The Spectroscopy of Solar Flares With an Echelon Grating

78004
SOV/33-37-1-4/31

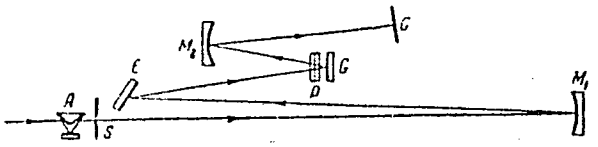

Fig. 2. Diagram of the spectrograph with an echelon grating.

Figure 2 shows the design where S is the slit; M_1, the collimation mirror; E, the echelon; P, a prism; and G, a grating designed to spread the spectra of various orders in a direction perpendicular to the plane of dispersion; M_2, the camera mirror; C, the plate holder; and A is a mirror compound which corrects the plane of atmospheric dispersion. This instrument

Card 2/4

is practically free from Rowland's "ghosts" and from scattered light. It is used for a simultaneous photography of the whole spectrum of short duration flares and "whiskers", while previously such photographs could not be obtained simultaneously. With exposures from 0.5 to 1.0 seconds, the spectrum is well exposed over the range from 3,200 to 6,600 A. During the summer of 1959, over 30 flares were photographed; three of these are reproduced here. The spectrum of a flare near the solar limb obtained on August 30, 1959, showed 11 emission lines of He; over 450 emission lines are shown on a photograph taken on August 17, 1959; there are listed in a table which indicates the intensities of the lines and of the same lines in Rowland's catalogue. The authors express their appreciation to F. M. Gerasimov who supplied an excellent copy of the echelon grating. There is 1 table; 5 figures; and 4 references, 1 Soviet, 3 U.S. The U.S. references are: J. T.

SEVERNYY, A.B.; SHABANSKIY, V.P.

Generation of cosmic rays in flares. Astron.zhur. 37 no.4: 609-615 Jl-Ag '60. (MIRA 13:8)

1. Krymskaya astrofizicheskaya observatoriya AN SSSR i Nauchno-issledovatel'skiy institut yadernoy fiziki Moskovskogo gosudarstvennogo universiteta.
(Solar radiation) (Cosmic rays)

SEVERNYY, A.B.

Generation of flares with the growth of solar magnetic fields. Astron. zhur. 38 no.3:402-408 My-Je '61. (MIRA 14:6)

1. Krymskaya astrofizicheskaya observatoriya AN SSSR.
(Sun)

22107
S/035/61/000/003/034/048
A001/A101

3,1550

AUTHOR: Severnyy, A.B.

TITLE: An investigation of magnetic fields connected with flares on the Sun

PERIODICAL: Referativnyy zhurnal. Astronomiya i Geodeziya, no. 3, 1961, 53-54, abstract 3A455 ("Izv. Krymsk. astrofiz. observ.", 1960, v. 22, 12-41, Engl. summary)

TEXT: The task of this investigation was to check the conclusions arrived at by the author (RZhAstr., 1959, no. 5, 3659) on the origination of flares in field neutral points and on annihilation of magnetic fields by flares in their vicinities. Twenty records of magnetic fields of active groups were taken by means of an essentially improved solar magnetograph (RZhAstr, 1959, no. 8, 6359; 8 of them provide information only on the location of the flares and 12 enable one, in addition, to judge on field changes during flares. Field recording was made in line λ4886 (Fe I) and sometimes in this line and in the H β line. The problem of calibrating the field of both of these lines is considered. There is a similarity in the general pattern of field distribution in H β and λ4886, especially above the groups of sunspots, although noticeable differences are observed in details.

Card 1/3

22107
S/035/61/000/003/034/048
A001/A101

An investigation of magnetic fields ...

The comparison of location of the main, most intensive flare seats at instants of their emergence with locations of neutral points, made for 61 cases, shows that in 46 cases flares practically originated in neutral points, in 8 cases differences in the locations of the flare and the neutral point might be due to errors, and in 7 cases they are beyond the limits of error but may be connected with absence of knowledge of the field topography and with different altitude of flare formation from the photosphere. Flares were never observed in the regions of magnetic poles or on the neutral line far from the strong crossed fields. The correspondence between locations of flares and neutral points is improved, if the field is considered which is recorded in the very nucleus of Hβ pertaining to the chromosphere. Intensity of fields in the chromosphere, in the limits of the active group, is of the same order as in the photosphere. A comparison of charts of magnetic fields made prior and after (sometimes also during) flares shows that after flares magnetic fields are simplified and in the vicinities of flares (neutral points) are annihilated (individual poles disappear or recess far aside, neutral points disappear), and field gradient decreases. Field gradients in the flare regions amount usually to from $\sim$0.02 to 0.1 gauss/km. Bright filaments emerging during development of flares tend to align along (or parallel) the neutral lines. An interesting case of originating a flare along a closed neutral line is also noted, which is interpreted as

Card 2/3

22107
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A001/A101

An investigation of magnetic fields...

pinch-effect appearing during the breakthrough of a tube of one polarity into the region of strong field of the other polarity. Thus the present work confirms all the main conclusions drawn earlier. There are 10 references.

Author's summary

[Abstracter's note: Complete translation]

Card 3/3

22108

S/035/61/000/003/035/048
A001/A101

3,1540
17 1450

AUTHOR: Severnyy, A.B.

TITLE: On non-stationary continuous emission of flares

PERIODICAL: Referativnyy zhurnal. Astronomiya i Geodeziya, no. 3, 1961, 54, abstract 3A456 ("Izv. Krymsk. astrofiz. observ.", 1960, v. 22, 67-74, Engl. summary)

TEXT: The author shows that non-stationary continuous emission of flares and nuclei of continuous emission can be considered as a long-wave tail of the brehmsstrahlung of fast electrons originating near the neutral region (H=0) at pinch-effect in flares. Extrapolation of emission distribution energy from the visible region of the spectrum to the region of X-rays leads to values in agreement with data of rocket measurements. The number of fast electrons necessary for the observed emission is estimated ($\sim$0.1% of the total electronic density), and it is shown that if these electrons start from the Sun's atmosphere, their density at the Earth's surface will be within the limits from $\sim$0.1 to $10^2 cm^{-3}$.

Author's summary

There are 7 references.

[Abstracter's note: Complete translation]

Card 1/1

22388

S/035/61/000/005/021/042
A001/A101

24.6750
3,1540

AUTHORS: Severnyy, A.B., Shaposhnikova, Ye.F.

TITLE: Dynamics of limb flares on the Sun and pinch-effect

PERIODICAL: Referativnyy zhurnal. Astronomiya i Geodeziya, no. 5, 1961, 54, abstract 5A356 ("Izv. Krymsk. astrofiz. observ.", 1960, v. 24, 235 - 257, Engl. summary)

TEXT: Of 180 Hα pictures of limb flares 25 were selected and 14 of them were subjected to a detailed quantitative investigation. It has been discovered that most flares over the disk edge have the appearance of a bright hill (often with a conical top) the front side of which rapidly extends and then contracts. These extensions and contractions are non-uniform (their speed varies from 50 to 600 km/sec); sometimes they have the nature of pulsation. Corresponding accelerations of motion of the front side are very high (5×10^4 - 10^6 cm/sec^2). There is an analogy with reverse ejections, although extension of a flare proceeds considerably faster (on an average 3 min). Altitudes attained by the front side are no more than 50,000 km, and the brightness is the same as in flares on the disk. Extending and contracting of a protrusion proceeds practically synchronously with

Card 1/ 2

S/035/61/000/005/021/042
A001/A101

Dynamics of limb flares on the Sun and pinch-effect

the change in the area of the flare bright region. Cumulativeness of protrusions is especially characteristic (formation of a conical top or tips), which excludes the possibility of interpreting the flare as a plain non-cumulative explosion and its subsequent contraction. It is also shown that the growth of the front separation from the initial flare nucleus proceeds with time faster than at nuclear explosions. Simple calculations show that liberation of thermal energy during flares must amount to $\sim 10^3$ erg/cm^3 sec in order to assure observed accelerations on account of expansion. If this energy arises at the expense of a magnetic field, then it is sufficient to destroy a field of $\sim$100 gauss (e.g. at pinch-effect) to cover these energy losses. Cumulativeness of explosion-like protrusions in flares and, possibly, motion along the channels can be generally explained by geometry of crossed magnetic fields surrounding the flare which arises in the neutral point of such a field as a result of pinch-effect. The high-temperature plasma of the flare is in these cases in magnetic traps. The plasma tends to get out of the trap or to expand in directions of least resistance from the surrounding field. Fields of about 100 gauss are sufficient lest the flare should pass across the field. Current arising in a neutral region at pinch-effect is subjected to electrodynamical acceleration which can attain the observed values at surrounding fields of $\sim$100 gauss only. There are 14 references. Authors' summary

[Abstracter's note: Complete translation]

Card 2/2

22384
S/035/61/000/005/017/042
A001/A101

3,1550

AUTHOR: Severnyy, A.B.

TITLE: Some features of plasma motion in solar magnetic fields

PERIODICAL: Referativnyy zhurnal. Astronomiya i Geodeziya, no. 5, 1961, 53, abstract 5A349 ("Izv. Krymsk. astrofiz. observ.", 1960, v. 24, 281-292, Engl. summary)

TEXT: A magnetic field of about 60 gauss was recorded in the chromosphere over the disk edge, near a sunspot, by means of a solar magnetograph (in the Hβ line); simultaneously were recorded radial velocities in the chromosphere and intensities of the center of the Hβ line. The analysis of these records has shown that gases of the chromosphere flow into the sunspot approximately along the force lines. At the same time, records of radial velocities in the sunspot nuclei indicate, as a rule, the flowing of gases from the nucleus. The analysis of simultaneous records of the field and radial velocities in the sunspot groups shows that neutral field points are practically always (in 30 cases out of 37) located on the neutral line of the velocity map where radial velocities are oppositely

Card 1/2

S/035/61/000/005/017/042
A001/A101

Some features of plasma motion ...

directed. It is shown that the concept of fluxes moving towards each other to the neutral point corresponds statistically to observational results. Some considerations are presented on the field geometry in sunspots and neutral points. There are 10 references.

Author's summary

[Abstracter's note: Complete translation]

Card 2/2

38809
S/035/62/000/006/015/064/
A001/A101

AUTHORS: Severnyy, A. B., Koval', A. N.

TITLE: Investigation of broadening of emission of flare strong lines and whiskers. I.

