various conditions over a period of one month. Each error is the probable error of a single reading rather than of the mean. Present indications are that in the case of the close doublet N_2-CO this error is quite conservative. In other cases the observation of a slight dependence of peak match on instrument parameters indicates the possibility of systematic errors of the order shown. Half-width resolution in all cases was about 15 000. It is thus evident that our technique of peak matching is astonishingly precise.

Table I shows a self-consistency of our results which is most gratifying. It shows further that values obtained from nuclear disintegration studies and those obtained by Ewald are in essential agreement with ours, while most other recent mass spectrometric measurements are not.

Further measurements and a more complete report will be presented soon.

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Decay Scheme of Magnesium 28†

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MAGNESIUM 28[1,2] is a recently discovered 21.3-hour β^- emitter with a complex gamma-ray spectrum. With the purpose in mind of producing Mg^{28} in order to study its decay scheme, a disk of magnesium metal of ordinary isotopic composition was bombarded in an external beam of 39-Mev alpha-particles for 9.2 hours in the University of California 60-inch cyclotron. The nuclear reaction is $Mg^{26}(\alpha,2p)Mg^{28}$. The Mg^{28} was separated as magnesium ammonium phosphate, as described in the previous publication.[1] Gamma-ray spectra of this chemically separated Mg^{28} were obtained using a sweep-type differential and integral discriminator similar to the one already described by Fairstein.[3] The gamma-rays are listed in Table I with their various energies and relative intensities. Gamma-ray 5 is to be associated with the decay of Al^{28}, which is a 2.3-min β^- emitter in secular equilibrium with Mg^{28}. Our value of 1.78±0.02 Mev is within our experimental error of the value of 1.782±0.010 Mev obtained by Motz and Alburger.[4] The relative intensities were obtained by correcting the areas in the photopeaks to account for the Compton distributions and for the geometry and efficiency of the sodium iodide crystal. It was not possible to determine accurately the energy or the relative intensity of the approximately 30-kev gamma-ray. However, there were indications of this gamma-ray both in the absorption measurements and in the gamma-ray spectra.

Table I. Gamma-rays observed from Mg^{28} and Al^{28} in secular equilibrium with each other.

Gamma-rays	Energy (Mev)	Relative intensity
1	~0.03	undetermined
2	0.40±0.02	0.30±0.03
3	0.95±0.02	0.28±0.03
4	1.35±0.02	0.71±0.05
5	1.78±0.02	1.00±0.05

Absorption measurements on Mg^{28} and Al^{28} show the approximately 3-Mev β^- of Al^{28} together with a 0.40±0.06-Mev β^- of Mg^{28}. The actual absorption measurements on the Mg^{28} β^- do not in themselves indicate as large an experimental error as that quoted. However, the inaccuracy in subtracting the Al^{28} 3-Mev β^- from the Mg^{28} β^- necessitates the setting of such a high error. The data on maximum β^- energy, half-life, logft, and degree of forbiddenness are shown in Table II. The logft value was determined from the graphs given by Moszkowski.[5]

Table II. Log ft values for − electrons from Mg^{28} and Al^{28}.

Isotope	Max energy of β^- (Mev)	Half-life (min)	log ft	Degree of forbiddenness
Mg^{28}	0.40	1278	4.0	allowed
Al^{28}	2.865	2.3	4.92	allowed[a]

[a] See reference 4.

These data determine the decay scheme shown in Fig. 1. Thus, for example, the β^- of Mg^{28} is shown by its ft value to be allowed.

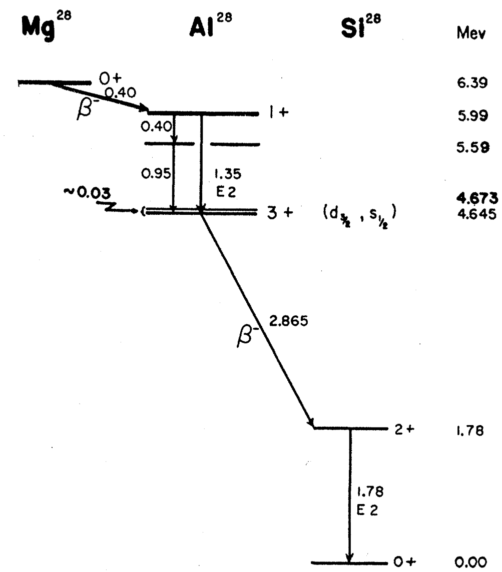

Fig. 1. The decay scheme for the isobaric triplet $Mg^{28}-Al^{28}-Si^{28}$.

Since Mg^{28} is an even-even nuclide, the beta-decay of Mg^{28}, being allowed, must enter a 0+ or 1+ state of Al^{28}. By the composition rules of Nordheim[6] for odd-odd nuclei only the 1+ state is a possibility. The gamma-ray intensities indicate that the β^- of Mg^{28} populates only the upper state of Al^{28}. Furthermore, both the gamma-ray intensities and energies indicate the energy level scheme for Al^{28} as shown. The gamma-ray spectrometer does not have the resolution necessary to distinguish easily a gamma-ray between the 1.35-Mev level of Al^{28} and the ground state, from a gamma-ray between the 1.35-Mev level and the ~30-kev level. A similar arbitrariness arises in the case of the 0.95-Mev level. Probably, unless the two components of the doublets to be expected in each of these two cases were almost equal in intensity, the gamma-ray spectrometer would lump them together as single gamma-rays. The ground state of Al^{28}, according to the rules of Nordheim,[6] must be 3+ since the spins of the odd neutron and odd proton groups will couple to larger than the minimum resultant which is 2. The first excited state of Si^{28} would be expected to be 2+.[7] This is also consistent with the fact that the β^- of Al^{28} is allowed as expected in a transition from the 3+ ground state of Al^{28} to the 2+ first excited state of Si^{28}.

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