ing.J. Baláž, PhD.

Zaměření 3: expozice det. stop KZ (návratné družice)

Tab. 2. Účast ÚEF SAV v experimentech na družicích a raketách (měření v automatickém režimu registrace)
Uvedeny jsou i aparatury, které byly zkonstruovány, ale nebyly na družicích vyneseny

Označení přístroje	Družice/raketa	Datum vypuštění	Perigeum (km)	Apogeum (km)	Sklon (°)
PG-1 *	IK-3	7. 8. 1970	206	1315	48.4
PG-1A *	IK-5	2. 12. 1971	196	1202	48.6
PG-1B *	IK-13	27. 1. 1975	278	1681	83.5
SK-1	IK-17	24. 9. 1977	466	511	83
DOK-T	PROGNOZ-8	20. 9. 1981	980	197390	65
URE-1	VERTICAL-10 **	21. 12. 1989	0	1510	–
DOK-1	INTERSHOCK	26. 4. 1985	421	200520	65
SPE-1	ACTIVE	28. 9. 1989	511	2487	82.6
DOK-S/1	ACTIVE/MAG 2	28. 9. 1989	511	2487	82.6
DOK-S/2	APEX/MAG 3	18. 12. 1991	440	3050	82.5
SONG-E	CORONAS-I	2. 3. 1994	500	500	83
DOK-2X	INTERBALL-T	3. 8. 1995	371	193 000	65
DOK-S/3	IB-T/MAG-4	3. 8. 1995	371	193 000	65
DOK-2A	INTERBALL-A	29. 8. 1996	7144	25 502	62.8
DOK-S/4	IB-A/MAG-5	29. 8. 1996	7144	25 502	62.8
SPE-1M	MIR	23. 4. 1996	324	352	51.6
SLED-2	MARS-96	16. 11. 1996	–	–	–
SPRUT-6	MIR	10. 1998	324	352	51.6
SONG-M	CORONAS-F	30. 7. 2001	500	500	83
EPD	CESAR	?	400	1000	70
MEP-1	COMPASS	?	350	400	79
NUADU	TC-2/Double Star	25. 7. 2004	700	39 000	90
PEEL	HotPay2 **	31. 1. 2008	0	381	–

* – přístroje zkonstruovány na MFF UK v Praze
** – raketa

Tab. 1. Družice využité na ÚEF SAV pro studium fragmentace a LET spekter kosmického záření

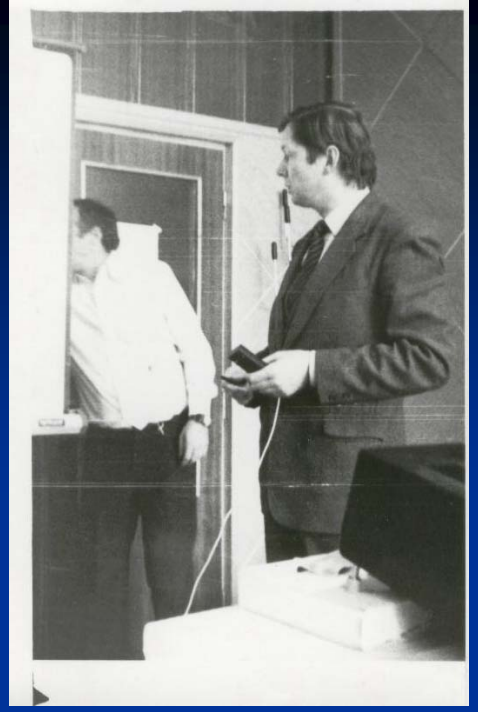
Družice	Datum startu	Počet dní	Per/Apog	sklon (°)	Exponovaný materiál
IK-6	07. 04. 1972	4	210/250	51	emulze
K-1129	25. 09. 1979	19	218/377	62,8	Kodak
K-1514	14. 12. 1983	5	226/288	82,4	K + CR 39
K-1667	10. 07. 1985	7	222/297	82,3	K + CR 39
K-1757	11. 06. 1986	15	189/252	82,3	4 × Kodak
K-1781	17. 09. 1986	14	217/405	70,4	Kodak
K-2044	15. 09. 1989	14	216/294	82,3	Kodak
OS-MIR	24. 06. 1991	34	389/410	51,6	Kodak
MIR	20. 2. 1999	6	324/352	51,6	Kodak

