

# The role of Physicists in the «*rebirth of a scientific movement*» in Portugal during the inter war period<sup>1</sup>

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**Abstract:** The advent of the Republic in 1910 brought with it important reforms to higher education in Portugal. In spite of severe political and financial difficulties of the next two decades, Portuguese universities financed the graduation studies of few young teachers abroad. Despite these relevant initiatives the Portuguese republican government was not successful in creating a national institution capable of promoting and funding the organization of scientific research in the country. Only in 1929 did the government set up this kind of institution, the *Junta de Educação Nacional* (JEN) [«National Board of Education»], with the aim of funding research centres in the universities and of providing grants for students to continue their advanced studies both at home and abroad. In the thirties, an important group of young scientists continued their studies in renowned European universities and laboratories where some of them attained their PhD degree. Paris University was the most sought after university for post-graduation in Chemistry, Mathematics and Physics and the Curie laboratory received an important group of Portuguese students during this period. After four years abroad and having established important international scientific links, some of these young scientists returned home and played an important role in their universities promoting the *rebirth of a scientific movement*. This lasted until the end of the Second World War, when several of them were dismissed from their positions because of their active opposition to Salazar's dictatorship.

## 1. The Iberian Peninsula: Portugal and Spain

The two countries in the Iberian Peninsula saw the end of the nineteenth century with the bitter taste of the political humiliation.

In Portugal, after the shameful British ultimatum made following the Berlin conference, an attempted coup to install a Republic took place in 1891 and was defeated; the Portuguese monarchy was going through a period of slow death. This political decline of the monarchy was associated with the political, economic and financial crisis felt all over the country. There was a strong belief that a Republic was imminent and that only

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<sup>1</sup> Communication presented to the 4th International Conference of the European Society for the History of Science Barcelona, 18-20 November 2010 in the Symposium «INTERNATIONALISM OF PHYSICS DURING THE 1920S AND 1930S: FORMATION OF A EUROPEAN RESEARCH NET AND ITS IMPACT IN THE DEVELOPMENT AND DISSEMINATION OF THE EUROPEAN SCIENTIFIC CULTURE». This work is financed by funds FEDER through the Operational Competitiveness Factors Program (COMPETE) and national funds through FCT (Foundation for Science and Technology) by the project HC/0077/2009.

the republican spirit could contribute to the complete regeneration of the country, both intellectually and historically.

In the same period, Spain was deeply wounded because of the humiliating military defeats inflicted by the United States and consequent loss of its colonial empire in America and Asia. The country sought to respond to this situation of political, economic and social deep depression. As a consequence of this reaction, a very strong intellectual and civic responsibility movement was born with the main purpose of promoting a profound modernization of Spanish culture, especially at a scientific levels. This movement, supported by eminent intellectuals (Ramon y Cajal (1852-1934), Nobel Prize winner in physiology in 1906) stimulated the creation of *Junta para Ampliación de Estudios* (JAE) [«Board for Advanced Studies»], a very important institution which was responsible for the major transformations in the Spanish scientific renewal. United in humiliation and defeat, albeit suffering different effects (Portugal did not lose its overseas territories), both nations tried to find a remedy for the crisis.

The impact of the JAE (*Junta para Ampliación de Estudios y Investigaciones Científicas*) on the Iberian cultural world was also considerable. In Portugal, scientists and scholars followed the JAE's path closely. The Spanish institution was created in Madrid on January 15, 1907; seven months later, the Portuguese government organized a system of scholarships to finance studies abroad, but was unable to transform this initiative into a permanent new organization. The government decree states: «similarly to what several modern nations have done, with proven and enviable success, we will seek to take advantage of the educational experience of more advanced countries in Europe, by sending a large number of Portuguese students to their schools »<sup>2</sup>.

