

## По физике и диагностике протонных вспышек

Definition of the parameters of solar protons in the vicinity of the earth from radio bursts.

I. Intensity function.

Akin'yan, S. T.; Fomichev, V. V.; Chertok, I. M.

Geomagn. Aehron., Tom 17, p. 10 – 15, 1977

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Definition of the parameters of solar protons in the vicinity of the earth from radio bursts.

II. Function of longitudinal weakening.

Akin'yan, S. T.; Fomichev, V. V.; Chertok, I. M.

Geomagn. Aehron., Tom 17, p. 177 – 183, 1977

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Determination of the parameters of solar protons in the vicinity of the earth from radio bursts.

III - Temporal reference functions

Akinian, S. T.; Chertok, I. M.

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On quantitative diagnostics of proton bursts from characteristics of microwave radio bursts at f?9 GHz frequency.

Akin'yan, S. T.; Alibegov, M. M.; Kozlovskij, V. D.; Chertok, I. M.

Geomagn. Aehron., Tom 18, p. 410 – 414, 1978

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Estimates of the intensity of solar protons from the integral parameters of microwave radio bursts

Akinian, S. T.; Fomichev, V. V.; Chertok, I. M.

Geomagnetism and Aeronomy, vol. 18, p. 395-398, 1979.

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Radio radiation as information source on proton fluxes from solar flares.

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The Proton Flare of 1976 April 30

Avdushin, S. I.; Perejaslova, N. K.; Fomichev, V. V.; Chertok, I. M.

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Edited by M.A. Shea, D.F. Smart, D.J. McLean, and G.J. Nelson. Hanscom AFB, MA: Air Force Geophysics Laboratory,  
1982., p.65

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Estimates of the proton energy spectrum exponent on the basis of solar microwave radio-burst data  
Chertok, I. M.

Geomagnetizm i Aeronomiia, vol. 22, Mar.-Apr. 1982, p. 182-186. In Russian.

Abstract

A method is developed for the short-term prediction of the energy spectrum exponent (gamma) of protons near the earth with energies of the order of tens of MeV; gamma is determined on the basis of the ratio of maximum intensities of solar radio bursts at frequencies of 9 and 15.4 GHz (S9/S15). Data on 35 proton events are used to determine the relationship between S9/S15 and gamma for flares on the western half of the disk, as well as the heliolongitudinal correction for protons arriving at the earth from eastern flares.

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Effects characterizing the relationship of radio bursts and proton flares by data for 1980.

Akinyan, S. T.; Fomichev, V. V.; Chertok, I. M.; Aurass, H.; Kruger, A.

Publ. Debrecen Heliophys. Obs., Vol. 5, Nos. 4 - 5, p. 639 - 652, 1983

Abstract

The present paper contains the main results of a diagnostic analysis of proton events during January - October, 1980. The aims of this analysis are (1) the consideration of the radio emissions of the largest flares in a wide frequency range, (2) the estimation of the expected parameters of proton fluxes of the order of some tens MeV, and (3) the comparison of the obtained estimations with the data of direct measurements of the proton fluxes in the interplanetary space near the earth

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Characteristics of radio bursts and proton fluxes from gamma-ray flares.

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Origin: ARI

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Chertok, I.; Fomichev, V.

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Development of Quantitative Proton Flare Diagnostics Technique by Radio Burst Data

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On the Connection Between the Solar Cosmic Ray Intensity and the Polar CAP Absorption Magnitudes  
Nazarova, M. N.; Pereyaslova, N. K.; Uljev, V. A.; Shirochkov, A. V.; Chertok, I. M.  
Proceedings of the 20th International Cosmic Ray Conference Moscow, Volume 3, p.109, 1987

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Use of radio radiation for diagnosis of proton flares and geoeffective phenomena on the Sun.  
Chertok, I. M.

Prediction of ionospheric, magnetospheric disturbances and of solar activity, p. 39-59, 1987

Origin: ARI

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On the Relation Between Radio Bursts Gamma-Ray Emission and Proton Fluxes from Solar Flares  
Chertok, I. M.; Fomichev, V. V.