Po r. 2008:
SPEKTR-R (MEP-1) merania energetických elektrónov ***od augusta 2011 doteraz***

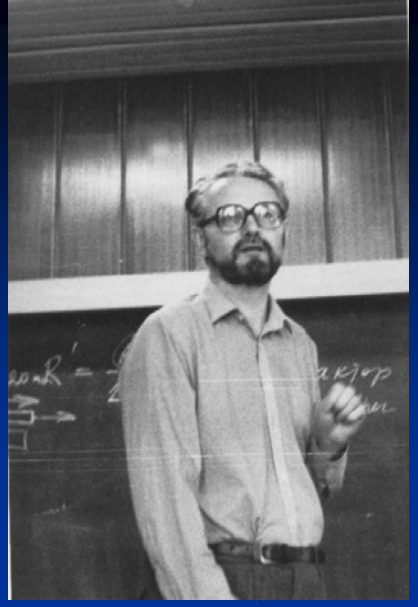
http://www.plasma-f.cosmos.ru/en/instruments

Ján Baláž *Marián Slivka*

Vľavo R. Nymmik, S. Fischer, S. Kavlakov, Košice 1987



M. Panasyuk, Košice 1987

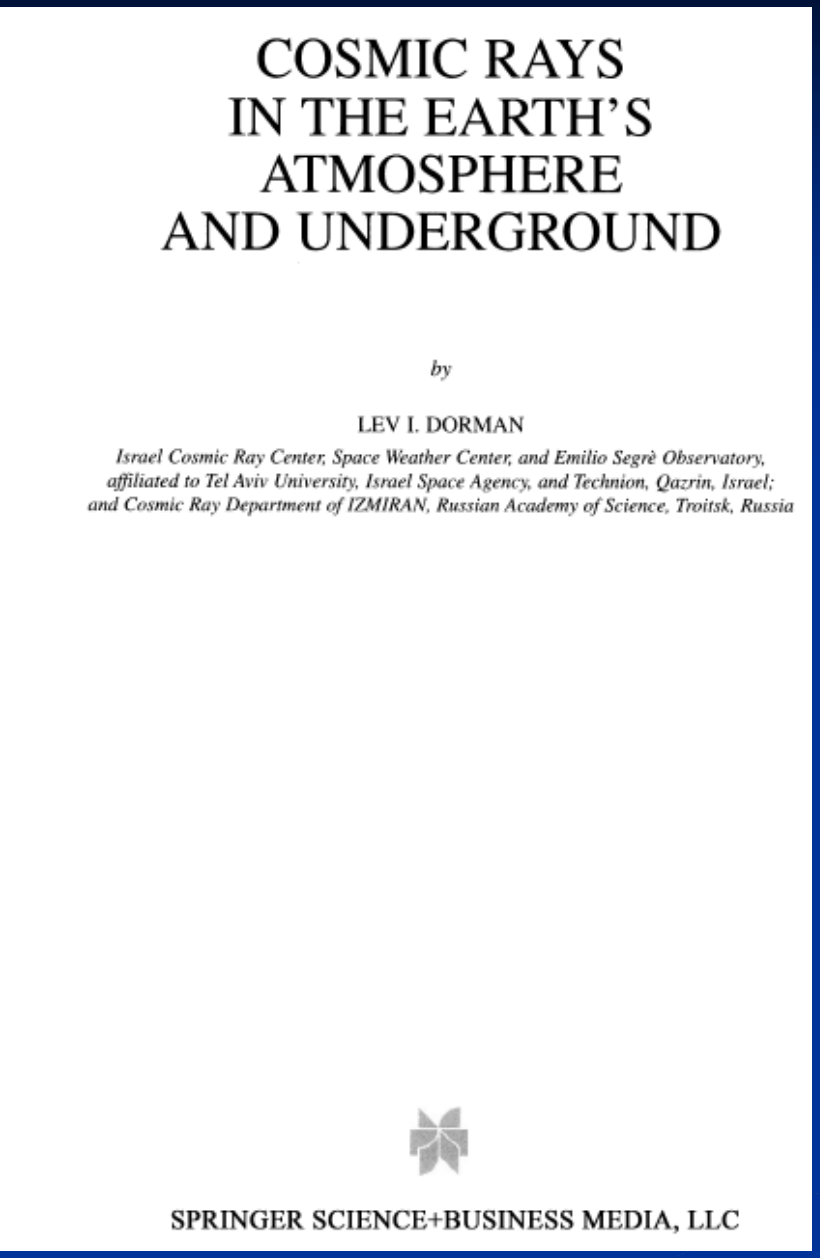


P. Király

Prof. Lev Dorman

K. Kecskeméty, Y. Logachev, M. Zeldovich

G. Pugacheva



COSMIC RAYS IN THE EARTH'S ATMOSPHERE AND UNDERGROUND

by

LEV I. DORMAN