PERIODICAL: Referativnyy zhurnal, Astronomiya i Geodeziya, no. 6, 1962, 55-56, abstract 6A414 ("Izv. Krymsk. astrofiz. observ.", 1961, v. 26, 3-40, English summary)

TEXT: Profiles of emission wings in whiskers and an eruptive flare over the limb are analyzed. It was found that distribution of emission in the wings of whiskers and in the eruptive flare over the limb cannot be explained by the Stark effect, although in nuclei of strong hydrogen lines the Stark effect may play a marked role. Distribution of the form $e^{-\alpha\Delta\lambda}$ also does not satisfy the observed distribution of emission in the wings of whiskers and eruptive flares; fair agreement with observations, which is sometimes obtained, may be due to poor image quality, tremors of the image in the slit, and low resolving power. Doppler emission distribution shows good agreement with observations in all cases considered. The authors discuss the possibility of representing emission

Card 1/2

Investigation of broadening ...

of whiskers and wings of flares as emission arising in a comparatively cold jet with a constant velocity gradient, which was formed during a contraction or expansion of a flare. In most cases such a concept agrees with observations even better than Doppler effect. Movement velocities of these jets (~ 300 km/sec) turn out to be of the same order as mean observed velocities of extension and contraction of flares on the limb. In individual cases the best agreement with observations is shown by Doppler broadening due to macroscopic disorderly movements at speeds of ~100 km/sec. The analysis of profiles of emission of an eruptive flare on the limb presents a rather complicated picture of comparatively slow movement of the protrusion as a whole and more rapid extension of a region giving rise to broad emission. Superposition of emission in such a multi-step movement is fairly well presented by Doppler distribution. The analysis of emission of metallic lines warrants the conclusion that it can originate in the chromospheric region surrounding the "nucleus" of a flare or in a region in which originates strongly broadened hydrogen emission. There are 20 references.

Author's summary

[Abstracter's note: Complete translation]

Card 2/2

39115
S/058/62/000/006/016/136
A061/A101

3,1540 (2205, 2805)

AUTHORS: Severnyy, A. B., Shabanskiy, V. P.

TITLE: The mechanism of solar flares and of the generation of cosmic rays in them

PERIODICAL: Referativnyy zhurnal, Fizika, no. 6, 1962, 52, abstract 6B366 ("Izv. Krymsk. astrofiz. observ.", 1961, v. 25, 88 - 113, English summary)

TEXT: The compression of a plasma around the central point of a magnetic field can be related to the pinch effect arising under free-field conditions when two power tubes (possessing, e.g., a force-free field) are approached and their azimuthal fields are mutually canceled. The possibility of this kind of compression in the case of a rapidly changing field of sunspots is considered. The authors come upon the representation of strong shock waves converging at the neutral point. In the vicinity of the latter (at distances of $\lambda \leq 10^7$ cm), the incident shock wave does not appear as hydromagnetic, and its front outstrips the motion of the magnetic wall. After reflection in the neutral plane,

Card 1/2

S/058/62/000/006/016/136
A061/A101

The mechanism of...

the front of the reflected wave moves about in the compressed plasma, and the more or less stationary high-temperature region forming behind it draws its energy from the magnetic energy required for the plasma compression. The front of the reflected wave, in interacting with the magnetic wall, may slow down or stop the motion of the latter, so that compression may be replaced by expansion or pulsations, which is also observed in the flares. Thermonuclear reactions take place in the hot region behind the front of the wave reflected from the neutral point. It is shown that fragments of these reactions (chiefly protons) with energies of the order of some mega-electron-volts, being reflected from the magnetic walls converging to the neutral point, are accelerated to energies of $\sim$10 Bev.

[Abstracter's note: Complete translation]

Card 2/2

MUSTEL', Eval'd Rudol'fovich; GEL'FGAT, B.Ye., red.; AMBARTSUMYAN, V.A., red.; SEVERNYY, A.B., red.; SOBOLEV, V.V., red.; KRYUCHKOVA, V.N., tekhn.red.

[Stellar atmospheres] Zvezdnye atmosfery. Red.kollegiia: V.A.Ambartsumian i dr. Moskva, Gos.izd-vo fiziko-matem. lit-ry, 1960. 444 p. (MIRA 14:2)
(Stars--Atmospheres)

SEVERNY, A. B., SHAPOSHNIKOVA, Ye. F.

"The Dynamic of Limb-Flares and Pinch-Effect."

Izv. Krym. Astrofiz. Obser, v 25 (~~in press~~ 1961).

The H_α -films of 14 limb-flares are measured. It was found that in most of the cases limb-flares appear in the form of brilliant hill with conical top, which undergoes to dilatations and contractions.
The pulsations sometimes were observed. The velocities of dilatations are up to 450 $\frac{km}{sec}$ and accelerations reach 10^5-10^6 $\frac{cm}{sec^2}$.
The formation of cone like top of flare is explained by the geometry of crossed magnetic fields (cusped field geometry) surrounding a flare which appears in neutral point of such a field as result of pinch-effect.

35076
S/712/60/025/000/010/014
D218/D301

3,1540 (also 1137)

AUTHOR: Severnyy, A. B.

TITLE: An estimate of the ultraviolet emission of solar flares in the resonance lines L_α, He I and He II

SOURCE: Akademiya nauk SSSR. Krymskaya astrofizicheskaya observatoriya. Izvestiya, v. 23. Moscow, 1960, 311-321

TEXT: Continuing earlier work the author gives calculations of the profiles and intensities of the above three lines. It is estimated that the intensity of radiation in the three lines at the boundary of the atmosphere is as follows: (ergs/cm^2 sec)

Temp. of flare	He I, λ584	He II, λ304	H, λ1215
10,000	2.9×10^{-10}	0	0.11
25,000	5.8×10^{-4}	~0.1	5.5

Card 1/3

S/712/60/023/000/010/014
D218/D301

An estimate of ...

The general conclusion is that an appreciable increase in the radiation emitted by the sun in the region λλ100-1215Å can only be expected in the L_α radiation of hydrogen and the λ304 He II line during the appearance of flares of importance greater or equal to 2 and occupying a considerable area. This radiation is variable: In L_α it may continue throughout the lifetime of the flare (4^m - $1^h.5$) and it is probable that it occurs with a certain delay relative to the H_α. Secondly, in the λ304 line the radiation is most probably emitted during the flash phase, when the emission in the helium lines is at its maximum (duration $\sim 10^m$). The increase in the emission in the λ304 line, which is indicated in the table, is very much greater than the normal level of this emission from the solar corona. According to G. Elwert it should not be more than 10^{-2} erg/cm^2 sec. The present results are said to be consistent with rocket experiments reported by E. Tousey. There are 4 figures,

Card 2/3

S/712/60/023/000/010/014
D218/D301

An estimate of ...

4 tables and 12 references: 5 Soviet-bloc and 7 non-Soviet-bloc. The reference to the English-language publication reads as follows: C. W. Allen, Astrophysical Quantities, 1955, Univ. of London, §28.

SUBMITTED: April, 1959

Card 3/3

SEVERNYY, A. B

Solar physics. IUn.tekh. 4 no.3:14-18 Mr '60.
(MIRA 13:6)

1. Direktor Krymskoy observatorii, chlen-korrespondent AN SSSR.
(Sun)

SEVERNYY, Andrey B.

"Report of the Crimean Astrophysical Observatory: (1) Spaceship satellite investigation of the helium λ304 line emission on the sun, and (2) Radiation danger of solar flares and methods of its prediction"

report to be submitted to the 13th Intl. Astronautical Congress, IAF, Varna, Bulgaria, 23-29 Sep 1962.

37397

S/033/62/039/002/011/014
E032/E314

3,1260

AUTHORS: Butslov, M.M., Kopylov, I.M., Nikonov, V.B., Severnyy, A.B. and Chuvayev, K.K.

TITLE: Experiments in electron-optical photography of galaxies in hydrogen light using the 2.6 m reflector of the Crimean Astrophysical Observatory

PERIODICAL: Astronomicheskiy zhurnal, 4. 39, no. 2, 1962, 315 - 322 + 3 plates

TEXT: Detailed studies of extragalactic nebulae require the use of large telescopes. As regards detecting apparatus, the use of ordinary photographic techniques in conjunction with narrow-band filters necessitates long exposures and is therefore inconvenient in practice. The authors have investigated therefore the possibilities of image-converters as a means of avoiding these disadvantages. An image-converter was set up in the direct focus of the 2.6 m reflector of the Crimean Astrophysical Observatory. The immediate object was to investigate the hydrogen emission in a number of galaxies. Four light colour filters were introduced in front of the converter and

Experiments in electron-optical ...

the screen of the latter was photographed by a motion-picture camera. Altogether 58 galaxies were photographed in H_α and other light. Photographs of 10 of these are reproduced and their features are described (NGC 604, 1569, 4214, 4449, 4490, 4736, 5194, 5457, 6822 and 6946). Many unknown clouds of hydrogen-emission were detected in the galaxies. In many cases there is no correspondence between hot-star clusters and hydrogen clouds. The hydrogen component shows greater concentration in the equatorial planes than the stellar component. In some galaxies the nuclei consist of isolated condensations. The dimensions of the nuclei in H_α light are in some cases appreciably larger than in other light, although in a number of cases the reverse situation obtains. In several galaxies, streams or ejections from the nucleus, which are visible only in H_α light, were detected.

SEVERNYY, A.B.

Some characteristics of magnetic fields connected with solar flares. Astron.zhur. 39 no.6:961-964 N-D '62.(MIRA 15:11)

1. Krymskaya astrofizicheskaya observatoriya AN SSSR.
(Magnetic fields (Cosmic physics))
(Sun)

43545

S/033/62/039/006/008/024
E032/E414

24 6714

AUTHOR: Severnyy, A.B.

TITLE: Instability of a layer of plasma with a neutral magnetic field point

PERIODICAL: Astronomicheskiy zhurnal, v.39, no.6, 1962, 990-995

TEXT: It is noted that there are two hypotheses as regards the generation of flares, namely the flares appear spontaneously as a result of the instability of a free field frozen into the solar plasma, or they appear as a result of the effect of external fields, e.g. sunspot fields, which give rise to a contraction of the plasma. In order to throw further light on these mechanisms, the author considers the stability of a plane-parallel plasma layer lying between the planes $x = -x_o$ and $x = +x_o$ in which the field increases linearly with distance from the $x = 0$ plane at which $H = 0$. It is assumed that the density and pressure inside the layer are symmetric functions of x and the space outside the layer is evacuated. The conductivity is assumed to be infinite, the displacement current is neglected and the line of force are assumed to be straight and parallel during the motion. The Euler equations for small displacements are solved and it is shown that

Card 1/2

instability can appear if the external field decreases with distance from the layer. The above three restricting assumptions are then relaxed and the analysis is repeated in the case where the field, the pressure and the density inside the plasma layer are of the form

$$H_y = H_0 \frac{x}{x_0}, \quad p = p_0\left(1 - \frac{x^2}{x_0^2}\right), \quad \rho = \rho_0\left(1 - \frac{x^2}{x_0^2}\right) \qquad (14)$$

while the field outside the plasma is $H_y = \text{const} = H_0$. It is shown that this type of layer is unstable. It is argued that the stability considerations reported by S.I.Syrovatskiy (Astronomicheskiy zhurnal, v.39, no.6, 1962, 987-989) are incorrect owing to an incorrect formulation of the problem and unacceptable assumptions. There are 2 figures.

