splittings of several terms. Using Arroe's data for the interval factor $A(4d^35s\,{}^5F_5)=-0.0078$ cm^{-1} (which are naturally more accurate than the present measurements), the value $a(5s)=-0.078$ cm^{-1} was obtained; and putting this into the Goudsmit-Fermi-Segrè formula, the value of the magnetic moment

$$\mu(\text{Zr}^{91})=-1.1\pm0.3 \text{ nm}$$

was obtained.

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Radiations from Ne^{19} and Na^{21}†

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THE half-lives, β-spectra, and accompanying γ-rays have been measured for the positron emitters Ne^{19} and Na^{21} with a 180° beta-ray spectrometer and a NaI crystal gamma-ray spectrometer. Calibration of the former was accomplished with the Cs^{137} conversion line and the 2.36-Mev β^+ spectrum[1] of Zn^{63}, while Na^{22} and Co^{60} were used with the latter. The samples were prepared from the reactions $F^{19}(p, n)Ne^{19}$ in BaF and CsF and $Mg^{24}(p, \alpha)Na^{21}$ in magnesium metal.

By means of a special probe it was possible to transfer the sample from the cyclotron to the spectrometer in about 30 seconds. With the β-spectrometer counting rate being recorded automatically the sample was allowed to decay for about two half-lives, the spectrometer field changed to a second value, and the sample then allowed to die out. These two decay rates were plotted on log paper using the previously determined half-life and so two relative values of momentum *vs* activity were obtained. Returning to a fiducial field value with each sample allowed data for a complete momentum plot to be accumulated.[2] It is clear that this method is useful with short-lived activities for which: (1) monitoring the total activity is unsatisfactory because the method of production does not insure the same ratio of "desired" to total activity for each sample and; (2) the time necessary to change the spectrometer field $\lessapprox$ the half-life.

Ne^{19} and Na^{21} exhibited half-lives of 18.5±0.5 sec and 22.8±0.5 sec, respectively, while the allowed Kurie plots gave end points of 2.18±0.03 Mev and 2.50±0.03 Mev, respectively.[3-7] Because of the necessity of source thickness the Kurie plots curved upward at lower energies and so masked possible low energy β^+ groups. Consequently, a search for accompanying γ-rays was made with a NaI crystal spectrometer. Whereas Ne^{19} was exposed to the crystal for about three half-lives as soon after production as possible, it was necessary to wait about 60 sec after bombardment before exposing Na^{21} in order to allow the competing shorter Al activities to die out. Several photographs with different numbers of exposures on each showed the 0.51-Mev annihilation line superimposed upon the expected continuous γ-distribution, but no line was detected above 0.51 Mev for either Ne^{19} or Na^{21}.

Comparison of *ft* values for this series of transitions ($T_z=-\frac{1}{2}\rightarrow T_z=+\frac{1}{2}$) shows most of them to be in the range 3 to 4×10^3. While Na^{21} falls within this range Ne^{19} with $Z=10$ is the notable exception[8] of the group having the lowest *ft* value at 1.8×10^3. Since differences in radial distributions are not expected to cause this much variation here, the proper choice of ground states from the shell models together with tensor or axial interaction should eliminate this difference. An experimental point at $Z=20$ would be of interest.

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Crystal Structure of the Ferroelectric Phase in $PbZrO_3$ Containing Ba or Ti

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A RECENT investigation[1] of (Pb92.5-Ba7.5)ZrO_3 has shown that this solid solution transforms, with rising temperature, from an antiferroelectric phase to a ferroelectric one at 175°C and further to a paraelectric phase at 200°C. The present authors have been studying the crystal structure of this ferroelectric phase in the same ceramic that was used for the previous dielectric study.

A series of powder photographs with rising temperature was taken with Cu $K\alpha$ radiation by using a high temperature camera of radius 5.5 cm. The Debye lines show pseudo-cubic features in the whole temperature range. The high order reflection lines in the photograph taken at 190°C show very small but definite line splittings: among them the (422) and (332) groups can be effectively used for the structure determination. In order to explain these line splittings, three possible lattice types are considered, namely, tetragonal, orthorhombic, and rhombohedral, corresponding to modifications of the perovskite structure. It has been proved that all of the multiplets can be well explained by assuming a rhombohedral lattice with $a=4.153$A and $\alpha=89°\ 51'$. This conclusion is strongly supported by the behavior of the (400) group, which shows no multiplet structure besides the single $K\alpha_1K\alpha_2$ doublet.

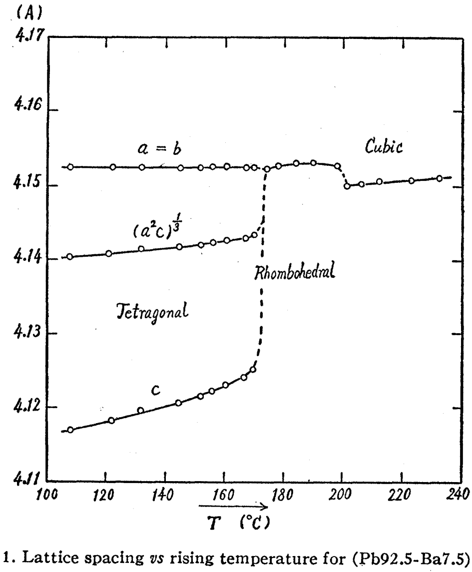

FIG. 1. Lattice spacing *vs* rising temperature for (Pb92.5-Ba7.5)ZrO_3.