Israel Cosmic Ray Center, Space Weather Center, and Emilio Segrè Observatory, affiliated to Tel Aviv University, Israel Space Agency, and Technion, Qazrin, Israel; and Cosmic Ray Department of IZMIRAN, Russian Academy of Science, Troitsk, Russia

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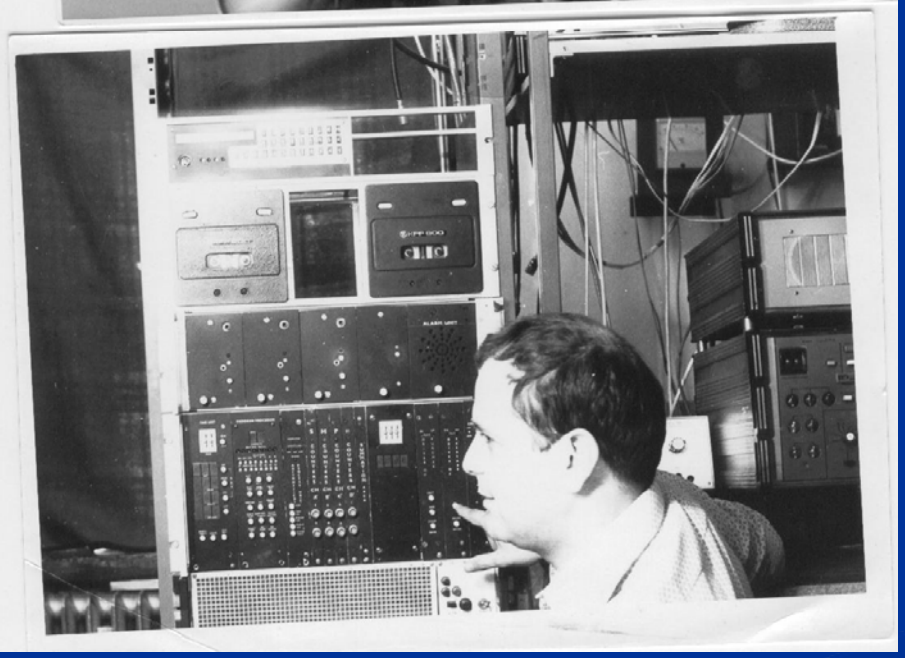
Acknowledgements
It is my great pleasure to thank cordially:

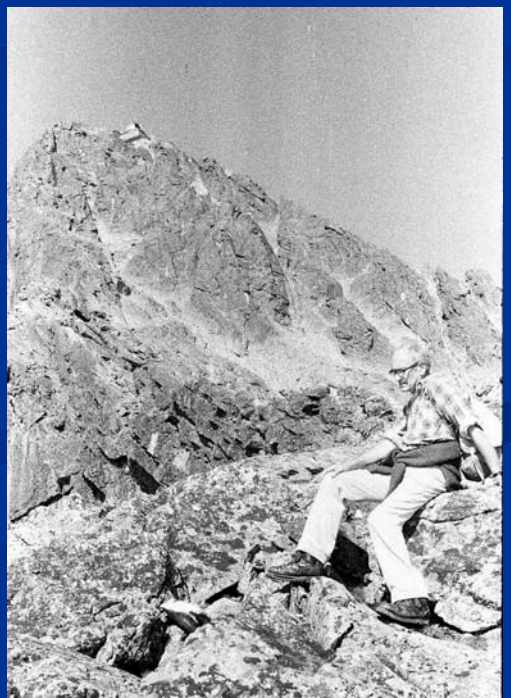
for interesting discussions and fruitful collaboration –
H.S. Ahluwalia, ..., M. Stehlik, ...