ASSOCIATION: Krymskaya astrofizicheskaya observatoriya AN SSSR (Crimean Astrophysical Observatory AS USSR)

SUBMITTED: July 5, 1962

GURZADYAN, Grigor Aramovich; AMBARTSUMYAN, V.A., red.; MUSTEL', E.R., red.; SEVERNYY, A.B., red.; SOBOLEV, V.V., red.; KULIKOV, G.S., red.; BRUDNO, K.F., tekhn. red.

[Planetary nebulae]Planetarnye tumannosti. Moskva, Gos.izd-vo fiziko-matem.lit-ry, 1962. 384 p. (MIRA 15:9)
(Nebulae)

45123

S/712/62/027/000/003/015
A001/A101

24.6710

AUTHORS: Babin, A. I., Luk'yanov, S. Yu., Severnyy, A. B., Sidorov, G. G., Sinitsyn, V. I., Steshenko, N. V.

TITLE: An investigation of hydrogen lines broadening in a powerful pulse discharge

SOURCE: Akademiya nauk SSSR. Krymskaya astrofizicheskaya observatoriya. Izvestiya, v. 27, 1962, 52 - 70

TEXT: Emission hydrogen spectrum of solar flares shows a great similarity with the spectrum of high-temperature hydrogen plasma glowing in a pulse discharge of high intensity. Therefore, the latter spectrum was investigated in the present study by methods used in studying physical processes on the Sun. At first the problem of broadening of hydrogen emission is considered. The equipment used and the methods of carrying out measurements are described in detail. Discharge was studied with the aid of a spectrograph with a diffraction echelle-grating (dispersion $\sim$1.5 Å/mm). The main results of the spectrophotometric study of broadening of hydrogen emission (H_α - H_ε) wings are as follows: 1) The

Card 1/3

emission of hydrogen line wings (extending to 30 - 40 Å), when observed in the spectra of a self-constricted pinch perpendicular in direction, turns out to be broadened due mainly to the linear Stark-effect (at the initial pressure p_o = = 0.1 mm Hg); 2) at p_o = 0.5 mm Hg the emission extends to 50 - 80 Å and is broadened in the wing, probably due mainly to the quadratic Stark-effect; 3) when the spectra are observed along the plasma pinch, the broadening of hydrogen emission in the wings of the lines is due to macroscopic motions of the plasma with velocities of the order of 10^8 cm/sec. The intensity variations in the wings are well explained by the hypothesis on the jet-type plasma motion directed along the discharge axis with velocity gradients; 4) when the spectra are observed outside the axis of discharge, the broadening of hydrogen emission (at p_o = 0.1 mm Hg) is entirely due to the linear Stark-effect in both transversal and longitudinal direction (next to the pinch). The mechanism of hydrogen emission broadening in a powerful discharge is similar to broadening of emission lines of solar flares. The variation of intensity in the line wings depends essentially on the direction along which the spectrum of plasma emission is observed. It is concluded that the analogy between the powerful pulse discharges in laboratory conditions and the phenomenon of chromospheric flares on

An investigation of hydrogen lines...

the Sun, is based on the close physical essence of both phenomena. There are 12 figures and 2 tables.

SUBMITTED: May 1961

Card 3/3

45124

S/712/62/027/000/004/015
A001/A101

AUTHOR: Severnyy, A. B.

TITLE: Nonstationary processes in solar magnetic fields (The generation of flares, heating of faculae)

SOURCE: Akademiya nauk SSSR. Krymskaya astrofizicheskaya observatoriya. Izvestiya. v. 27, 1962, 71 - 109

TEXT: The present article is a continuation of the author's studies of magnetic fields related to flares, carried out in 1958. The initial concept of generation of solar flares is complemented with an investigation of slow processes of heating and contraction of the solar plasma, which are of importance for the explanation of solar faculae. The studies of magnetic fields related to solar flares show that the latter arise where magnetic polarity changes its sign. The observational data indicate that the surrounding field changes in intensity, gradient and magnetic hills from the state preceding the flare to that following it, although in the region of flares proper no appreciable changes are observed. The changes of the surrounding field proceed sometimes very rapidly.

Card 1/4

The data of H_α films and spectra of limb flares show the rapid formation of cumulative jets with some gradient of velocity along the jet. The equation of intensity distribution in the contour of the lines looks as follows:

$$I(\Delta\lambda) = \frac{C_k}{\alpha} \ln \frac{\Delta\lambda_m}{\Delta\lambda} \qquad (1.2)$$

where C_k is some constant, and $\Delta\lambda_m$ is the full width of the wing. The picture of spectral lines broadening during the magnetic contraction of the plasma depends essentially on the direction along which the plasma is being observed. The author analyzes the mechanism of magnetic contraction of the solar plasma leading to the phenomenon of flare, which he calls automodel contraction, assuming magnetic fields to be frozen-in into the plasma. Solving the equations for the automodel contraction, the author estimates the time of contraction to be of the order of 3 hours and considers it to be applicable to photospheric layers. The next problem is consideration of rapid contraction process resulting from the growth of the external magnetic field (flare). The solution of equations of magnetic contraction is represented in Figure 5 which shows the origination of pulsations. The author concludes that even comparatively slow changes in the

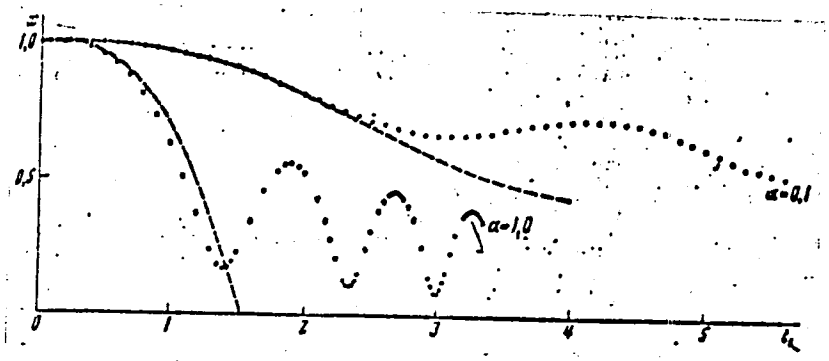
Nonstationary processes in...

field of sunspots may lead to very rapid and intensive contraction and subsequent pulsations during the times comparable with the time of flare formation. This can lead to generation of shock waves converging to the neutral point and producing considerable heating of plasma. Shock waves arise if the initial dimensions of the condensation are sufficiently large ($> 5 \times 10^8$ cm); however, if the initial rate of the magnetic field growth is high (~ 0.1 gauss/sec), a contraction takes place even at small dimensions of the condensation ($\sim 10^8$ cm). The last problem considered is the slow growth of the external magnetic field and processes related to it. The process of automodel contraction is analyzed with ohmic losses taken into account, and it is shown that the latter are of importance in the slow heating of faculae. The initial dimensions of condensations do practically coincide with the characteristic dimension (~ 100 km) of emission nuclei arising in the photosphere and showing characteristic spectral features (nuclei of the faculae fine structure). The heating of condensations due to Joule losses leads to a strong ionization of hydrogen. The existence of heated condensations has been confirmed by both studies of the solar radio emission and studies of its ultraviolet spectrum. There are 6 figures.

SUBMITTED: April 1961

Card 3/4

Figure 5. Approximate (dotted line) and exact (dots) solutions of the magnetic contraction equation



Card 4/4

S/712/62/028/000/007/020
E032/E314

AUTHORS: Stepanov, B.Ye. and Severnyy, A.B.

TITLE: Photoelectric method for measuring the magnitude and direction of the magnetic field on the solar surface

SOURCE: Akademiya nauk SSSR. Krymskaya astrofizicheskaya observatoriya. Izvestiya. v. 28. 1962. 166-193

TEXT: The aim of this work was to develop a photoelectric method of measuring the magnitude and direction of the magnetic field, the direction being characterized by the angle between the field vector and the line of sight γ and the azimuth of the transverse component of the field χ. A search for this method was begun in 1958 and the development was completed in 1959. Since then, the method has been used to record the fields in active regions and a preliminary description of it was given in a previous paper (A.B. Severnyy - Trans. IAU, 11-13, 1961 (in press)). The method is being used with the magnetograph of the Krymskaya astrofizicheskaya observatoriya (Crimean Astrophysical Observatory). $\pm \lambda/4$ modulation is employed in measurements of the longitudinal field and the photocurrents due to oscillations in the intensity

Card 1/3

Photoelectric method ....

of σ_1 and σ_2 components at the two slits of the photometer are subtracted. In measuring the transverse magnetic field a 0, $\lambda/2$ modulation is used (ADP crystal plus quartz $\lambda/4$ plate) and the two photocurrents are added. The azimuth of the transverse field is determined by recording the signals with the quartz $\lambda/4$ plate in two positions separated by an angular distance of 45°. In order to determine the relation between the signals and γ, χ the electrical oscillations for a magnetically split line are resolved into two mutually perpendicular oscillations so that their intensities can be added within the limits of an optically thick absorption line, and the blending and interaction between differently polarized σ and π components can be taken into account. Calculations used in the interpretation of the data were reported in earlier papers (V.Ye. Stepanov - Izv.Krymskoy astrofiz. obs., 19, 20, 1958; 18, 136, 1958). A method is described for the calibration of the apparatus with the aid of a special magnet. The noise level corresponds to about 100 Oe in measurements of transverse fields, so that the method cannot be used for regions with very low fields ($H < 100$ Oe). The noise level for the

Photoelectric method ....

longitudinal component is about 1 Oe. Charts showing magnetic-field distributions in active regions are reproduced. The magnetic-field charts reveal an eddy structure in some cases. The spiral structure of H_l shows that apart from the azimuthal component H_φ, there is also a radial component H_r. This indicates that the sunspot field differs from a force-free field with cylindrical symmetry. Further studies designed to obtain more detailed information will be concerned with the variation in the field with height. There are 14 figures and 1 table.

SUBMITTED: December 20, 1961

Card 3/3

SEVERNYY, A.B.

"Solar magnetic field."

Report submitted to the Symposium on Results of the IGY-IGC (Intl. Geophysical Year) Los Angeles, California 12-16 Aug 1963

GOPASYUK, S.I.; OGIR', M.B.; SEVERNYY, A.B.; SHAPOSHNIKOVA, Ye.F.

Structure of solar magnetic fields and its variations in flare regions. Izv. Krym. astrofiz. obser. 29:15-67 '63. (MIRA 16:10)

VLADIMIRSKIY, B.M.; SEVERNYY, A.B.

