

Physics. — *Comparison of some platinum thermometers with the helium thermometer between 0 and -183° C.* By W. H. KEESOM and B. G. DAMMERS. (Abstract of Communication N^o. 239e from the KAMERLINGH ONNES Laboratory at Leiden).

(Communicated at the meeting of October 26, 1935).

Five platinum thermometers, which satisfy the conditions stipulated in the definition of the international temperature scale, were compared with the helium thermometer between 0° C and -183° C in a cryostat giving a temperature constant and uniform within 0.002 degree.

The readings of three of the thermometers (two of wire from HERAEUS, one of wire we obtained from the Bureau of Standards) agree within 0.003 degree. The fourth thermometer, made from wire furnished by JOHNSON and MATTHEY and not directly compared with the others, agrees with those mentioned within the accuracy of the readings of the helium thermometer.

The fifth thermometer, from HERAEUS wire, gives readings which differ 0.03 degree at -138° C from those of the first mentioned set.

The international temperature scale lies for temperatures between 0° C and -100° C below the thermodynamic scale to an amount of about 0.04 degree at -80° C.

Between -120 and -183° C the international temperature scale lies above the thermodynamic scale. Maximum deviation between -130 and -140° C. Amount of the deviation as shown by the four first mentioned thermometers 0.01 to 0.02 degree.

Physics. — *The Isotopic Constitution of Iron.* By J. DE GIER and P. ZEEMAN.

(Communicated at the meeting of October 26, 1935).

Looking at an isotopic table of 1934, one will perceive that iron as well as nickel are still tabulated with two isotopes. Titanium and chromium, the two elements of even atomic number that immediately precede have five respectively four isotopes. And the following elements such as zinc and germanium are known to consist of five isotopes each.

Such a point of view made it already apparent that more isotopes of nickel and iron will exist. The difference could easily be explained by the experimental difficulties in examining these substances.

Attempts to systematize the isotopic table, such as MATTAUCH's¹⁾ rules, consequently predicted several isotopes in this region as well.

Meanwhile the isotopic constitution of nickel has been settled, four even numbered isotopes²⁾ being identified.

Iron now examined by us, was early dealt with by ASTON³⁾ by means of volatile carbonyl. He reported on two isotopes of mass numbers 56 and 54 with an estimated abundance of 95 % and 5 %.

Recently⁴⁾, in using a particularly pure sample of the carbonyl, ASTON discovered a third isotope of mass number 57. The values obtained for the relative abundance were:

| | | | |
|--------------|-----|------|------|
| Mass numbers | 54 | 56 | 57. |
| % abundance | 6.5 | 90.7 | 2.8. |

A line of mass number 58 was also present but weakened as the work proceeded and was, according to ASTON, most probably due to traces of nickel still left in the tube from the preceding nickel experiments.

Already during the summer we made experiments with iron. The carbonyl was used, but as we had only the disposal of a sample dissolved in paraffin, the experiments were not conclusive.

Exposures with intensities sufficient to obtain all three isotopes were taken. Lines for the monocarbonyls of these isotopes were equally present as well as several higher carbonyls from the strongest isotope.

But nevertheless line 58, though always present, could not be identified with sufficient certainty.

The cause was that the solvent had too high a vapour pressure. The carbonyl got greatly contaminated by the vapour of the paraffin. So the photos exhibited strong series of carbonhydrides, which series often reached beyond the iron group.

This was demonstrated by the frequent presence of 55 and by the enhanced intensity of 57 and 58.

At the same time much hydrogen was liberated in the tube by the action of the discharge, and the formation of ironhydride could not always be excluded.

A generous gift of the I. G. Farbenindustrie at Frankfurt helped us out of this trouble. A free sample of very pure carbonyl was sent to us, for which we are highly grateful.

Yet it was by no means easy to obtain photos with sufficient intensity. The discharge with the pure sample was much more difficult to manage than in the case of nickelcarbonyl. To keep the tube steady, it required diluting with much oxygen. While nickel gave a black deposit all over the

1) J. MATTAUCH, *Zeitschr. f. Phys.*, **91**, 361, 1934.

2) J. DE GIER and P. ZEEMAN, *These Proceedings*, page 810.

3) F. W. ASTON, *Phil. Mag.*, **45**, 940, 1923. *Ibid.* **49**, 1198, 1925.

4) F. W. ASTON, *Proc. Roy. Soc. London*, **149**, 402, 1935.