2004

Vlado Kollár, Samo Štefánik



Jaroslav Sláma

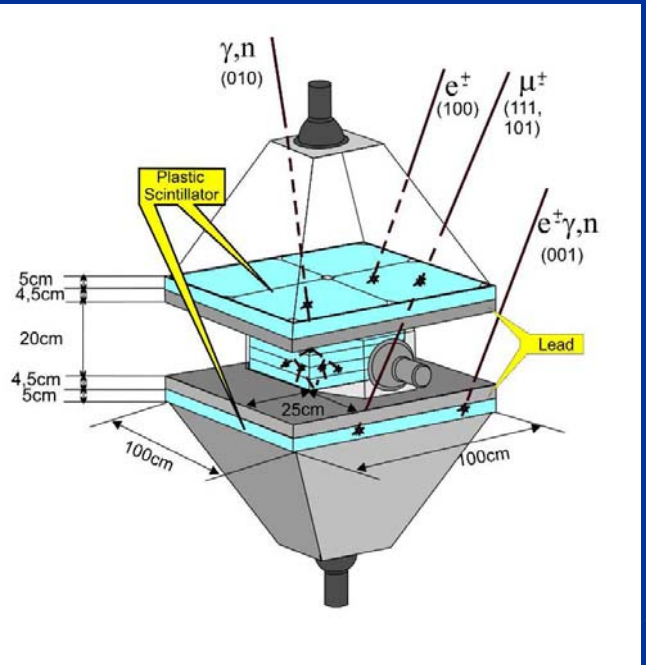


Roni Langer a kolegovia na LS

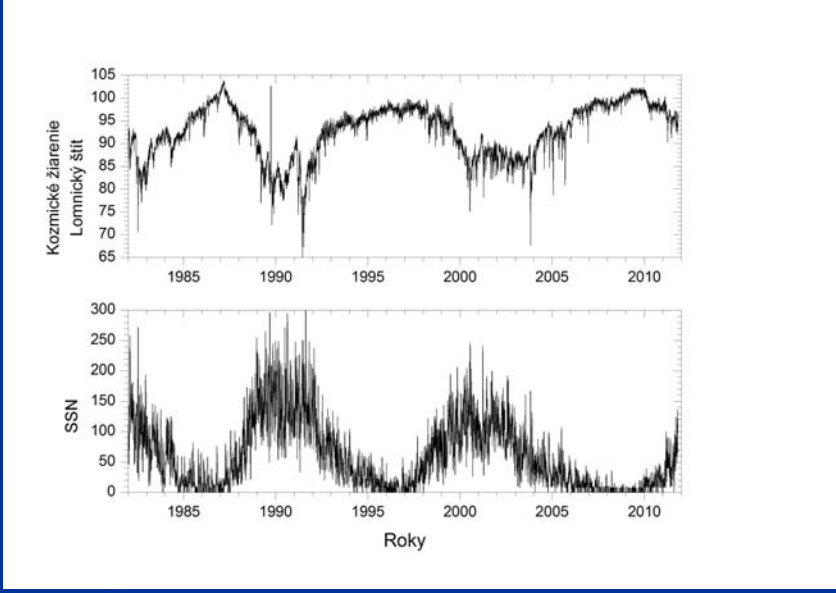
19. a 23.5. 2012

Projekt ŠF EÚ "Centrum kozmických výskumov: vplyvy kozmického počasia" AsÚ SAV, ÚEF SAV, PF UPJŠ, admin. J. Štetiarová

1982 – first response of solar ***n*** from flare on the ground reported (Jungfraujoch and Lomnický štít). Analysis invoked by Prof. E.L. Chupp (UNH) – info about flare with high energy gammas observed on satellite SMM.