Nuclear processes in chromospheric flares. Izv. Krym. astrofiz. obser. 29:80-85 '63. (MIRA 16:10)

ACCESSION NR: AR4021615 S/0269/64/000/002/0058/0058

SOURCE: RZh. Astronomiya, Abs. 2.51.414

AUTHOR: Severny*y, A. B.

TITLE: Distribution of strong flares in the magnetic fields of spot groups

CITED SOURCE: Izv. Kry*msk. astrofiz. obsery., v. 30, 1963, 161-184

TOPIC TAGS: sun, solar activity, chromospheric flare, solar magnetic field, cosmic ray, astronomical modeling, solar filament, magnetic field neutral point, astronomy

TRANSLATION: A study was made of 15 very large (with cosmic ray effect) flares at the phase of their maximum development relative to magnetic fields. All available data on magnetic fields, both ordinary determinations of the absolute field from the spectrum and isogauss maps obtained for eight cases using the Crimean magnetograph, were used for this purpose. The position of most of the flares was determined from Hα films from the Crimea. Laboratory modeling of the transverse

Card 1/2

ACCESSION NR: AR4021615

field by the H_1 method, described earlier (see RZhAstr, 1964, 1.51.418), was carried out for each flare. Asymptotes (lines passing through the neutral point and like poles) were drawn. The filaments of flares were oriented in the magnetic field either along the mentioned asymptotes or along the neutral line of the longitudinal field, or parallel to these lines. This property is expressed the more clearly the greater the field gradient across the mentioned lines. The filaments of flares deviate appreciably from the neutral lines in the region of weak fields. The cited data indicate that the filaments of flares always pass through the neutral point of the transverse field of the model. Neutral points can appear at the centers of spots (even over the center itself) and also over the region of a strong transverse field. In the case of eight large flares observed in the Crimea there was no observable separation of one filament into two parallel filaments, as reported by certain investigators (RZhAstr, 1962, 10A389). Bibliography of 10 items. Author's abstract.

DATE ACQ: SUB CODE: AS ENCL: 00

Card 2/2

KAPLAN, Samuil Aronovich; PIKEL'NER, Solomon Borisovich; AMBARTSUMYAN, V.A., red.; MUSTEL', E.R., red.; SEVERNYY, A.B., red.; SOBOLEV, V.V., red.; KULIKOV, G.S., red.; AKSEL'ROD, I.Sh., tekhn. red.

[Interstellar medium] Mezhzvezdnaia sreda. Moskva, Fizmatgiz, 1963. 531 p. (MIRA 17:2)

GORBATSKIY, V.G.; MININ, I.N.; ; AMBARTSUMYAN, V.A., red.; BUSTEL',
E.R., red.; SEVERNYY, A.B., red.; SOBOLEV, V.V., red.;
KULIKOV, G.S., red.; AKSEL'ROD, I.Sh., tekhn. red.

[Nonstable stars] Nestatsionarnye zvezdy. Moskva, Fizmatgiz,
1963. 355 p. (MIRA 16:4)
(Stars, Variable)

SEVERNYY, A.B.

Sun Flares and Magnetic Fields.

Reports of the following Soviet Scientists were presented at the XIIIth International Congress on Astronautics in Varna, Bulgaria,

P: Tekhnika Molodezhi, #1, 1963, pp.24-25

L 8529-65 EWT(l)/EWG(v)/EEC-4/EEC(t) Pe-5/Pq-4 SSD/AFWL/ASD(a)-5/AS(mp)-2/
RAEM(c)/ESD(t)/RAEM(t) GW
ACCESSION NR: AP4046586 S/0030/64/000/009/0062/0067

AUTHOR: Severny*y, A. B. (Corresponding member AN SSSR)

TITLE: Investigations of the magnetic fields on the sun

SOURCE: AN SSSR. Vestnik, no. 9, 1964, 62-67

TOPIC TAGS: sun, magnetic field, Zeeman effect

ABSTRACT: The author outlines the history of discovery and investigation of the sun's magnetic fields. He points out that, despite numerous studies, the subject is still one of the most enigmatic of cosmic physics. Such studies were begun at the Kry*mskaya astrofizicheskaya observatoriya Akademii Nauk SSSR (Crimean Astrophysical Observatory of the Academy of Sciences SSSR) in 1954. Attention was first focused on strong magnetic fields concentrated chiefly in sun spots, and photographs were made of the Zeeman effect on spectra of the spots and neighboring regions. The study of weak fields was begun in 1956 by means of the photoelectric method. This method is described briefly. The author states that the possibility of measuring both longitudinal and transverse components of the field and the position of the field vector in space was first realized by V. Ye. Stepanov and A. B. Severny*y in 195?. Inhomogeneities in the field, particularly transverse fields within the major field of a sun spot, have been confirmed by several investigations. A strong

Card 1/2

L 8529-65
ACCESSION NR: AP4046586

rotation of the magnetic vector has been observed with depth, amounting to 90° and more at depths of 100 km. Studies of flares (of 1957) in comparison with maps of magnetic fields indicate that the position of the flares cannot be related to crossover points of differently oriented fields. An interesting point is that the strongest changes in a magnetic field are observed in flares that generate cosmic rays. Existing data on the value and direction of the magnetic field permit determination of the nature of the electrical currents. But the existence of contrary currents is difficult to explain on the view of a stationary, long-lived system. This needs further study. Another problem is the difference in properties of magnetic and nonmagnetic segments of the sun and, in particular, differences in chemical composition of these zones. This relation should be compared with the known fact that magnetic-variable stars change chemical composition with change in magnetic field. Orig. art. has: 2 figures.

ASSOCIATION: Kry*mskaya astrofizicheskaya observatoriya Akademii nauk SSSR
(Crimean Astrophysical Observatory, Academy of Sciences SSSR)

SUBMITTED: 00 ENCL: 00

SUB CODE: AA NO REF SOV: 000 OTHER: 000

Card 2/2

L 61002-65 EWT(1)/EWG(r)/EEC-4 Pe-5/Pg-4 Gd

ACCESSION NR: AP5010424 UR/0033/65/042/002/0217/0232
523.745

27
26
B

AUTHOR: Severnyy, A. B.

TITLE: The nature of solar magnetic fields (the fine structure of the field)

SOURCE: Astronomicheskiy zhurnal, v. 42, no. 2, 1965, 217-232

TOPIC TAGS: solar magnetic field, solar surface oscillation, sunspot magnetic field, sunspot

ABSTRACT: An investigation is made of the fine structure of strong solar magnetic fields obtained at high resolving power. Detailed treatment is given to 1) the appearance of a purely transverse field within regions of strong longitudinal $H_{\parallel}$ unipolar fields, 2) the appearance of field peaks 2-5" in size; 3) strong rotations of the transverse field vectors at the surface and through the depth of solar atmosphere; 4) the concentration of field lines from the spots into separate radially emerging bands; 5) the joining (with spots) of $\partial H_{\parallel}/\partial z$ region of opposite polarity; and 6) the convection with sunspots. The non-coincidence of Evershed motions with the lines of force of the spot fields seem to indicate a possible infiltration of gases into the intervals between the bunches where the field is

Card 1/2

L 61002-65
ACCESSION NR: AP5010424

weakened. The strong fields under study are on the one side similar to potential dipole-type fields, but on the other side the twisting, fine structure is reminiscent of force-free fields. The general solar magnetic field which is characterized by the absence of any uniform coherent polar fields is also discussed. A comprehensive description of the general micropattern is given including the appearance of "higher modes" in one or two octaves in characteristic lengths of elements of the general field which seem to provide evidence of peculiar oscillations of the solar surface. Orig. art. has: 5 formulas, 13 figures, and 1 table.

ASSOCIATION: Krymskaya astrofizicheskaya observatoriya Akademii nauk SSSR (Crimean Astrophysical Observatory, Academy of Sciences, SSSR)

SUBMITTED: 02Oct64 ENCL: 00 SUB CODE: AA

NO REF SOV: 014 OTHER: 028

Card 2/2

L 00730-67 EWT(1) GW

ACC NR: AP6019666 SOURCE CODE: UR/0033/66/043/003/0465/0479

AUTHOR: Severnyy, A. B.

64
60
B

ORG: Crimean Astrophysical Observatory, Academy of Sciences SSSR (Krymskaya astrofizicheskaya observatoriya Akademii nauk SSSR)

TITLE: Magnetic fields at various depths of the solar atmosphere

SOURCE: Astronomicheskiy zhurnal, v. 43, no. 3, 1966, 465-479

TOPIC TAGS: magnetic field, solar atmosphere, chromosphere, photosphere, astrophysics, hydrogen, spectroscopy

ABSTRACT: Measurements of the chromospheric magnetic fields in the H_β and KCa^+ lines are reviewed and are shown to be misleading. In fact, the blending of the H_β -lines with magnetic lines may pertain to fields in the photosphere rather than in the chromosphere. The author contends that H_α lines will be more suitable for measurements of chromospheric fields. To this end, the double magnetograph of the Crimean Astrophysical Observatory is described. This installation permits the simultaneous recording of the magnetic field in any two lines. Extensive amounts of data obtained by this magnetograph seem to repeat all the features of the photospheric magnetic field at the chromospheric level. Cases of anomalous appearance of fields of

Card 1/2 UDC: 523.745

L 00730-67

ACC NR: AP6019666 4

opposite sign in the chromosphere are discussed, and the appearance of small loop-tubes of lines of force in the photosphere is noted. The direction of the field in the photosphere is found to be opposite to the chromospheric fields, leading to possible contact between fields of opposite directions. Also noted is the presence of isolated fields of one sign only at the intermediate level of $\lambda = 6102.7$ between $\lambda = 5250$ and H_α -lines. This fact, plus the appearance of zigsags in the π-component of some spots, is considered to be evidence of the very fine structure of solar magnetic fields. The author expresses his thanks to N. S. Nikulin, G. A. Monin, S. I. Gopasyuk, and T. T. Tsap for their part in constructing and running the magnetograph. Orig. art. has: 13 figures and 1 table.

SUB CODE: 20, 03/ SUBM DATE: 28Jan66/ ORIG REF: 013/ OTH REF: 004

Card 2/2 LC

SEVERNYY, A.B.

Experimental investigation of the effects of rotation of the polarization plane and of the nonmagnetic polarization on the sun. Izv. Krym. astrofiz. obser. 31:126-158 '64.

Observations of transversal and longitudinal magnetic fields connected with solar flares. Ibid.:159-199 '64. (MIRA 17:9)

L 29452-66 EWT(1) GW SOURCE CODE: UR/0269/65/000/008/0049/0050

ACC NR: AR5023003

AUTHOR: Severnyy, A. B.

