

succeeding pulses is observed, that is to say, only the first pulse of the sequence is self-focused in pure form. The same occurs in ethanol, but no "capture" of the succeeding pulses is observed in this case.

Thus, the dynamics of the phenomenon reduces to the following. Gradients of  $n$ , leading to self-focusing of the radiation, are produced in the liquid by the USP within a very short time. Self-focusing causes a rapid local heating of the liquid, as a result of which shock waves propagate from the heating regions (filaments or points). The local-heating regions spread out slowly at the thermal-diffusion rate. The next USP entering the liquid encounters in the focal region gradients of  $n$  in the shock wave and in the regions of local heating at the center of the shock wave; these gradients can "capture" part of the USP energy, leading to a further increase of  $n$  in the gradient-localization regions. A rarefaction region is produced inside the shock wave, where self-focusing is thus hindered. Figure 2k shows a Schlieren photograph obtained with a USP train in nitrobenzene. One can see in the center of the photograph bright converging filaments and shock waves propagating from them, in the form of a superposition of many instantaneous pictures of each pulse of the train. Unlike the picture for one pulse, the filaments seem brighter here than the waves, since they exist during the entire USP train and produce the same picture for each pulse. Photographs of the same type, taken through crossed polaroids, were obtained in [5], but the authors erroneously identified the shock waves with the self-focusing filaments.

The authors are grateful to A.N. Zherikhin, E.V. Kurganova, and S.A. Churilova for help with the work, and also S.D. Zakharov and V. Ragul'skii for a discussion.

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#### SPIN-LATTICE RELAXATION TIME IN SF<sub>6</sub> IN THE CRITICAL TEMPERATURE REGION

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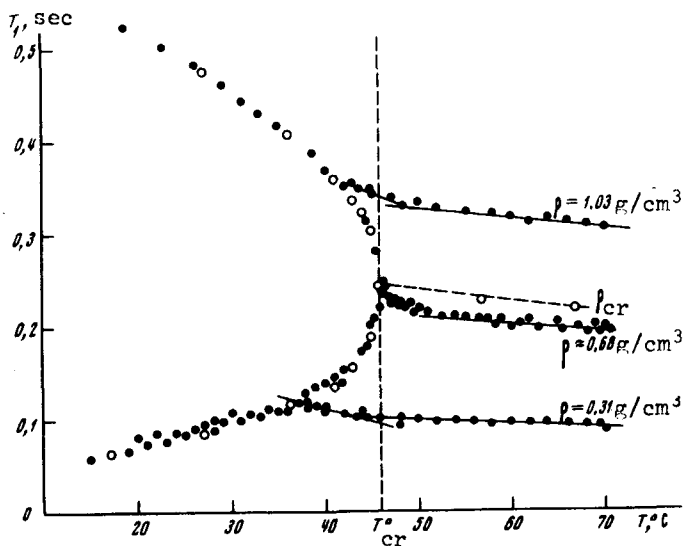
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Submitted 27 December 1971

ZhETF Pis. Red. 15, No. 3, 151 - 153 (5 February 1972)

Investigation of transport processes in the vicinity of the liquid-vapor critical point by the method of nuclear magnetic resonance are very important for the study of the liquid state. It is therefore of interest to investigate in this region the behavior of the spin-lattice NMR relaxation time  $T_1$ , which is determined in a liquid by the character of the thermal motion of the individual molecules and of their nearest neighbors.

Reports have already been published on the temperature dependence of the spin-lattice relaxation time along the liquid-vapor coexistence curve in different substances [1 - 3], but no detailed investigations have been made as yet of the behavior of  $T_1$  at constant density, when the distances between the molecules remain constant on the average, and as the temperature changes  $T_1$  depends only on the character and velocity of the molecule thermal motion.



Dependence of the spin-lattice relaxation time  $T_1$  in  $\text{SF}_6$  on the temperature and the density: o - data of [4], ● - our data. Resonant frequency  $\nu_0 = 18 \text{ MHz}$ .

We have investigated the temperature dependence of the spin-lattice relaxation time  $T_1$  for a number of isochores and along the liquid-vapor coexistence curve in  $\text{SF}_6$ .<sup>1)</sup>

Sulfur hexafluoride is a convenient object for such research. Its critical parameters ( $P_c = 37 \text{ atm}$ ,  $T_{cr} = 45.5^\circ\text{C}$ ) make it possible to perform relatively simple measurements in the critical region. The spin-lattice relaxation times in  $\text{SF}_6$  are short, making the measurement procedure fast. The spherical shape of the  $\text{SF}_6$  molecules makes it possible to compare the experimental results with the theoretical under a minimum number of arbitrary assumptions [5].