SEVAN od 3/2014



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(KK, I. Strhárský, R. Langer)

Dáta sú využívané na monitorovanie kozmického počasia

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Space Research *Space Operations* *Space Standards*

November 25, 2014

Dear Karel,

Space Environment Technologies is pleased to inform you that we use the neutron monitor data at Lomnicky stit for helping drive the Nowcast of Atmospheric Ionizing Radiation System (NAIRAS) for NASA Langley Research Center that assists global aviation radiation specification – please see the URL at http://sol.spacenvironment.net/~nairas/index.html. This is a NASA Applied Sciences Program to develop an operational prototype for a global, real-time, data-driven predictive system needed to assess biologically harmful radiation exposure levels for aviation.

We thank you for your excellent neutron monitor data at Lomnicky stit and sincerely appreciate its availability.

Best regards,

W. Kent Tobiska

W. Kent Tobiska
President, Space Environment Technologies

Na OKF aj diaľkový prieskum Zeme, druhá polovica 80. a začiatok 90 rokov.

Peter Sinčák, prof. na TU Košice

Sinčák, P. (1991). Teoretical and experimental analysis of application of edge operators in image processing, . International Journal Isledovanie Zemli iz Kozmosa, ISSN 0205 9614 Moskva, 119-223 – in russian

Juhász, L., K. Kudela, Estimating the spectral characteristics of soil from Landsat-5 TM data (Otsenka spektral'nykh kharakteristik pochv po dannym TM sputnika 'Landsat- 5') , Issledovanie Zemli iz Kosmosa. Nov. Dec. 1989, p. 49-53

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1st	1968	Bern (Switzeland) and Lodz (Poland)
2nd	1970	Amsterdam (the Netherlands) and Leeds (UK)
3rd	1972	Göttingen (Germany) and Paris (France)
4th	1974	Lodz (Poland) and Frascatti (Italy)
5th	1976	Leeds (UK)
6th	1978	Kiel (Germany)
7th	1980	Leningrad (USSR)
8th	1982	Rome (Italy)
→ 9th	1984	Košice (Czechoslovakia)
10th	1986	Bordeaux (France)
11th	1988	Balaton (Hungary)
12th	1990	Nottingham (UK)
13th	1992	Geneva (Switzerland)
14th	1994	Balatonfüred (Hungary)
15th	1996	Perpignan (France)
16th	1998	Madrid (Spain)
17th	2000	Lodz (Poland)
18th	2002	Moscow (Russia)
19th	2004	Florence (Italy)
20th	2006	Lisbon (Portugal)
→ 21st	2008	Košice (Slovakia)
22nd	2010	Turku (Finland)
23rd	2012	Moscow (Russia)

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KOŠICE, CZECHOSLOVAKIA, AUGUST 20—25, 1984

1984

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V Košiciach sa začalo 9. európske sympózium

O kozmickom žiarení

Košice (zet) — Za účasti podpredsedu ČSAV a predsedu SAV akademika Vladimíra Hajku a primátora mesta Košíc Ing. Rudolfa Schustera, CSc., začalo sa včera v aule Maxima VŠT v Košiciach 9. európske sympózium o kozmickom žiarení. Na podujatí, ktoré potrvá do piatku, sa zúčastňuje vyše sto vedcov zo Sovietskeho zväzu, Bulharska, Poľska, Maďarska, Československa, NSR, Veľkej Británie, Finska, Francúzska, Švajčiarska, Talianska, Grécka, USA a Mexika.

Okrem plenárnych zasadnutí bude 14 prehľadných prednášok a 14 prednášok v troch odborných sekciách: kozmické žiarenie v slnečnom systéme, v galaxii a pri vysokých energiách. Odznie tu 113 referátov zaoberajúcich sa geofyzikálnymi, astrofyzikálnymi a jadrovofyzikálnymi aspektami výskumu kozmických

[Pokračovanie na 2. strane.]