TITLE: Studies of the rotation of a magnetic field with depth in the Solar atmosphere

SOURCE: Ref. zh. Astronomiya, Abs. 8.51.442

REF SOURCE: Izv. Krymsk. astrofiz. observ., v. 33, 1965, 3-33

TOPIC TAGS: astronomic data, solar atmosphere, solar magnetic field, rotating magnetic field

ABSTRACT: A deduction previously made by the author (RZhAstr, 1964, 10.51.367) on the rotation of a polarization plane with depth in the Solar atmosphere is subjected to verification. For this purpose records of the transverse magnetic field were taken on the magnetograph in three lines of different powers: λλ 5302, 5250, and 4808; for checking the possible rotation of a polarization plane, a record was later taken again in the original line (usually the λ 5250). Studies of the records and maps of lateral oscillations of the σ vector showed a strong rotation effect in the transition from one line to another, which was analogous to the effect described earlier. In the majority of cases the effect of the rotation of the σ vector

UDC: 523.76

Card 1/2

L 04318-67 EWT(1) GW
ACC NR: AR6013397 SOURCE CODE: UR/0269/65/000/011/0046/0047

AUTHORS: Bruns, A. V.; Nikulin, N. S.; Severnyy, A. B.

TITLE: New method for simultaneous recording of the transverse magnetic field parameters

SOURCE: Ref. zh. Astronomiya, Abs. 11.51.412

REF SOURCE: Izv. Krymsk. astrofiz. observ., v. 33, 1965, 80-85

TOPIC TAGS: solar magnetic field, transverse magnetic field, magnetic field measurement, analog computer

ABSTRACT: A method is described which allows the simultaneous recording of both components of the transverse field and the direct recording of the transverse vibration azimuth χ on a strip chart by reprocessing the signals. This is accomplished by placing in front of the entrance slit of the spectrograph a plane polarization analyzer made in the following manner. A compound plate of two quarter-wave plates whose axes cross at 45° is placed in front of an ordinary circular polarization analyzer consisting of an ammonium phosphate crystal and a polaroid. The plate mount is the armature of a polarized relay to which is supplied a 20-hz voltage from an audio oscillator. Thus the angle between the extraordinary axis of the quarter-wave plate and the principal axis of the crystal alternately takes the values 0° or 45°, which allows the simultaneous recording of both signals. To calculate the vibration

Card 1/2

UDC: 522.61

SEVERNYY, A.B.

Study of solar magnetic fields. Vest. AN SSSR 34 no.9:62-67 S '64.
(MIRA 17:10)

1. Krymskaya astrofizicheskaya observatoriya AN SSSR; Chlen-korrespondent AN SSSR.

L 06357-67 EWT(1) GW
ACC NR: AR6013398 SOURCE CODE: UR/0269/65/000/011/0047/0047

AUTHOR: Severnyy, A. B.

TITLE: Investigation of the magnetic field and electric currents of unipolar sunspots

SOURCE: Ref. zh. Astronomiya, Abs. 11.51.416

38
13

REF SOURCE: Izv. Krymsk. astrofiz. observ., v. 33, 1965, 34-79

TOPIC TAGS: solar magnetic field, sunspot, transverse magnetic field, longitudinal magnetic field, magnetic field measurement

ABSTRACT: The transverse and longitudinal magnetic fields for a number of unipolar groups, recorded on the Crimean solar magnetograph, are analyzed. A method of calibrating the transverse field by comparing the magnetograph readings with photographic measurements is suggested. It is noted that the vortex structure of the transverse field recorded in group No. 53 from 8 through 18 July 1962 is a rare phenomenon; fluctuations of curvature of the vortex spirals reflecting the hydrodynamic torsional oscillations move quickly. The field of unipolar spots is concentrated primarily in ropes proceeding from the spot outwards. The appearance of strong transverse fields inside spots is again noted. The values of the total field vector $\vec{H}$ and its inclination to the vertical γ are calculated for two groups. Analysis of the variation of γ and $|\vec{H}|$ with distance from the spot center shows a slower change of these quantities than found at Mount Wilson observatory and than

UDC: 523.746

Card 1/2

L 39743-66 EWT(1) GW/GD-2
ACC NR: AP6005464 SOURCE CODE: UR/0053/66/088/001/0003/0050

AUTHOR: Severnyy, A. B. 9 B

ORG: Crimean Astrophysics Observatory, AN SSSR (Krymskaya astrofizicheskaya observatoriya AN SSSR)

TITLE: Magnetic fields of the sun and stars 12 55 12 55

SOURCE: Uspekhi fizicheskikh nauk, v. 88, no. 1, 1966, 3-50

TOPIC TAGS: solar magnetic field, sunspot, transverse magnetic field, spectral line, Doppler effect, stellar astronomy, solar activity, magnetic field, magnetic field intensity, solar photosphere, solar atmosphere

ABSTRACT: After G. E. Hale discovered Zeeman fission in Fraunhofer lines of sunspot spectra, the problem arose of the existence of magnetic fields on the sun and stars. Although much research has been devoted to this problem, the nature of solar and stellar magnetic fields has not been thoroughly investigated. Many hypotheses have been developed, but none of them can explain these phenomena in detail. The stellar magnetic field must be stable because of high temperatures and good plasma

UDC: 523.038

Card 1/7

conductivity. Observations prove a variable stellar field with a sudden change in stellar plasma. Stellar magnetic fields of the intensity of 34 kgs have been found.

The field intensity can be measured by the magnetic fission of spectral lines of the wavelength λ using the formula

$$\Delta\lambda_H = \pm H \frac{\mu\lambda^2}{hc}(m_2 g_2 - m_1 g_1),$$

where H is the positive or negative field intensity, m represents the magnetic quanta numbers of the upper and lower levels which may change their sign, and g is the Lande's factor for each level. When the field direction is inclined to the sight line under an angle γ, the triplet components σ_1, σ_2, π can be determined using the formulas

$$\sigma_1 = \frac{1}{4}(1-\cos\gamma)^2, \quad \pi = \frac{1}{2}\sin^2\gamma,$$
$$\sigma_2 = \frac{1}{4}(1+\cos\gamma)^2.$$

Figure 1 shows the change of the components of the triplet under the action of the magnetic field.

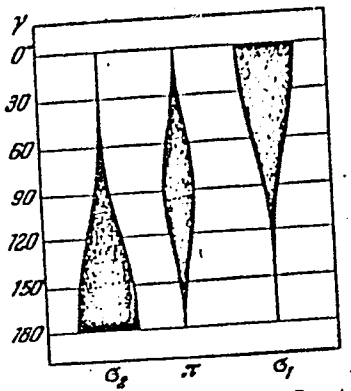


Fig. 1. Relative intensities of components σ_1, π, and σ_2, depending upon the angle γ.

Solar magnetograms of the Institute of Terrestrial Magnetism, Ionosphere, and Propagation of Radio Waves at Moscow contain records of the hydrogen line H_α from selected solar regions which make it possible to investigate the magnetic field of this region in detail.

According to Hale's and Babcock's investigations, the solar magnetic field has variable changing polarities and, sometimes, loses its intensity for longer or shorter periods. Measurements at Cambridge and the Crimean Astrophysical Observatory showed that no magnetic field could be found at the solar South Pole during the period 1961—1964. At the same time a negative magnetic field was recorded at the North Pole. Changes of the polar field were recorded in 1927 and 1937. There is some time coincidence between the change of polarity of the solar magnetic field and the maximum of solar activity. The minimum activity coincides with the maximum phase of positive or negative fields.

The fine structure of the solar magnetic field was investigated by A. B. Severnyy. Statistical data show that observations with an instrument of low resolution found a weak magnetic field, and an increase of the instrument resolution revealed an increase in the total field. Unipolar regions on the sun became multipolar when the instrument resolution was increased. Histograms of statistical data show the intensity and polarity at the North and South Poles of the sun during the first half of 1964. South polarity was predominant at the North Pole of the sun, and no polarity was evident at the South Pole.

A strict dividing line between a sunspot and the photosphere and between the umbra and penumbra indicates that the cooling layer is thin. This layer is located in regions where a convection is developed in the solar atmosphere. The magnetic field in sunspots impedes the heating in the convection region. In 1958, during the maximum of solar activity, a spot couple with different polarities had the following magnetic fields: the forward spot in the Northern Hemisphere and the following spot in the Southern Hemisphere had positive (northern) polarity. Both spots usually have opposite polarities. The polarity of a spot is determined by Zeeman fission of spectral lines. High resolution ability of the spectroscope shows a filament structure of the spot umbra. The heterogeneous magnetic structure of the spot may be checked by measuring the transverse magnetic field, the vector of which makes rapid turns in transition from point to point. The nature of the magnetic field in sunspots is a coexistence of inconsistencies, as the absence of electric currents or the presence of a system of electric currents.

Solar active regions (M-regions) appear in bipolar (BM), multipolar (M), and unipolar (UM) forms. Bipolar regions are associated with calcium flocculi and an increased coronal emission. With weak in-

L 39743-66
ACC NR: AP6005464

no changes in spectra. Orig. art. has: 27 figures, 8 formulas, and 1 table.
[ATD PRESS: 4204-F]

SUB CODE: 03, 20 / SUBM DATE: none / ORIG REF: 040 / OTH REF: 124

Card 7/7 HS

84671

S/020/60/134/006/014/031
B016/B067

15814

AUTHORS: Andrianov, K. A., Corresponding Member AS USSR and Severnyy, V. V.

TITLE: Telomerization / Reaction of Organo-cyclosiloxanes /

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol. 134, No. 6, pp. 1347-1349

TEXT: The use of telomerization reaction in organosilicon compounds is rendered difficult due to the lack of elemental-organic monomers with double bonds between element and oxygen, and capable of polymerization. The authors, however, effected the telomerization of octamethyl cyclotetrasiloxane as cyclic compound and dimethyl dichlorosilane as a substance effecting the rupture of the molecular chain. Experiments showed that, in addition, the former compound is polymerized by the latter. The authors found that the reaction of the ring cleavage without catalysts proceeds rapidly at 200-250°C. At a ratio between the first and the second substance of 2 : 1 it was completed at 250°C within 3 hours. Oligomers were obtained corresponding to the compounds of the

Card 1/3

84672

Telomerization Reaction of Organo-cyclosiloxanes

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B016/B067

followed by the rupture of the ring and the formation of a linear α,ω-dichloro dimethyl siloxane. These presumable reaction mechanisms are explained by schemes. The authors continue the study of this reaction by the example of similar cycles , and they investigated further reagents effecting the rupture of the molecular chain. There are 3 tables and 11 references: 4 Soviet, 4 US, 1 British, and 1 Japanese.

