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It is now well recognized that 5f electrons occur in the ground state configurations of atoms and ions of the actinide elements.[1]

Fluorescence is well known in a number of lanthanide ions where it occurs because of the presence of 4f electrons. By analogy, one would expect to observe fluorescence in some actinide ions.

Fluorescence has not been observed in neptunium or plutonium compounds.[2] We wish to report here the first observation of the Am^{+3} fluorescence spectrum.

Single crystals of $LaCl_3$ (m.p. 860° C) containing 0.04 (Sample I) and 0.20 (Sample II) mol percent Am^{+3} were grown by the Stockbarger method.

The fluorescence is self-excited at room temperature due to the radioactivity of Am^{241}. For the observation of the fluorescence spectrum however, a 1000 w AH-6 mercury lamp was employed. The spectrum was photographed on a Jarrell-Ash 21 ft Wadsworth mount spectrograph using a 15000 lines/in grating and a 400 μ slit with exposure times of 3 to 9 hr. The dispersion of the instrument is about 5A/mm. Spectra were taken at room temperature and at liquid nitrogen temperature.

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1. G. T. Seaborg, Chapter 17, The Actinide Elements, National Nuclear Energy Series IV - 14A, McGraw-Hill Book Company, Inc., New York (1954).

2. G. R. Price, J. Opt. Soc. 39, 1054 (1949).

All of the lines observed in the fluorescence spectrum are listed in Table I together with their visually estimated intensities. Lines marked with an asterisk coincide exactly with lines found in the absorption spectrum, and may be assumed to represent transitions from excited electronic states to the $^7F_0$ level of the ground state multiplet. The Am^{+3} fluorescence spectrum shows somewhat different behavior in this respect from its analogue Eu^{+3}. In the former, we have observed fluorescence arising from five relatively low-lying excited electronic levels whereas in the latter fluorescence is observed only from the two lowest-lying electronic levels above the ^7F ground state multiplet.[3]

The Am^{+3} fluorescence spectrum is different in still another way. The two lines at 4565A and 5227A are observed only at room temperature where they are very strong. They disappear completely at 77° K.

Most of the lines listed except the most intense ones are observed only at 77° K.

An attempt has been made to rule out as far as possible effects due to lanthanide or actinide impurities. The $LaCl_3$ starting material for Sample I came from the Lindsay Light and Chemical Co. Absorption spectra taken at 77° K on a single crystal of this material 1 cm thick revealed the presence of a Pr^{+3} impurity of ≈0.01 mol percent. The $LaCl_3$ starting material for Sample II came from Research Chemicals Co. Low temperature absorption spectra on a single crystal of this material showed no absorption lines due to other rare earths. The americium, (475-year alpha emitting Am^{241}, originating from β^- decay of Pu^{241}) was given a final purification by ion exchange from concentrated HCl solution using a Dowex-50 column. Sample I was given a single, and Sample II a double, column purification. No lanthanide or actinide impurities were found in either of these samples by emission spectroscopic analysis.

The fluorescence spectra obtained from Samples I and II were identical in every respect except that Sample I had two extra lines which could be identified as Pr^{+3} fluorescence lines since they correspond exactly with two of the Pr^{+3} absorption lines found in the $LaCl_3$ starting material.

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3. E. V. Sayre and S. Freed, J. Chem. Phys., (in press).

We are in the process of studying the polarization properties of the fluorescence lines as an aid to an interpretation of the spectrum.

A search is being made for the fluorescence of Pu^{+3}.

We wish to acknowledge the skillful purification of americium by Dr. J. C. Wallmann. We thank the Health Chemistry Group for the design and construction of radiation protection equipment. One of us (D. M. G.) wishes to thank Dr. W. M. Manning of the Argonne National Laboratory and Dr. G. T. Seaborg of the Radiation Laboratory for making it possible for him to spend a year at the Radiation Laboratory.

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TABLE I

FLUORESCENCE SPECTRUM OF Am^{+3} IN $LaCl_3$

No.	Wavelength (A)	Intensity	No.	Wavelength	Intensity
1	4249 *	2	18	4789	1
2	4311 *	2	19	4806	1
3	4565 *	9	20	4809	1
4	4626 *	10	21	5220	1
5	4641	1	22	5227	3
6	4654	5	23	5251	1
7	4667	1	24	5259	1
8	4669	1	25	5284	5
9	4672	2	26	5292	1
10	4687	1	27	5309	3
11	4694	1	28	5320	3
12	4718	6	29	5326	1
13	4722	1	30	5952	2
14	4732	1	31	5969	2
15	4754	8	32	6119	9
16	4772	7	33	6155	8
17	4782	1	34	6714	3