The measurements were performed with a pulsed NMR spectrometer constructed at the Molecular Physics Department of the Moscow State University, and also with the Bruker BKR322 spectrometer. The errors in the relative measurement of  $T_1$  did not exceed 2% (3% in the gaseous phase).

The investigated substances was placed in a Pyrex ampoule with inside diameter 5 mm and length 70 mm. To exclude the influence of gravity on the results, the ampoules were placed horizontally during the measurements along the isochores. During measurements along the coexistence curve, the position of the ampoule had practically no effect on the measured value of  $T_1$ . The impurity concentration in the employed  $\text{SF}_6$  samples did not exceed 0.01% [4].

We used a liquid thermostat. The accuracy of sample temperature setting was not worse than  $0.05^\circ\text{C}$ , and the gradient along the ampoule was less than  $0.05^\circ\text{C}$ . The sample was kept 1 - 1.5 hours at constant temperature prior to the measurement of each point. Within that time, a stationary value of  $T_1$  was established in the entire investigated range of temperatures and densities. The experimental results are shown in the figure. It follows from the data in the figure that at temperatures below the lamination temperature and at all measured densities the slopes of the curves increase on approaching the temperature at which two phases are produced. Such a dependence is apparently connected with the fact that the local density of the substance begins to differ from the average density in the sample on approaching the temperature of transition into the two-phase system. A similar dependence was observed for the

<sup>1)</sup>The  $\text{SF}_6$  used in the investigation was provided by the High Pressure Physical Chemistry Laboratory of the State Institute for Nitrogen Manufacture.

viscosity in [6]. The temperature dependence of  $T_1$ , measured by us along the liquid-vapor coexistence curve, agrees well with the results of [5].

For a detailed interpretation of the results it is necessary to know the behavior of the self-diffusion coefficient  $D$  and of the relaxation time  $T_2$  of the transverse NMR in the same temperature region.

The results of such investigations will be published in a forthcoming paper.

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PULSED INCREASE OF INTENSITY OF SOLAR X-RAYS ON 10 DECEMBER 1970

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Submitted 29 December 1971

ZhETF Pis. Red. 15, No. 3, 153 - 156 (5 February 1972)

The present paper is devoted to an analysis of the solar x-ray burst registered by the RIFMA spectrometric apparatus [1] on the mobile automatic laboratory "Lunokhod-1" [2]. In accordance with the capabilities of the apparatus, the energy and time of arrival of each individual quantum were recorded, so that the dynamics of solar x-ray generation could be studied. The energy range of the registered x-ray quanta was determined by the geometry and the operating regime of the proportional counters, as well as by the concrete conditions of the experiment. For the case in question, the energy range was 15 - 30 keV.

Figure 1 shows the time dependence of the x-ray quantum-detector counting rate from which it is possible to determine the temporal characteristics of the burst: start - 18<sup>h</sup>44'16" Moscow time, 10 December 1970, maximum intensity reached 8 seconds after the start, characteristic time of intensity decay 15 sec, and total duration ~1 min.

As already noted, the apparatus was capable of determining the energy spectra of the detector pulses for arbitrary finite time intervals. Some of them are shown in Figs. 2 and 3. The rising part of the spectrum is due to the increase in the probability of the passage of the quanta through the layer of matter surrounding the working gas of the counter with increasing energy. The descending part, on the other hand, is determined mainly by the shape of the x-ray energy spectrum. By starting with the universally accepted hypothesis (cf., e.g., [3, 4]) that the x-ray quanta have a

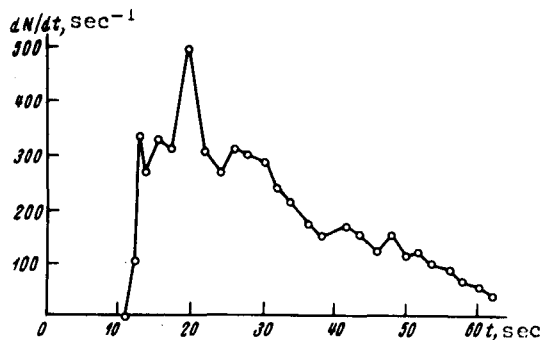


Fig. 1. Time dependence of the counting rate in the detector. The zero of the time scale corresponds to 18<sup>h</sup>44'16".