ASSOCIATION: Institut elementoorganicheskikh soyedineniy Akademii nauk SSSR (Institute of Elemental-organic Compounds of the Academy of Sciences, USSR)

SUBMITTED: July 9, 1960

Card 3/3

26402
S/062/61/000/008/006/010
B117/B206

15-8170

AUTHORS: Andrianov, K. A., Severnyy, V. V., and Zavin, B. G.

TITLE: Telomerization reaction of dimethyl cyclosilanes. Communication I. Production of linear α,ω-dichloro-dimethyl siloxanes

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye khimicheskikh nauk, no. 8, 1961, 1456-1461

TEXT: The authors investigated the telomerization of hexamethyl-cyclotrisiloxane and octamethyl-cyclotetrasiloxane with dimethyl-dichlorosilane, as well as the effect of the ratio of octamethyl-cyclotetrasiloxane to dimethyl-dichlorosilane on the composition of the reaction products. The following were used for the synthesis: crystalline hexamethyl-cyclotrisiloxane, melting point 62-64°C, boiling point 132-136°C; octamethyl-cyclotetrasiloxane, boiling point 174-176°C; dimethyl-dichlorosilane with a chlorine content of 55.7 %. The reaction was found to proceed according to

$$n[(CH_3)_2SiO]_m + (CH_3)_2SiCl_2 \rightarrow Cl[(CH_3)_2SiO]_{mn}Si(CH_3)_2Cl.$$

Card 1/6

Telomerization reaction of dimethyl...

methyl siloxanes showed that conformable to law boiling points, specific gravities and refractive indices change with the number of silicon atoms in the molecule. No anomalies are observed in this connection. The telomerization of octamethyl-cyclotetrasiloxane with dimethyl-dichloro-silane was investigated at different molar ratios of the components: 1:1, 2:1 and 3:1. Experiments showed (Fig. 3) that telomerization does not yield pure products for any of the ratios investigated. Telomer mixtures with maximum yield of the product corresponding to the ratio concerned, develop continually. When increasing the ratio of the reacting components, the yield of low telomers is reduced and the amount of high-boiling products is greatly increased. There are 3 figures, 5 tables, and 2 references: 1 Soviet and 1 non-Soviet. The reference to the English-language publication reads as follows: W. Patnode, D. Wilcock, J. Amer. Chem. Soc. 68, 2291 (1946).

ASSOCIATION: Institut elementoorganicheskikh soyedineniy Akademii nauk SSSR (Institute of Elemental-organic Compounds, AS USSR)

Card 3/6

Telomerization of dimethyl ...

where m denotes the number of silicon atoms in the initial ring, n = 1, 2,3 etc. In this study, the monofunctional trimethyl-chloro silane and not a difunctional compound was used as chain-terminating substance for the telomerization of dimethyl cyclosiloxanes. Equimolar amounts of octamethyl cyclotetrasiloxane and trimethyl-chloro silane telomerize in an autoclave at 250°C within 5 hr according to the scheme

$$n\left[(CH_3)_2SiO\right]_4 + (CH_3)_3SiCl \longrightarrow (CH_3)_3Si-\left[OSi(CH_3)_2\right]_{4n}-Cl\ .$$

Pure telomers with n = 2, 3, and 4 were obtained from the reaction mixture by fractional distillation. The physical constants of the telomers are listed in Table 1. The physical properties exhibit no anomalies. Tests carried out with various molar ratios of octamethyl cyclotetrasiloxane to trimethyl-chloro silane showed that at ratios of 1 : 1, 2 : 1, and 3 : 1 mixtures of telomers only, and no pure compounds were formed. In all of these mixtures the telomer formed in maximum quantity did not correspond to the stoichiometric ratio of the reactants. The telomer having a chain by 4 dimethyl-siloxane units longer than would correspond to the

27490
S/062/61/000/009/005/014
B117/B101

stoichiometric ratio of the initial mixture was observed to form in maximum yield. An increase of the octamethyl cyclotetrasiloxane : Trimethyl-chloro silane ratio lowers the yield of the lowest telomers, and highly increases the yield of high-boiling products. Within the range of molar ratios studied, lower trimethyl-chloro silane contents in the initial mixture did not decrease the conversion of octamethyl cyclotetrasiloxane. There are 2 figures, 6 tables, and 4 references: 2 Soviet and 2 non-Soviet. The reference to the English-language publication reads as follows: D. Wilcock, J. Amer. Chem. Soc. 68, 692 (1946).

ASSOCIATION: Institut elementoorganicheskikh soyedineniy Akademii nauk SSSR (Institute of Elemental Organic Compounds of the Academy of Sciences USSR)

SUBMITTED: November 28, 1960

Table 1. Physical properties of α-chloro-ω-trimethyl-siloxy-dimethyl siloxanes.
Legend: (1) formula, (2) physical properties, (3) b.p., °C, (p, mm Hg),
Card 3/4

27492
S/062/61/000/009/007/014
B117/B101

15.8170

AUTHORS: Andrianov, K. A., and Severnyy, V. V.

TITLE: Reactions of bis(trimethyl-siloxy)-dichloro silane with alcohols, phenols and alcoholates

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye khimicheskikh nauk, no. 9, 1961, 1624-1629

TEXT: The reactions of bis(trimethyl-siloxy)-dichloro silane with monovalent alcohols, its alcoholates, divalent alcohols, mono- and divalent phenols were studied. Bis(trimethyl-siloxy)-dichloro silane (b.p. 173°C, d_4^{20} 1.0017, n_D^{20} 1.3983), was prepared by heating hexamethyl disiloxane with silicon tetrachloride at 250°C in an autoclave. Monovalent alcohols used were methyl-, ethyl-, n-propyl-, isopropyl-, n-butyl-, and isobutyl alcohol. Etherification of bis(trimethyl-siloxy)-dichloro silane with a 10% excess of the corresponding anhydrous alcohol, without a hydrogen chloride acceptor, is highly exothermic and accompanied by evolution of hydrogen chloride. It was not possible, however, to isolate bis(trimethyl-siloxy)-dialkoxy silane derivatives from the reaction

Card 1/4

Reactions of bis(trimethyl- ...

bis(trimethyl-siloxy)-dichloro silane with sodium alkoxides. The physical constants of these alkoxy silane derivatives are listed in Table 1. The reaction of bis(trimethyl-siloxy)-dichloro silane with divalent alcohols was studied using glycol and 1,4-butanediol. With glycol, an infusible, insoluble precipitate and products boiling below 110°C consisting mainly of hexamethyl disiloxane were formed. In the reaction with 1,4-butanediol the latter is dehydratized practically quantitatively to tetrahydrofuran. The hydrolyzation is obviously modified by the tetrahydrofuran present, so that compounds which can be distilled off between 150° and 260°C under vacuum and a small quantity of a liquid residue are formed. The properties of these compounds are being studied at present. Hydroquinone and 1,4-dihydroxy-diphenyl propane were used to study the reaction of bis(trimethyl-siloxy)-dichloro silane with divalent phenols. With hydroquinone, both in the presence of anisol as solvent and without a solvent, an elastic polymer $(C_{12}H_{22}Si_3O_4)_n$ is formed which swells strongly in organic solvents. On prolonged standing in air it becomes sticky and deliquesces. On boiling in dilute alcohol it hydrolyzes readily with formation of hydroquinone. The reaction with 1,4-dihydroxy-diphenyl propane yields a darkbrown, tough polymer $(C_{21}H_{32}Si_3O_4)_n$ which remains unchanged on standing

Card 3/4

27492
S/062/61/000/009/007/014
B117/B101

in air and is easily soluble in toluene. There are 2 tables and 3 references: 2 Soviet and 1 non-Soviet. The reference to the English-language publication reads as follows: R. O. Sauer, J. Amer. Chem. Soc. 66, 1707 (1944).

ASSOCIATION: Institut elementoorganicheskikh soyedineniy Akademii nauk SSSR (Institute of Elemental Organic Compounds of the Academy of Sciences USSR)

SUBMITTED: February 2, 1961

Legend to Table 1.
(1) Formula,
(2) b.p., °C,
(3) calculated,
(4) found.

(1) Формула	(2) T, кип., °C	n_D^{20}	d_4^{20}	MR (3) вычислено	MR (4) найдено
$[(CH_3)_3SiO]_2Si(OC_4H_9\text{-}n)_2$	232—234	1,4003	0,8847	96,94	96,61
$[(CH_3)_3SiO]_2Si(OC_4H_9\text{-}i)_2$	225—227	1,3968	0,8757	96,94	96,88
$[(CH_3)_3SiO]_2Si(OC_3H_7\text{-}n)_2$	214—126	1,3943	0,8903	87,68	87,25
$[(CH_3)_3SiO]_2Si(OC_3H_7\text{-}i)_2$	202—203	1,3875	0,8752	87,68	87,31
$[(CH_3)_3SiO]_2Si(OC_2H_5)_2$	191—193	1,3870	0,8921	78,46	78,10
$[(CH_3)_3SiO]_2Si(OCH_3)_2$	174—175	1,3855	0,9155	69,16	68,84
$[(CH_3)_3SiO]_2Si(OC_6H_5)_2$	157—159 (3 мм)	1,4750	1,0330	106,59	106,85

Card 4/4

28271 S/062/61/000/010/006/018
B117/B101

5-3700

AUTHORS: Andrianov, K. A., and Severnyy, V. V.

TITLE: Telomerization of dimethyl cyclosiloxanes. Communication 3. Telomerization by methyl vinyl dichloro silane and methyl phenyl dichloro silane

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye khimicheskikh nauk, no. 10, 1961, 1788 - 1791

TEXT: Telomerization of octamethyl cyclotetrasiloxane by methyl vinyl dichloro silane and methyl phenyl dichloro silane is described. The aim of this paper was to investigate the effect of various substituents on the course of reaction. In the experiments, octamethyl cyclotetrasiloxane with boiling point 174° - 176°C, methyl vinyl dichloro silane with boiling point 93°C (Cl 50.6%), and methyl phenyl dichloro silane with boiling point 200° - 202°C (Cl 37.0%) were used. From the reaction of equimolecular quantities of octamethyl cyclotetrasiloxane and methyl vinyl dichloro silane, a mixture of telomer homologs was formed. From this mixture, α-chloro methyl vinyl siloxy-ω-chloro dimethyl siloxanes with

Card 1/4

Telomerization of dimethyl...

n = 1, 2, and 3 were isolated and identified on the basis of boiling temperature, refractive indices, specific gravities, molecular refractions, results of elementary analysis, and bromine numbers. The properties of the compounds obtained are listed in Table 1. The mean conversion of vinyl methyl dichloro silane was 32.8%, and that of octamethyl cyclotetrasiloxane 54.0%. The yield of telomers was 45.1% by weight of the initial mixture. Contents of the individual telomer homologs with n = 1, 2, and 3 were 18.5, 30.8, and 14.6%, respectively. Higher telomers with a polymerization degree $n \geq 3$ were formed in the amount of 36.1%. Thus, it was established that telomerization is the only reaction at the moment by which compounds of the α-chloro methyl vinyl siloxy-ω-chloro dimethyl siloxane series with given atomic number may be obtained. The reaction of octamethyl cyclotetrasiloxane with methyl phenyl dichloro silane showed low conversion under standard conditions (3 hr, 250°C). Also the experiments with 2 M methyl phenyl dichloro silane and 1 M octamethyl cyclotetrasiloxane resulted in a total conversion of only 18.4% at 300°C in 5 hr. The conversion of methyl phenyl dichloro silane was 9.1%, and that of octamethyl cyclotetrasiloxane 19.0%. From the reaction products, telomer homologs with n = 1 and 2 were isolated. 49.0% of the telomers

Card 2/4

had a boiling point higher than 350°C (3 mm). The properties of the resultant α-chloro phenyl-ω-chloro nonamethyl pentasiloxane and α-chloro phenyl-ω-chloro heptadecamethyl nonasiloxane are listed in Table 2. Thus, it was proved that telomer homologs of the α-chloro methyl phenyl siloxy-ω-chloro dimethyl siloxane series are formed by the reaction of octamethyl cyclotetrasiloxane with methyl phenyl dichloro silane. There are 4 tables and 3 Soviet references.