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ECRS KOŠICE '84
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9. EURÓPSKE SYMPOSIUM O KOZMICKOM ŽIARENÍ
KOŠICE
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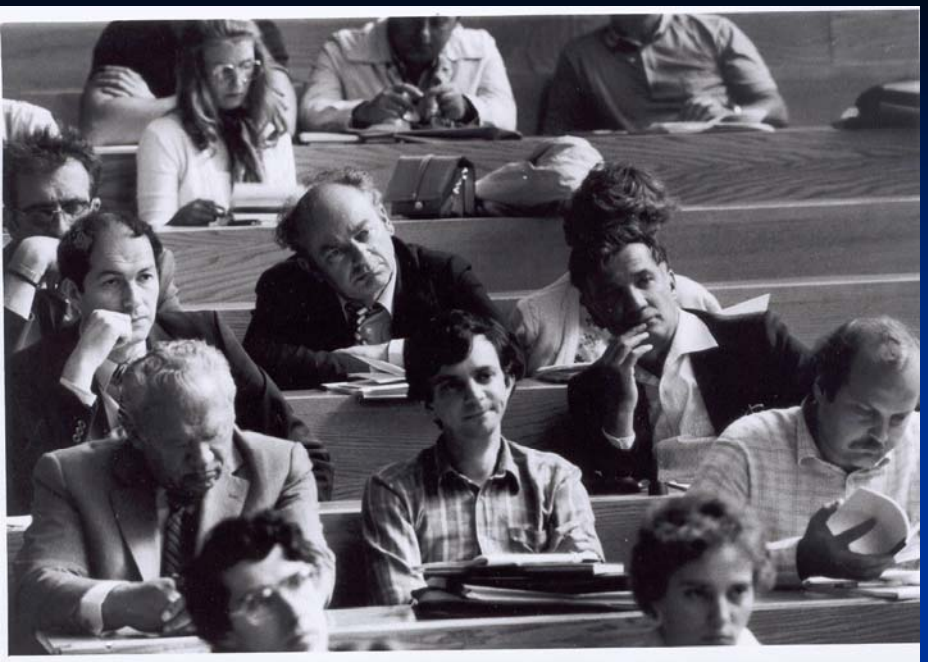

Pravdepodobne prvá návšteva vedeckého pracovníka z ESA na konferencii v ČSSR, Košice 1984.
Klaus-Peter Wenzel pri prehľadovej prednáške o časticiach stredných energií.

21st European Cosmic Ray Symposium

9 - 12 September 2008, Košice, Slovakia

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Najvýznamnejším hosťom sympózia bol prof. A.W. Wolfendale. Na snímke je pri prezentácii výsledkov, ktoré ukazujú veľké otázniky nad súvislosťami medzi kozmickým žiarením a nízkou oblačnosťou. O tejto otázke sa veľmi intenzívne diskutuje v posledných rokoch. Spoluautormi referátu boli aj slovenskí odborníci.

na 9 ECRS 1984

— Prehĺbiť vedecké kontakty a orientovať ich na mierové využitie vesmíru — na tom sa zhodli všetci účastníci sympózia, — podčiarkol prof. Arnold W. Wolfendale z Univerzity v Durhame vo Veľkej Británii (na snímke uprostred).

A prečo Košice?...

Možno práve vďaka neutrónovému monitoru dodávajúcemu informácie o kozmickom žiarení do celého sveta, sir Arnold Wolfendal na otázku denníka Korzár prečo boli za miesto konania tohtoročného sympózia vybrané znovu Košice, odpovedal s úsmevom, že "...preto, lebo sú centrom kozmického sveta. A už vážnejšie dodal, že košický Ústav experimentálnej fyziky je významným európskym a svetovým pracoviskom v oblasti výskumu kozmického žiarenia, ktoré dosahuje unikátne vedecké výsledky v rámci širokej medzinárodnej spolupráce". (Kurzíva – citát z článku "Európske sympózium o kozmickom žiarení (rm)", Korzár 10. 9. 2008).

