Letters to the Editor.

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Spectrographic Junction between the X-ray Region and the Extreme Ultra-Violet.

IN previous papers (*Comptes rendus*, **182**, 1083, and 183, 193, May and July 1926) a method was given, suitable for spectrographic work in the unknown region between 20 and 150 Ångström units. In the meantime, some *Kα* lines belonging to light elements (oxygen, carbon, boron), and a few *N* barium lines, have been measured. It was interesting to apply the new method to the detection of lowest frequency *N* and *O* series of a heavy element. Thanks to the kind help of Dr. Holst, Director of the Philips Laboratory, obtained a sample of thorium wire, prepared by Dr. de Boer, and I used it as a hot cathode in the X-ray tube of my vacuum spectrograph. With an exposure of 4 hours, with a current of 29 milliamperes under 2·8 kilowatts peak value, I obtained good thorium spectra. The middle part of each plate is covered by a filter consisting of goldbeater's foil, 7×10^{-6} cm. thick, used to estimate penetrating power and order of spectra. All the lines detected are new *N* and *O* thorium lines of very low frequency. A very strong 45·3 Å.U. line coincides with the *Kα* line of carbon, but is a different one. This is proved by three facts: that tantalum, molybdenum or zirconium hot-wire cathodes, used in the same conditions, do not show the carbon line; that the thorium deposit on the target was very important and visible to the naked eye; that measurements of critical potentials, made with another apparatus, by the ionisation method, do not show at all the carbon *K* critical potential (287 volts) but the two well-defined N_3 (355 volts) and N_{12} (312 volts) thorium critical voltages, corresponding to the respective emission of 45·3 and 51·5 Å.U. lines.

The strong 45·3 Å.U. line appears in three successive orders and covers, by its broadness, a new line, 48·2 Å.U., which appears only in the second order. This one cannot be the first order line, as it is shown by application of the combination principle, and is, in fact, the highest frequency line in the *O* series. All the recorded lines fit very closely into the theoretical requirements. Only one line, O_5P_3, is missing, probably owing to faintness, its probable intensity being supposed to be only half of that of the 71 Å.U. line.

These lines are tabulated below and designated by the usual terminology:

λ: Å.U.	ν/R.	Line.	Intensity.	Combination.	Corresponding Energy Levels: ν/R.
45·3	21·0	*Nβ*	very strong	N_3-O_{12}	$N_3=26{\cdot}2$ (directly measured); $O_{12}=5{\cdot}2$
48·2	18·9	*Oδ*	medium	O_6-P_{12}	$O_6=20{\cdot}4$; $P_{12}=1{\cdot}5$
51·5	17·7	*Nα*	strong	$N_{12}-O_{12}$	$N_{12}=23{\cdot}0$ (dir. m.); $O_{12}=5{\cdot}3$
71·0	12·8	*Oγ*	faint	O_4-P_3	$O_4=14{\cdot}8$; $P_3=2$
121	7·5	*Oβ*	faint	O_3-P_{12}	$O_3=8{\cdot}5$; $P_{12}=1$

The only low-frequency line escaping detection (*Oα*) would have a wave-length of about 230 Å.U. It is the last pure Röntgen line waiting to be found. In the short wave-length side of the spectrum, higher frequency *N* lines are faint and fogged by the strong optical reflection upon the grating of very soft X-rays. Nevertheless two faint lines, 26 and 27·2 Å.U., have once been found.

Remarkable is the simplicity of these spectra in which there is neither spark- nor semi-optical lines, thanks to the small exciting potential. This series of measurements completes in this way our knowledge of Röntgen series and atomic levels and, at the same time, leads to the long-desired spectrographic junction between ordinary X-rays and Millikan optical spectra in the extreme ultra-violet (136 Å.U.: short wave-length limit of aluminium).

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Prof. Labbé's Production of "Allomorphs."

PROF. LABBÉ in a recent paper (*Arch. Zool. Exp.*, t. 62, p. 498, 1924), in speaking of some copepods and other animals, has made the following statement:—

"The eggs of species *A* laid in a medium of *p*H 8·2 would give the form *A*, but at *p*H 8·4 would give the form *A′*, and at *p*H 8·6 the form *A″*. . . .

"It is exact for Artemia, but for the other forms the fact is more important, for it brings about the transition [il conduit à l'émiettement] of one species to another; this is what I shall call the *allomorph* or the allomorphs of the species."

The paper then goes on to state that various allomorphs have been obtained experimentally by a gradual increase in *p*H. It also claims that *Cyclops helgolandicus* Rehberg is an allomorph of this type, *Cyclops bicuspidatus* Claus being the real species.

Mr. Robert Gurney (NATURE, vol. 118, p. 336, 1926) has severely criticised Prof. Labbé's statements and leads one to think that the necessary attention to detail has not been given and that the allomorphs were not really the offspring of the species described. Mr. Gurney suggests that the mistake might have arisen through the accidental introduction of the minute larvæ of other species.

I wish to bring forward evidence of an entirely different nature which leads to the same conclusion as that of Mr. Gurney.

For the last three years I have been making a detailed study of the genus Cyclops, an important group of copepods, and in every case the *p*H value of the water in which the animals were actually living was taken. In this way in Great Britain alone I have recorded 31 species, 5 of which are new to the country and 3 new to science. I do not propose to give here either a full list of the species or of their ranges of *p*H since the work is by no means finished, but I will give simply the ranges observed for a few of the better known ones:

Species.	Range of *p*H.
Cyclops vulgaris	4·6-9·8
,, *strenuus*	4·6-8·6
,, *lucidulus*	4·4-7·4
,, *robustus*	4·6-8·2
,, *pulchellus* (syn. *bicuspidatus*)	5·8-8·6
,, *signatus* (syn. *fuscus*)	5·0-8·0
,, *annulicornis* (syn. *albidus*)	4·4-9·8
,, *serrulatus* (syn. *Leptocyclops agilis*)	4·6-9·8
,, *prasinus*	4·6-9·8
,, *fimbriatus*	5·0-8·1
,, *nanus*	4·4-7·2
,, *venustus*	5·1-7·4

It is more than likely that as time goes on these ranges will be increased, but I have carried out observations in the following districts: The Isle of