Letters to the Editor

The Editor does not hold himself responsible for opinions expressed by his correspondents. He cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.*

NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 71.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Quantum Mechanics and Physical Reality

IN a recent article by A. Einstein, B. Podolsky and N. Rosen, which appeared in the *Physical Review* of May 15, and was reviewed in NATURE of June 22, the question of the completeness of quantum mechanical description has been discussed on the basis of a "criterion of physical reality", which the authors formulate as follows: "If, without in any way disturbing a system, we can predict with certainty the value of a physical quantity, then there exists an element of physical reality corresponding to this physical quantity".

Since, as the authors show, it is always possible in quantum theory, just as in classical theory, to predict the value of any variable involved in the description of a mechanical system from measurements performed on other systems, which have only temporarily been in interaction with the system under investigation; and since in contrast to classical mechanics it is never possible in quantum mechanics to assign definite values to both of two conjugate variables, the authors conclude from their criterion that quantum mechanical description of physical reality is incomplete.

I should like to point out, however, that the named criterion contains an essential ambiguity when it is applied to problems of quantum mechanics. It is true that in the measurements under consideration any direct mechanical interaction of the system and the measuring agencies is excluded, but a closer examination reveals that the procedure of measurements has an essential influence on the conditions on which the very definition of the physical quantities in question rests. Since these conditions must be considered as an inherent element of any phenomenon to which the term "physical reality" can be unambiguously applied, the conclusion of the above-mentioned authors would not appear to be justified. A fuller development of this argument will be given in an article to be published shortly in the *Physical Review*.

N. BOHR.

Institute of Theoretical Physics,
Copenhagen.
June 29.

Isotopic Constitution of Palladium and Gold

THESE two elements are among the few from which positively charged atoms have not been obtained by means of volatile compounds introduced into the electrical discharge or by means of anode rays. In a letter in NATURE[1], the possibility of using the ions from a high-frequency spark was pointed out. With the mass-spectrograph [recently described in NATURE[2]] it was found that palladium consists of six isotopes with atomic masses 102, 104, 105, 106, 108, 110. They could be compared with doubly-charged platinum and gold atoms which were present as a slight impurity. The four middle components are about equally strong; the one at 110 is weaker, and the lightest at 102 is the faintest.

From its atomic weight 197·2 and the behaviour of other elements of odd atomic number, it was anticipated that gold would have two isotopes at 197 and 199, one about ten times the intensity of the other. It was somewhat of a surprise to find that no second component could be found. Exposures were made with 300 and 500 times the time required to show the main line, and failed to show any trace of a heavier isotope. It is thus very probable that gold has only one component, and that the accepted atomic weight is too high.

A. J. DEMPSTER.

University of Chicago.
June 12.

[1] NATURE, 135, 542; 1935.
[2] NATURE, 135, 993; 1935.

Platinum Isotopes and their Nuclear Spin

Using a water-cooled hollow cathode of a new design, the hyperfine structure of the arc lines of platinum λλ 3408 and 3042 A. have been studied. These two lines have a common lower level $5d^8 6s^2 a^3F_4$; and the similarity of their structure patterns leads to the conclusion that in neither case is the upper level split. The lines have the following structure:

Wave-length (in I.A.)	Classification[1]	Structure (in cm.$^{-1}$)
3408·13	$5d^8 6s^2\ a^3F_4 - 5d^8 6s6p\ z^5D^0_4$	+ 0·161 (5), 0·000 (18), − 0·086 (7), − 0·176 (1), − 0·314 (4). (vide Fig. 1)
3042·75	$5d^8 6s^2\ a^3F_4 - 5d^8 6s6p\ z^5G^0_5$	+ 0·162 (5), 0·000 (18) − 0·087 (7), − 0·174 (1), − 0·314 (4).

An examination of the structure leads to the unique inference that the three central components 0·000 (18), − 0·086 (7) and − 0·176 (1) have to be ascribed to the even isotopes 196, 194 and 192 respectively, the remaining two components being due to the odd isotope 195 with a nuclear spin of $\frac{1}{2}h/2\pi$. The centre of gravity of the latter components falls at − 0·050 cm.$^{-1}$ between the bright components due to 196 and 194. The deeper level $5d^9 6sa^3D_2$ shows no measurable isotopic displacement. The hyperfine levels in platinum are inverted. These results are confirmed by the analysis of eight other arc lines of platinum, namely, 2998, 2929, 2734, 2719, 2705, 2702, 2659 and 2650 A. Neglecting