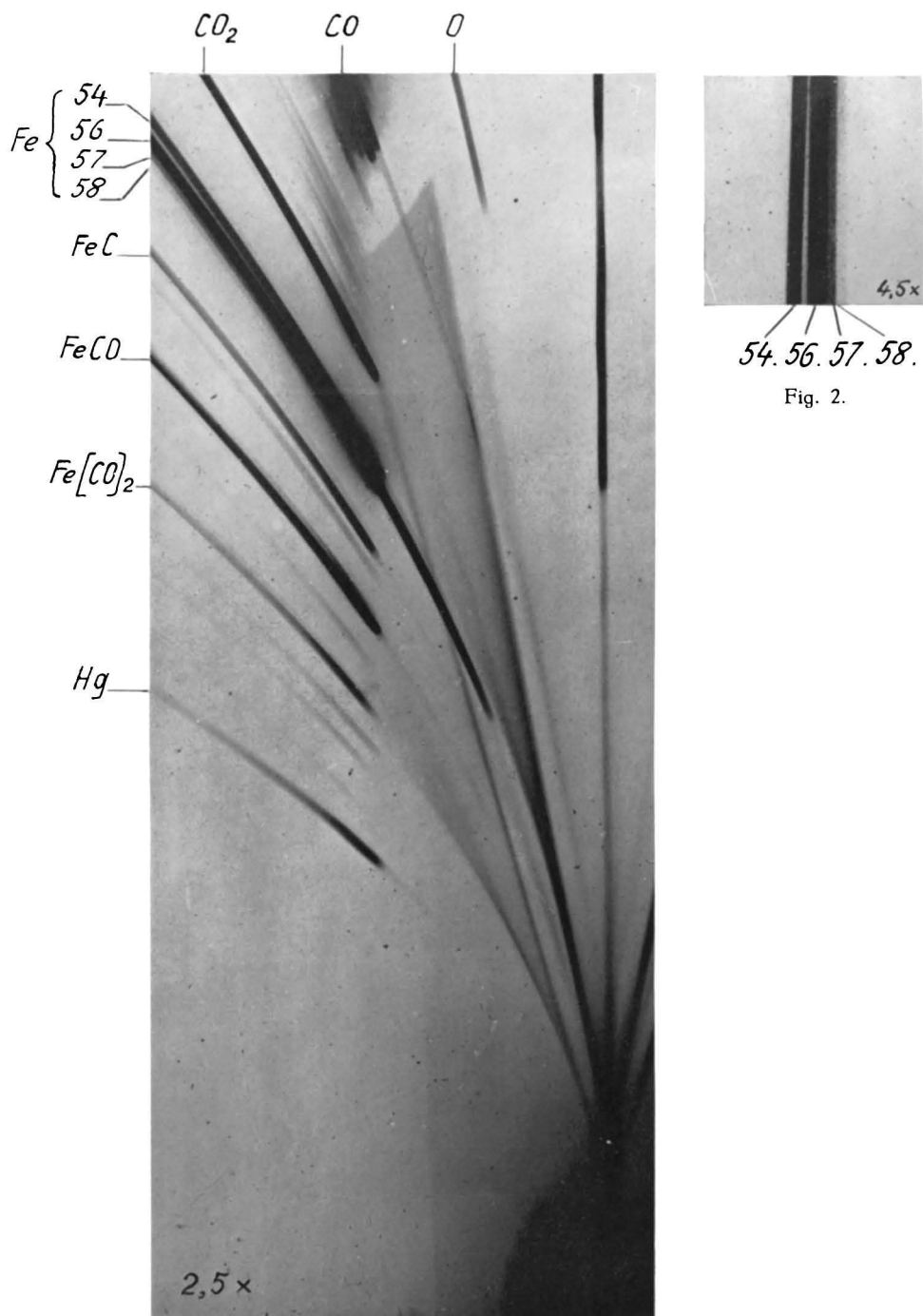


Fig. 1.

wall of the heated tube, iron by the action of the discharge mainly deposited in the cathodic region, causing a quick disturbance of the bundle.

On the other side too much oxygen soon reduced the iron intensity. The more so as the carbonyl contains five CO groups the concerning line being by far the most intensive one.

Added to this it was difficult to keep the discharge conditions constant for a long time.

With properly chosen canals the intensity of the iron lines could be increased so far that isotope 58 can be seen in the reproduction (fig. 1 and 2). The photo — taken with the pure sample — could easily be interpreted now. Iron hydrides were not feared further and all compounds in this region have disappeared.

The appearance of line 58 could now be followed closely when varying the circumstances of the experiments. In this way we obtained several most convincing plates of the new isotope.

The abundance relative to 57 was estimated by varying the time of exposure. On account of the wide canals however the resolving power of the apparatus is only just great enough to separate 56 and 57. The shadow of the principal isotope made it difficult to give a figure. But surely we will not be far from the correct value if we take the abundance of 58 relative to 57 at 1 : 6. With this figure the table runs as follows:

| | | | | |
|--------------|-----|------|-----|-----|
| Mass numbers | 54 | 56 | 57 | 58 |
| % abundance | 6.5 | 90.2 | 2.8 | 0.5 |

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Oct. 1935.

Physics. — *On the dissociation energy of CO.* By D. COSTER and F. BRONS.

(Communicated at the meeting of October 26, 1935).

Figure 1 gives the level diagram of the CO-molecule at which we arrived in our recent investigations. The position of the dissociation states relative to the electronic levels is based upon the observation of predissociation phenomena in the CO-bands. Formerly¹⁾ we already observed predissociation in the upper level ($B^1\Sigma$) of the ÅNGSTRÖM-bands at 11.08 volts above the normal state of the molecule. At first we interpreted this predissociation as due to the dissociation state $^3P + ^1D$ and arrived in this manner at a dissociation energy of the normal level ($X^1\Sigma$) of 9.82 volts. Later on we revised this view and ascribed the predissociation in $B^1\Sigma$

¹⁾ D. COSTER and F. BRONS, *Physica* **1**, 155, 1934.