NATO Advanced Research Workshop

Coordinated Studies of the Solar Wind-Magnetosphere-Ionosphere Interaction: Interball Observations

September 7-11, 1998

Faculty of Electrical Engineering and Informatics

Technical University, Kosice, Slovakia

The local organization will be arranged by the Faculty of Electrical Engineering and Informatics, Technical University; by the Faculty of Science of P.J. Safarik's University and by the Institute of Experimental Physics of the Slovak Academy of Sciences.

Organizers:

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Karel Kudela (kkudela@kosice.upjs.sk , phone ++421-95-6224554, fax ++421-95-6336292)

Coorganizers/ key speakers:

Maha Ashour-Abdalla (UCLA)
J. Bernie Blake (Aerospace Corporation)
Yurii Galperin (Space Research Institute, Moscow)
Joerg Buechner (MPAe Katlenburg-LIndau, Germany)
Toshifumi Mukai (ISAS, Tokyo, Japan)
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Lev Zeleny (Space Research Institute, Moscow)
Peter Kiraly (KFKI Budapest, Hungary)
Atsuhiro Nishida (ISAS, Japan)
T. Terasawa (Tokyo University, Japan)
Pavel Triska (Inst. Atmospheric Physics, Prague)
Georgy Zastenker (Space Research Institute, Moscow)

PhD na KJF PF UPJŠ obhájené z oblasti KF:

1. **RNDr. Pavol Bobík,** „***Prechod kozmického žiarenia magnetosférou Zeme***“
obhajoba dňa 31.10.2001 na PF UPJŠ (vedúci OKF od 2011, PI v experimente JEM-EUSO od 2015)

2. RNDr. Radoslav Bučík, ***The Fluxes of Secondary Gamma Rays Observed at Low Earth Polar Orbit***, P.J. Šafárik University in Košice, Slovakia, Dec 2003
(teraz na MPS Goettingen, projekt NASA-ESA STEREO, častice)

3. **RNDr. Kazi Md. Abul Firoz** – Nuclear and Sub-nuclear Physics
„***Cosmic Rays and Space Weather***“ (teraz na U. Alcala, Spain)

Záverečné poznámky.

-poďakovanie všetkým kolegom a kolegyniam OKF za prácu v r. 1980 – 2011

-nestrácať „historickú pamäť „ v kozmickom výskume (u)robenom už na pracoviskách SR a Košíc (SAV, Univerzity) – pre médiá a decíznu sféru: vedci ktorí už dokázali niečo (u)robiť v kozmickej vede a technológiách by mali byť pri rozhodovaní o kozmických aktivitách SR

-za rozvoj OKF vďačím(e) aj Katedre jadrovej fyziky PF UPJŠ ako aj jej zakladateľovi Prof. Jurajovi Dubinskému.

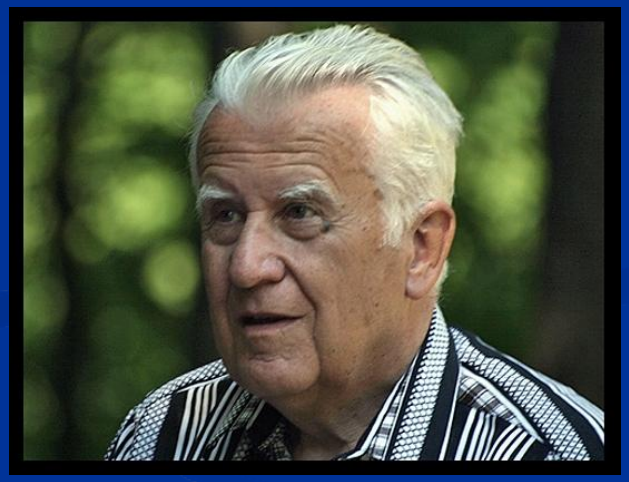
Prof. RNDr. Juraj Dubinský

(* 12.6.1914 † 22.11.1994)

RNDr. Ladislav Just, CSc

(* 14.9.1946 † 7.3.2004)

Ing. Jozef Rojko, CSc



(* 7.5.1934 † 12.4.2011)