periodic lattice produced by the piezoactive shear wave propagating with velocity 1.7 10 cm/sec. The intensity I of the diffracted radiation depends in this case strongly on the angle of incidence of the light on the crystal. At low electric conductivity of the crystal, $\sigma_1 \simeq 1\times10^{-6}\Omega^{-1}cm^{-1}$ (sample in darkness), the diffraction is accompanied by a 90° rotation of the polarization plane, and occurs only at $\theta_i \simeq 16°$ (curve 1 of Fig. a); this is in good agreement with the calculated values of the angles for anisotropic diffraction due to the lattice photoelasticity of the material.

At sufficiently strong illumination of the crystal ($\sigma_2 \simeq 3\times10^{-3}\Omega^{-1}cm^{-1}$), effective diffraction is produced also at $\theta_i^* \simeq 10.5°$ (curve 2 of Fig. a). The polarization plane of the diffracted light coincides then with the polarization plane of the in-ident light (see Fig. b), and the intensity of the diffracted light is smaller by a factor 50 — 100 than the intensity of the diffraction maximum for anisotropic lattice diffraction at $\theta_i \simeq 16°$. The equality of the angles θ_i and θ_d^*, their close agreement with the Bragg angle $\theta_B = \sin^{-1}(1/2)(\lambda_0/\lambda_s)$ (estimates yield $\theta_B \simeq 10°36'$), and the polarization of the diffracted radiation, all indicate that the resultant diffraction is of the isotropic Bragg type. Estimates, based on [1, 2], of the intensity ratios of the diffraction maxima following scattering by electron waves and following anisotropic lattice diffraction yield $(I_1)_{lat}/(I_1)_e \simeq 50$, in satisfactory agreement with experiment.

These data give grounds for assuming that the diffraction observed at the incidence angle $\theta_i^* \simeq 10.5°$ is due to scattering of light by electronic waves accompanying the transverse piezoactive wave in the CdS. Additional evidence indicating that the observed isotropic is by electrons rather than by the lattice is seen also in the differences between the behaviors of the "anisotropic," "lattice," and "electronic" components when an electronic nonlinearity sets in with increasing wave intensity. This agrees qualitatively with [6], where it is shown that at high sound-wave intensities the anharmonicity in the electron wave sets in much earlier than in the elastic wave.

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IDENTIFICATION OF TRANSITIONS FROM DOUBLY EXCITED LEVELS OF LITHIUM-LIKE Ti AND V IONS CONTAINED IN A LASER PLASMA

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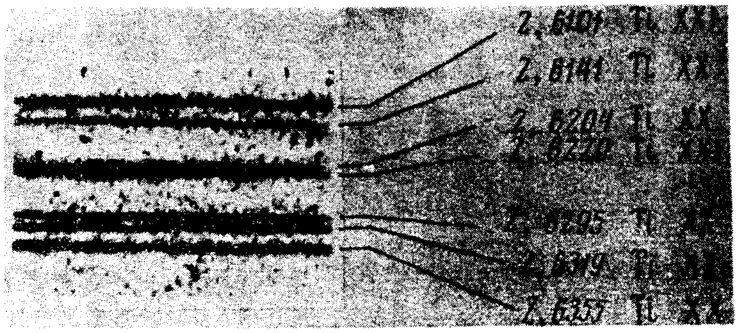
Results are presented of observation of the helium-like ions Ti-XXI and V-XXII (with ionization potentials 6.250 and 6.825 keV, respectively). Identification of transitions of the type 1s2pnℓ → $1s^2$nℓ of Li-like Ti-XX and V-XXI (altogether 19 lines) is also reported (measurement accuracy 0.0005 Å).

We report here the results of observation of the spectral lines of the helium-like ions Ti-XXI and V-XXII (ionization potentials 6.250 and 6.852 keV, respectively), and the identification of the transitions of the type 1s2pn → $1s^2$nℓ of the lithium-like ions Ti-XX and V-XXI. The excitation source, just as in the earlier investigation of the doubly-excited levels of the ions Mg-X, Mg-XI, Al-XI, and Al-XII [1, 2], was a laser plasma produced by sharp focusing of laser beam of flux density 5×10^{14} W/cm^2. Spectrograms suitable for the study were obtained with a mica x-ray spectrograph [3] on type UF-VR films after 10 - 15 flashes of the laser. The wavelengths were measured in the third and fifth orders. The references were the wavelengths of the lines of Mg-XI and Al-XII from [4]. The table lists the obtained wavelengths, the earlier laboratory [5] and astrophysical [6] measurement results, and the wavelengths calculated from the data of [2]. In spite of the absence of calculated wavelengths for transitions of the type $1s2p3p \to 1s^2 3p$, the lines 2.6141 (Ti-XX) and 2.3856 (V-XXI) are ascribed in the present paper to the transitions indicated in the table, on the basis of the identification of the corresponding Al-XI line in [7] with extrapolation of our experimental data for the isoelectronic sequence Mg-X to V-XXI. We note that the 2.631 line of Ti-XX measured in [5] has been ascribed by us in the table, on the basis of the calculated data of [2], to the transition $1s2p^2\ ^2D \to 1s^2 2p^2P$. The weak and broadened lines 2.6480 (Ti-XX) and 2.4140 (V-XXI) correspond apparently to the aggregate of seven lines of the transitions $1s2p^2\ ^4P \to 1s^2 2p^2P$ and $2s2p[^3P]1s^4P \to 1s^2 2s^2S$, which lie in the intervals indicated in the table.