Solar Maximum Analysis. Proceedings of the International Workshop, held in Irkutsk, USSR, June 17-24, 1985

Editors, V.E. Stepanov, V.N. Obridko;

Publisher, VNU Science Press, Utrecht, The Netherlands, P.315, 1987

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Relationship between proton-flux delay with respect to a flare and radio-burst parameters

Chertok, I. M.; Bazilevskaia, G. A.; Sladkova, A. I.

Geomagnetizm i Aeronomiia (ISSN 0016-7940), vol. 27, p. 362-369. 1987, In Russian.

Abstract

Events with a large delay of the flux maximum of protons with energy greater than 10 MeV at the earth with respect to the corresponding solar flare are examined on the basis of data for 1966-1980. It is shown that western events with a delay of 10 hours are characterized by a soft frequency spectrum of centimeter-wave radio bursts (at a frequency not greater than about 5 GHz), a relatively soft proton energy spectrum, faint meter-wave radio emission, and a prolonged microwave burst.

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Comparison of data on proton fluxes at the earth with results on the diagnostics of solar proton flares according to radio bursts

Fomichev, V. V.; Chertok, I. M.

Geomagnetizm i Aeronomiia (ISSN 0016-7940), vol. 28, May-June 1988, p. 353-359. In Russian.

Abstract

A method for estimating the parameters of proton fluxes with energies exceeding 10, 30, and 60 MeV near the earth according to radio-burst data is applied to events occurring during 1970-1980. It is shown that the recognition of proton flares on the basis of this approach leads to a greater frequency of correct recognition than previous approaches. Proton flux parameters (the maximum intensity and the time characteristics) calculated using the proposed approach are found to agree well with satellite data.

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Dependence Between the Energy Spectrum of Protons and Maximum Spectral Frequency of Solar Microwave Bursts

Chertok, I. M.

SOLNECHNYE DANNYE. BYUL. GLAV.ASTR.OBS. NO.11, P. 83, 1989

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Correlation method for determining the energy parameters of proton fluxes giving rise to inducing polar CAP absorption

Ul'Ev, V. A.; Chertok, I. M.

Geomagnetizm i Aeronomiia (ISSN 0016-7940), vol. 29, Mar.-Apr. 1989, p. 228-233. In Russian.

Abstract

A correlation method for determining the optimal threshold energy ( $E_0$ ) and the energy of the maximum contribution ( $E_m$ ) of proton fluxes giving rise to PCA. It is shown that for  $E_0$  the best correlation is between the absorption amplitude and the integral flux, while for  $E_m$  the best correlation is between the absorption amplitude and the differential proton intensity. The mean values of  $E_0$  and  $E_m$  are calculated to be 6.4 and 9.1 MeV from data on 89 events observed during 1970-1979.

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On the correlation between gamma-ray emission, radio bursts and proton fluxes from solar flares.

Chertok, I. M.

Soln. Dannye, Byull., No. 1989/8, p. 81 - 85

Abstract

The paper criticizes the assertion that the  $\gamma$ -ray line emission unlike other types of the flare emission (hard X-rays, microwave bursts) reveals a highly poor relation or even an anticorrelation with proton fluxes in the interplanetary space. About 30 flares (1972 - 1985) have been analyzed with known values of the  $\gamma$ -ray line emission in the 4 - 7 NeV band (F4-7) and the intensity of  $>10$  MeV proton fluxes (J10). It is shown that (1) a considerable positive correlation between F4-7 and J10 takes place for large nonimpulsive flares with a significant metric component; (2) the  $\gamma$ -ray emission F4-7 correlates well with the maximum flux density of microwave bursts at 15 GHz. It is concluded that the  $\gamma$ -ray line emission in relation to interplanetary protons behaves as well as other types of flare emission.

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Determination of the intensity of proton fluxes near the Earth from solar radio bursts taking into account their frequency spectrum.

Fomichev, V. V.; Chertok, I. M.; Del Poso, E.

Geomagn. Aehron., Tom 29, No. 4, p. 537 - 544, 1989

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Determination of the index of energy spectra of proton fluxes near the Earth from frequency spectra of solar microwave bursts.