ASSOCIATION: Institut elementoorganicheskikh soyedineniy Akademii nauk SSSR (Institute of Elemental Organic Compounds of the Academy of Sciences USSR)

SUBMITTED: March 23, 1961

Legend to Tables 1 and 2: (1) Formula; (2) boiling point, °C (p mmHg); (3) calculated; (4) found.

S/079/62/032/005/004/009
D204/D307

AUTHORS: Andrianov, K.A., and Severnyy, V.V.

TITLE: Hydrolysis of trimethylsiloxychlorosilanes and condensation of their hydroxy derivatives

PERIODICAL: Zhurnal obshchey khimii, v. 32, no. 5, 1962, 1633-1636

TEXT: The hydrolysis reactions were studied to determine the reactivity of the above compounds with electrophilic and nucleophilic reagents. $[(CH_3)_3SiO]_2$ (I) was hydrolyzed in acid and basic media, with and without solvents. In the absence of solvent, aqueous hydrolysis at 10°C resulted in the removal of the trimethylsiloxy group, yielding $(CH_3)_3SiOSi(CH_3)_3$ (II) and a polymer $(CH_3)_3$ $SiO.SiO_{1.5}$ $(SiO_2)_n$ (III). Solvents decreased the tendency of the trimethylsiloxy group to split off; thus in ether and THF aq. hydrolysis gave an insoluble polymer and crystalline $[(CH_3)_3SiO]_2Si(OH)_2$ (IV). No polymers were obtained from the hydrolysis of I in the presence of HCl acceptors (pyridine, NH_3, $NaHCO_3$), under similar conditions, the

Card 1/2

S/079/62/032/005/004/009
D204/D307

Hydrolysis of trimethylsiloxy- ...

only product being IV, in $\gtrsim$ 50 % yields. On heating at 200°C for 30 min. IV condensed to HO $\{[(CH_3)_3SiO]_2SiO\}_2H$ and HO $\{[(CH_3)_3SiO]_2SiO\}_3H$. Trimethylsiloxy group was also split off $[(CH_3)_3SiO]_3SiCl$ in an acid medium, without a solvent. In aq. $NaHCO_3$ the latter compound gave $[(CH_3)_3SiO]_3SiOH$, in 60 % yield. There are 2 tables.

SUBMITTED: April 22, 1961

Card 2/2

ANDRIANOV, K.A.; SEVERNYY, V.V.

Hydrolysis of trimethylsiloxychlorosilanes and condensation of their hydroxyl derivatives. Zhur.ob.khim. 32 no.5:1633-1636 My '62. (MIRA 15:5)
(Silicon organic compounds) (Hydrolysis)

S/062/62/000/007/007/013
B117/B180

AUTHORS: Andrianov, K. A., and Severnyy, V. V.

TITLE: Splitting methyl-phenyl cyclosiloxanes with dimethyl dichlorosilane

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye khimicheskikh nauk, no. 7, 1962, 1237 - 1242

TEXT: The reaction of trimethyl-triphenyl cyclotrisiloxane with dimethyl dichlorosilane was studied at ratios 1 : 2 and 1 : 1. The telomers

$$Cl - \overset{CH_3}{\underset{CH_3}{Si}} - (O\overset{CH_3}{\underset{CH_3}{Si}})_{3n} - Cl \quad (I)$$

and oligomers

$$Cl - \overset{CH_3}{\underset{CH_3}{Si}} - (O\overset{CH_3}{\underset{CH_3}{Si}})_{n} - Cl \quad (II),$$

with n = 2 - 10 were obtained. Despite the change in component ratio, the products are not dominating individual substances, but always mixtures of homologs. Reduction of the dimethyl dichlorosilane content reduced the yield of lowest homologs considerably and increased that of highest homologs (distillation residue). In the reaction of tetramethyl-tetra-

Card 1/2

phenyl cyclotetrasiloxane with dimethyl dichlorosilane in the ratio 2.5 : 1, only highest oligomers ($> Si_{10}$) were obtained, with a 35.3% yield. Products with three and four silicon atoms were hydrolyzed, to confirm the structure of oligomers of formula (II). The authors are the first to have obtained 1,3-diphenyl-tetramethyl cyclotrisiloxane (yield: 18%, b.p. 138 - 140°C (3 mm Hg); d_4^{20} 1.0679; N_D^{20} 1.5017; MR 95.52) a six-membered cycle with methyl-phenyl siloxane and methyl siloxane links, from 1,5-dichloro-1,3-diphenyl-tetramethyl trisiloxane. The hydrolysis of 1,7-dichloro-1,3,5-triphenyl-pentamethyl-tetrasiloxane yielded 72% of the well known 1,3,5-triphenyl-pentamethyl cyclotetrasiloxane with a boiling point of 198 - 201°C at 4 mm Hg. There are 1 figure and 5 tables.

ASSOCIATION: Institut elementoorganicheskikh soyedineniy Akademii nauk SSSR (Institute of Elemental Organic Compounds of the Academy of Sciences USSR)

SUBMITTED: December 27, 1961

41336

S/020/62/146/003/012/019
B101/B144

AUTHORS: Andrianov, K. A., Corresponding Member AS USSR, Severnyy, V. V.

TITLE: Telomerization of organocyclosiloxanes with dimethyl dichlorosilane

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 146, no. 3, 1962, 601-603

TEXT: The telomerization first observed on dimethyl cyclosiloxanes with organochlorosilanes (DAN, 134, no. 6, 1437 (1960)) proved applicable to other organocyclosiloxanes also. The reaction was studied between $(R'R''SiO)_3$, where $R' = R'' = C_2H_5$ (I) or $R' = CH_3$, $R'' = C_6H_5$ (II) and $(CH_3)_2SiCl_2$ (III). Six-membered cyclic compounds were chosen because the eight-membered proved to be less active. The reaction proceeded according to $(R'R''SiO)_3 + (CH_3)_2SiCl_2 \longrightarrow Cl(CH_3)_2Si-(OSiR'R'')_{3n}Cl$ forming telomer homologs with n = 1, 2, 3 .... . The reaction of I with III took place in glass ampoules with 5 hrs heating at 250°C. Conversion of I was 65%, of III 53.4%. The yield of telomers with n = 1 was 64.8%, with n = 2,

Card 1/3

Telomerization of organocyclosiloxanes ...

17.6%, the residue containing 18.6% telomers with $n > 2$. For the telomer with $n = 1$, the b.p. is 150°C/5 mm Hg, d_4^{20} 1.0102, n_D^{20} 1.4303; for $n = 2$ the b.p. is 175-178°C/0.01 mm Hg, d_4^{20} 0.9988, n_D^{20} 1.4364. The reaction of II with III under the same conditions as for I with III yielded 32.9% telomer with $n = 1$, 4.9% $n = 2$, residue 63.2%. Conversion of II was 88.6%, of III 36.5%. Telomer with $n = 1$ had b.p. 198°C/4 mm Hg, d_4^{20} 1.1276, n_D^{20} 1.5118, and with $n = 2$ b.p. 201-203°C/0.01 mm Hg, d_4^{20} 1.1310, n_D^{20} 1.5304. Reaction of II with III in a steel autoclave led to cleavage of the siloxane bonds and formation of oligomers $Cl(CH_3)_2Si-[OSi(CH_3)(C_6H_5)]_nCl$ owing to catalytic action of the resulting $FeCl_3$. In the reaction of trimethyl trivinyl cyclotrisiloxane with III in glass ampoules at 250-200°C no telomers could be identified, owing to intense polymerization. The hexaorganotricyclotrisiloxanes are in the following order of telomerizing capacity:

Card 2/3

Telomerization of organocyclosiloxanes ...

$[(CH_3)_2SiO]_3 > [(C_2H_5)_2SiO]_3 > [CH_3(C_6H_5)SiO]_3 > [(CH_2{=}CH)CH_3SiO]_3$. There is 1 table.

ASSOCIATION: Institut elementoorganicheskikh soyedineniy Akademii nauk SSSR (Institute of Elemental Organic Compounds of the Academy of Sciences USSR)

SUBMITTED: June 4, 1962

Card 3/3

S/062/62/000/012/002/007
B117/B101

AUTHORS: Andrianov, K. A., and Severnyy, V. V.

TITLE: Catalytic cleavage of dimethyl cyclosiloxanes in the presence of dimethyl-dichloro silane

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye khimicheskikh nauk, no. 12, 1962, 2133-2138

TEXT: The effect of catalytic amounts of iron chloride on the reaction of dimethylcyclosiloxanes with dimethyl-dichloro silane was studied. Experiments with 1% by weight of iron chloride, and without any, were conducted under equal conditions: sealed glass ampuls, kept at 250°C for 5 hrs, rectification of the mixture first at atmospheric pressure, then at 4 mm Hg. Results: Without iron chloride, only α,ω-dichloro-dimethyl siloxanes containing 4, 7, and 10 silicon atoms formed. When using iron chloride, telomerization takes place with the Si-O-Si bonds being ruptured and all homologs of the formula

$$ClSi(CH_3)_2 - (OSi(CH_3)_2)_n Cl$$

being formed with 2 to 7 silicon atoms. The following mechanism of cleavage was suggested: The reaction begins by a coordination of the iron atom with an oxygen atom in the siloxane chain either of the telomer or dimethyl cyclosiloxane. An active complex forms which then decomposes. The assumption that this reaction takes place in equilibrium was confirmed by experiments with octamethyl cyclotetrasiloxane and dimethyl-dichloro silane at different component ratios (Fig. 2; Table 1) and also by the fact that the composition of the reaction products is determined by the quantitative ratio of the Si-O- and Si-Cl- bonds in the system, not by the type of compound used. The reaction examined was suggested as an easy method of synthesizing low-molecular and high-molecular α,ω-dichloro-methyl siloxanes. There are 2 figures and 4 tables.