Transitions	Titanium				Vanadium	
	Calc. [2]	LP	Spark [5]	Corona [6]	Calc. [2]	LP
$1s2p\ ^1P_1 - 1s^2\ ^1S_0$	2,6097[1)]	2,6101	2,612	2,608	—	2,3823
$1s2p3p - 1s^2 3p$	—	2,6141	—	—	—	2,3856
$2s2p(^1P)1s\ ^2P_{3/2} - 1s^2 2s\ ^2S_{1/2}$	2,6196	-	-	—	2,3899	—
$1s2p^2\ ^2S_{1/2} - 1s^2 2p\ ^2P_{3/2}$	2, 6195	2,6204	—	—	2,3900	2,3888
$2s2p(^1P)1s\ ^2P_{1/2} - 1s^2 2p\ ^2S_{1/2}$	2,6206	—	-	—	2,3909	2,3907
$1s2p\ ^3P_1 - 1s^2\ ^1S_0$	2,6221[1)]	2,6229	2,623	2,621	—	2,3939
$1s2p^2\ ^2P_{3/2} - 1s^2 2p\ ^2P_{3/2}$	2,6296	2,6295	—	-	2,3986	2,3992
$2s2p(^3P)1s\ ^2P_{1/2} - 1s^2 2s\ ^2S_{1/2}$	2,6295	—	-	-	2,3989	-
$1s2p^2\ ^2D_{3/2} - 1s^2 2p\ ^2P_{1/2}$	2,6313	2,6319	2,631	-	2,4000	2,4013
$1s2p^2\ ^2D_{5/2} - 1s^2 2p\ ^2P_{3/2}$	2,6347	2,6355		2,634	2,4033	2,4047
$1s2p^2\ ^2D_{3/2} - 1s^2 2p\ ^2P_{3/2}$	2,6356	-		-	2,4043	-
$1s2p^2\ ^4P - 1s^2 2p\ ^2P$	2,6451 to	-	-	-	2,4125 to	—
$2s2p(^3P)1s\ ^4P - 1s^2 2s\ ^2S$	2,6490	2,6480 ± ±0,0015	—	-	2,4161	2,4140 ± ±0,0015
?	—	2,6540 ± ±0,0015	-	-	—	2,4210 ± ±0,0015

The results presented here are of interest for the development of diagnostic procedures for a thermonuclear laser plasma [8], e.g., for a determination of the temperature and density of the plasma from the lines of helium-like and lithium-like ions in accordance with the procedure of [9]. We note that the quality of the x-ray spectra emitted by a laser plasma permits a sufficiently detailed identification of transitions in multiply-charged ions. It is difficult to use for this purpose, say, a vacuum spark, because the presence of a high-power electron beam and of a large amount of weakly-ionized plasma leads to excitation of intense K_α lines of ions of lower multiplicity, and this interferes with the observation of transitions of astrophysical interest (see, e.g., [10]).

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1)Calculation by L. A. Vainshtein.
Note. Measurement accuracy: LP (laser plasma) ±0.0005, spark ±0.005, corona ±0.001.

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ACCELERATION OF LASER-PLASMA IONS WITH THE PREINJECTOR OF THE JINR LINEAR PROTON SYNCHROTRON

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We report the first instance of shaping and acceleration of a beam of multiply-charged ions of a laser plasma with the preinjector of the linear proton synchrotron accelerator. A procedure is considered for the formation of a beam of multiply charged ions, and data are given on the flux of carbon ions at the output of the preinjector. The feasibility of developing a laser source of nuclei is indicated.

1. We have effected, for the first time, the acceleration of multiply-charged ions of a laser plasma and the formation of an ion beam with the preinjector of a proton-synchrotron linear accelerator.

Experiments [1, 2] have shown that a laser plasma can serve as an effective source of ions in injectors of accelerators [3]. Acceleration of D^+ ions produced in a laser plasma was reported earlier [4]. The preceding studies of spatial and energy characteristics of the ion emission [5] have indicated, however, that the advantages of ion emission of a laser plasma can be utilized most effectively if the laser plasma is a source of ions in the preinjector of a linear accelerator. Indeed, the characteristics of the ion emission of a laser plasma make it possible to shape in a relatively simple manner an ion packet having the required characteristics.

2. For a linear accelerator that injects ions into a proton synchrotron, it is necessary to have packets of definite durations. Since the laser-plasma ions exhibit an appreciable velocity spread [5], the required ion packet was shaped in the course of the natural spreading of a plasmoid that had traversed an appreciable flight distance[1]. A narrow spatial distribution for ions with $Z = Z_{max}$ has made it possible to prevent appreciable losses incurred during the spread of the plasma and to use for the acceleration the greater part of ions with maximum ionization multiplicity. The energy spread $\Delta E(Z)$ of ions with specified Z, a spread used to control the beam duration Δt, does not prevent the ions from becoming captured in the