Fomichev, V. V.; Chertok, I. M.; Del Poso, E.

Geomagn. Aehron., Tom 29, No. 4, p. 545-550, 1989

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Dependence between energy spectrum of protons and maximum spectral frequency of solar microwave bursts.

Chertok, I. M.

Soln. Dannye, Byull., No. 1989/11, p. 85 - 90, 1989

Abstract

It is shown by data for 1966 - 1986 that a specific dependence takes place between the power index  $\beta$  of the proton energy spectrum in the range of tens of MeV near the Earth and the frequency  $f$  at which the flux density of centimetre bursts has the maximum. This relationship of the spectra agrees qualitatively with the model of the formation of the proton spectrum in coronal magnetic traps in a process of the interaction with the small-scale turbulence. Based on the discovered dependence the heliolongitude function describing the softening of the proton spectrum from east flares is determined. It is demonstrated that the parameter  $f_m$  may be used for the short-term prediction of the proton spectral index by radio data.

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Surplus Proton Fluxes From Solar Flares with Soft Frequency Spectrum of Radio Bursts

Chertok, M. I.; Fomichev, V. V.

Proceedings of the 21st International Cosmic Ray Conference. Volume 5 (SH Sessions), p.171, 1990

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Some Characteristics of Delayed Proton Events

Bazilevskaya, A. G.; Sladkova, I. A.; Chertok, M. I.

Proceedings of the 21st International Cosmic Ray Conference. Volume 5 (SH Sessions), p.175, 1990

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Determination of the intensity of proton fluxes at the Earth from solar radio bursts with their frequency spectrum taken into account.

Fomichev, V. V.; Chertok, I. M.; Del Poso, E.

Geomagn. Aeron., Vol. 29, No. 4, p. 410-415, 1990

Abstract

During the period 1966 - 1986, the regularities of the relationship between solar radio bursts and proton fluxes at the Earth with  $E > 10$  MeV (J10) were analyzed. It is established that the flux of protons is determined by the energy released (intensity of the microwave burst), conditions of escape of particles from the region of the burst (meter component of the radio radiation), and heliographic longitude of the flare. Also noted is the strong dependence of J10 on the frequency spectrum of the protons. The corresponding functional relations are derived to enable accounting for these effects in short-term prognoses of the proton flux parameters.

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Determination of the exponent of the energy spectrum of protons at the Earth according to the frequency spectrum of solar microwave bursts.

Fomichev, V. V.; Chertok, I. M.; Del Poso, E.

Geomagn. Aeron., Vol. 29, No. 4, p. 416-420, 1990

Abstract

It is shown from the data (1966 - 1986) that a close relationship exists between the exponent of the power spectrum of the protons at the Earth in the energy range  $E > 10$  MeV and the ratio of the radio fluxes at frequencies of 7, 9, and 15 GHz. In particular, for western flares a soft energy spectrum corresponds to a soft radio radiation spectrum. A quantitative function is derived to describe the skewing (softening) of the proton energy spectrum from eastern flares. Also investigated is the energy dependence of the redundancy measure of the flux of protons. A possible use of the radio data for an advance estimate of the exponent of the proton spectrum at the Earth is demonstrated.

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Possible Relation Between Solar Proton Fluxes in Interplanetary Space and the Formation of a Post-Flare System of Loops

Bazilevskaya, G. A.; Sladkova, A. I.; Fomichev, V. V.; Chertok, I. M.

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The High-Energy Gamma-Ray Flare of June, 15, 1991: Some Evidence of Prolonged Particle Acceleration at the Post-Eruption Phase

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On the correlation between spectra of solar microwave bursts and proton fluxes near the Earth

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## По диагностике геоэффективности солнечных эрупций (CMEs)

Magnetic Flux of EUV Arcade and Dimming Regions as a Relevant Parameter for Early Diagnostics of Solar Eruptions - Sources of Non-recurrent Geomagnetic Storms and Forbush Decreases  
Chertok, I. M.; Grechnev, V. V.; Belov, A. V.; Abunin, A. A.  
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