ASSOCIATION: Institut elementoorganicheskikh soyedineniy Akademii nauk SSSR (Institute of Elemental Organic Compounds of the Academy of Sciences USSR)

SUBMITTED: March 31, 1962

Fig. 2: Yield of $Cl[(CH_3)_2SiO]_n$-$Si(CH_3)_2Cl$ oligomers depending on the ratio dimethyl-dichloro silane : octamethyl cyclotetrasiloxane = curve (1) 2 : 1; curve (2) 1 : 1; where the y-axis gives the yield in %, and the x-axis gives the number of silicon atoms.

Table 1: Dependence of the molecular weight and oligomer yield on the molar ratio octamethyl cyclotetrasiloxane : dimethyl-dichloro silane.

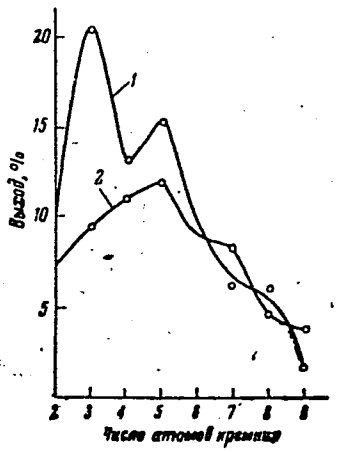
Legend: (1) ratio; (2) calculated; (3) determined; (4) according to viscosity; (5) yield, %.

Catalytic cleavage of dimethyl...

Table 1

(1) Соотношение	(2) Вычислено		(3) Найдено			Выход, %
	Si_n	M	Si_n	M по Cl	M (4) по вязкости	
10 : 1	40	2960	35—38	2750	2900	75—85
20 : 1	80	5920	71—76	5250—5630	5300	70—80
25 : 1	100	7400	89—93	6560—6870	64200	70—80
50 : 1	200	14800	150—170	11200—12600	13850	65—70
100 : 1	400	29600	220—250	16700—18500	18700	55—65

Fig. 2



Card 4/4

S/062/63/000/001/011/025
B101/B186

AUTHORS: Andrianov, K. A., and Severnyy, V. V.

TITLE: Telomerization of dimethyl cyclosiloxanes. Communication 4. Reactions with silicon tetrachloride

PERIODICAL: Akademiya nauk SSSR, Izvestiya. Otdeleniye khimicheskikh nauk, no. 1, 1963, 82 - 86

TEXT: The reaction of dimethyl cyclosiloxanes with $SiCl_4$ was studied to determine its applicability for the synthesis of tetrafunctional telomers, and to obtain missing data. The reaction of equimolecular amounts of hexamethyl cyclotrisiloxane with $SiCl_4$ in a glass ampoule at 250°C confirmed the occurrence of telomerization according to $n[(CH_3)_2SiO]_3 + SiCl_4 \rightarrow Cl_3Si-[OSi(CH_3)_2]_{3n}Cl$. The reaction product contained 71.5% of the compound with n = 1 and 13.5% with n = 2. A much more complicated mixture formed in a steel autoclave under the same conditions from octamethyl cyclotetrasiloxane and $SiCl_4$ by the catalytic action of $FeCl_3$ traces. Compounds of the struc-

Telomerization of dimethyl ... S/062/63/000/001/011/025
B101/B186

tures $ClSi(CH_3)_2-[OSi(CH_3)_2]_nCl$ (1); $Cl_3Si-[OSi(CH_3)_2]_nCl$ (2), and $Cl_3Si-[OSi(CH_3)_2]_n-OSiCl_3$ (3) were formed. At the molar ratio $SiCl_4$: octamethyl cyclotetrasiloxane 4:1, the yield of substances with high chlorine content, such as $Cl_3Si-[OSi(CH_3)_2-]_n-OSiCl_2-OSiCl_3$, increased. At the ratio 1:2, the yield of substances boiling above 250°C/4 mm Hg rose to 38.7%. Contrary to S. Maeda, E. Nojimoto (Jap. patent 3860 (1957), Chem. Abstrs 52, 5880 (1958)), no formation of dimethyl dichlorosilane was found. The catalytic action of $FeCl_3$ is explained by binding of the Fe atom to an O atom of the siloxane chain. The resulting active complex $\rangle Fe-O-Si\langle$ decomposes under the action of a compound containing Si-Cl bonds; $FeCl_3$ is set free again, and an Si-O-Si bond is formed: $\begin{matrix} Cl \\ Cl \end{matrix}\!\!\rangle Fe-O-Si.$ The data for the newly $\begin{matrix} Cl-Si-Cl \\ Cl \quad\; Cl \end{matrix}$

synthesized compounds are given in the order b.p. (mm Hg), d_4^{20}, and n_D^{20}: oligomers of formula (2), n = 3: 65(4), 1.1475, 1.4079; n = 4: 91 (4), 1.1043, 1.4081; n = 5: 112 (4), 1.0968, 1.4092; n = 6: 132 (4), 1.0870,

Card 2/3

1.4108; oligomers of formula (3), n = 3: 86 (3), 1.2207, 1.4112; n = 7: 189(3), 1.1256, 1.4118; n = 8: 205(3), 1.1165, 1.4123; n = 16: 215(0.01), - , 1.4135; n = 17: 226-230(0.01), - , 1.4137. There are 4 tables.

ASSOCIATION: Institut elementoorganicheskikh soyedineniy Akademii nauk SSSR (Institute of Elemental Organic Compounds of the Academy of Sciences USSR)

SUBMITTED: April 16, 1962

Card 3/3

S/062/63/000/002/011/020
B144/B186

AUTHORS: Andrianov, K. A., Severnyy, V. V., and Izmaylov, B. A.

TITLE: Telomerization of dimethyl cyclosiloxanes. Communication 5. Reactions with trifunctional compounds

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye khimicheskikh nauk, no. 2, 1963, 282 - 290

TEXT: Reacting hexamethyl cyclotrisiloxane (I) with organotrichloro silanes at 250°C led to the formation of telomers of the formula $RSi(Cl)_2-[OSi(CH_3)_2]_{3n}Cl$ in which the degree of telomerization depended on the organic radical R. The activity of $RSiCl_3$ decreased in the order R = CH_3, C_2H_5, $CH_2=CH$, C_6H_5. When R was CH_3 or C_2H_5, a 1:2 excess of I effected a reduction of the yield in the telomer with n = 1, a slight increase of the telomers with n = 2 and n = 3, and a sharp increase of the higher telomers. This effect was absent, when the reaction with CH_3SiCl_3 was brought about in two stages with separation of 1,1,7-trichloro-heptamethyl tetrasiloxane. This is attributed to the dependence of the $RSiCl_3$

Telomerization of dimethyl cyclosiloxanes...

activity on the number of Cl atoms bound to one Si atom. The boiling points, d_4^{20}, n_D^{20}, molecular weights and compositions are given for the 11 new trifunctional telomers obtained. In the presence of $FeCl_2$, not only trifunctional form but also the difunctional telomers $ClSi(CH_3)_2-[OSi(CH_3)_2]_nCl$. For R = CH_3 or C_2H_5, mixtures of tri- and difunctional telomers with equal n formed. With R = C_2H_5 or C_6H_5, the relation $n \geq m$ was found to depend on the type of the initial dimethyl cyclosiloxane $[(CH_3)_2SiO]_m$. The physical properties of the new C_6H_5 homologues with n = 4,5,7,8,16,20 and C_2H_5 homologues with n = 4,5,7 are given. In the presence of $FeCl_2$ the percentage of dimethyl cyclosiloxane conversion decreased in the same order as indicated that above for the telomerization. In the reaction with vinyl and phenyl compounds, I proved more active than octamethyl cyclotetrasiloxane. There are 8 tables.

ASSOCIATION: Institut elementoorganicheskikh soyedineniy Akademii nauk SSSR (Institute of Elemental Organic Compounds of the Academy of Sciences USSR)

Telomerization of dimethyl cyclosiloxanes... S/062/63/000/002/011/020 B144/B186

SUBMITTED: May 16, 1962

Card 3/3

ANDRIANOV, K.A.; SEVERNYY, V.V.

Telomerization reaction of organocyclosiloxanes with dimethyldichlorosilane. Dokl. AN SSSR 146 no.2:[illegible]03 S '62. (MIRA 15:10)

1. Institut elememtoorganicheskikh soyedineniy AN SSSR. 2. Chlen-korrespondent AN SSSR (for Andrianov).
(Siloxanes) (Silane) (Polymerization)

ANDRIANOV, K. A.; SEVERNYY, V. V.

Catalytic cleavage of dimethylcyclosiloxanes in the presence of dimethyldichlorosilane. Izv. AN SSSR Otd. khim. nauk no.12:2133-2138 D '62. (MIRA 16:1)

1. Institut elementoorganicheskikh soyedineniy AN SSSR.

(Siloxanes) (Silane) (Catalysis)

ANDRIANOV, K.A.; SEVERNYY, V.V.; IZMAYLOV, B.A.

Telomerization of dimethylcyclosiloxanes. Report No.3: Reactions with trifunctional compounds. Izv.AN SSSR.Otd. khim.nauk no.2:282-290 F '63. (MIRA 16:4)

1. Institut elementoorganicheskikh soyedineniy AN SSSR.
(Siloxanes) (Polymerization)

ANDRIYANOV, K.A., SEVERNY, V.V.

Telomerization of silicon-organic cycles.

Report submitted for the 12th Conference on high molecular weight compounds devoted to monomers, Baku, 3-7 April 62

ANDRIANOV, K. A.; SEVERNYY, V. V.

Telomerization reaction of dimethylcyclosiloxanes. Report No. 4: Reactions involving silicon tetrachloride. Izv. AN SSSR. Otd. khim. nauk no.1:82-86 '63. (MIRA 16:1)

1. Institut elementoorganicheskikh soyedineniy AN SSSR.

(Siloxanes) (Polymerization)
Silicon chlorides)

SEVERNYY, Vadim Vladimirovich, kand. khim. nauk; NOVITSKIY, Eduard Grigor'yevich, inzh.; STAROSEL'SKAYA, M.Ya., nauchn. red.

[Synthesis of organosilicon oligomers and polymers and their stabilization; survey of foreign patents] Sintez kremniiorganicheskikh oligomerov i polimerov i ikh stabilizatsiia; obzor inostrannykh patentov. Moskva, TsNIIPI, 1964. 34 p. (MIRA 18:5)