The transformation of Portugal into a Republic in October 1910 triggered a number of important initiatives in the educational field. In 1911, the University of Coimbra (the oldest and only university in Portugal over the past centuries) was reformed and the institutions of higher education in Lisbon and Porto were reorganized on a new basis: two universities were founded in the same year in those major cities. Republican

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<sup>2</sup> In government decree of 31 May 1907.

reformists assigned the universities a definite number of goals. Among them, the promotion of scientific research, the systematic study of problems regarded as of national interest, and the transmission of culture directly from the universities to other sectors of the population. In spite of financial difficulties, the Portuguese universities supported the graduation studies of few young teachers abroad and some of which went to important European laboratories. Despite these important modifications, the Portuguese government was unable to organize an institution similar to the Spanish JAE with the purpose of coordinating the national scientific policy. It is worth noting that all the plans to reform the universities were implemented in an environment dominated by the old corporation of full professors who kept their old chairs in the new universities.

After the end of the First World War, in 1918, and during the next decade there were several attempts to create a scientific institution capable of promoting a pedagogical and scientific renewal. In 1924, the minister of education, António Sérgio (1883-1869)<sup>3</sup>, submitted to the Parliament a diploma to create the *Junta de Orientação dos Estudos* [«Board for Studies Orientation»]. As in previous attempts, the Parliament did not approve the project because of financial restraints and of the differing approaches of the various political groups towards education problems.

Between 1916 and 1924, several Portuguese teachers and students went to Madrid to visit JAE<sup>4</sup> and to collect information about its methods and policies.

Medical doctors were the dominant force in the Portuguese scientific community and it is worth noting the importance of this group and its enthusiastic action for the creation of an institution similar to the Spanish JAE. Two of them were of particular relevance: Augusto Celestino da Costa (1884-1956), full professor of the Faculty of Medicine in Lisbon and his scientific disciple, Luís Simões Raposo (1898-1934); both were Ramon Y Cajal admirers and had scientific and institutional contacts with him<sup>5</sup>.

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<sup>3</sup> A central personality of the Portuguese intellectual group during the first Republic. He introduced in Portugal modern ideas concerning education, history and philosophy. He was an “intellectual engagé” in the Portuguese first half of the XX<sup>th</sup> century and his ideas and action influenced several generations of intellectuals.

<sup>4</sup> Costa, A. Celestino da (1918). *A universidade portuguesa e o problema da sua reforma*. Lisbon. Raposo, L. Simões (1929). Considerações Gerais, in *Relatório dos trabalhos da Junta Lisboa*.

<sup>5</sup> *Ibid.*

## 2. «Junta de Educação Nacional» –JEN

After the 28<sup>th</sup> of May 1926, with the country under a military dictatorship with no plans to innovate an education system and suffering from a severe funding restrictions, the Minister of Education, following the orientation of his predecessor, approved in the promulgation of a Decree that created the *Junta de Educação Nacional* (JEN) [«National Board of Education»]. The government assigned the indispensable financial resources for its operation. The main important contributions of «JEN»'s program were «to found, improve or subsidize institutions devoted to scientific research (...) to organize and monitor a grants service to be used in Portugal and abroad (...) to promote locations for the scientific work of the ex-grant holders»<sup>6</sup>. The new *Junta de Educação Nacional* (JEN) was officially created in 1929 with Simões Raposo as its Secretary. Following the Spanish JAE example, the new Portuguese institution concentrated initially on offering research scholarships in Portugal and abroad, with the further goals of promoting scientific research at the higher levels of university education, and the transfer to Portugal of the technologies needed for a better management of the country and its colonies. It also planned to support existing research centers, encourage scientific publications and to promote wider cultural exchanges with foreign countries. The JEN policy of sending a large number of students abroad was an implicit recognition of the inability of the Portuguese universities to produce the graduates Portugal needed to work in pure and applied sciences.

In the beginning of its activity, JEN gave some funding to «institutions, public or private, whether or not incorporated in universities or Technical Schools, provided these institutions showed: (...) that their practice was directed exclusively to scientific research (...) that they had good results in recent years, and that their work was cited or earned the appreciation of national and international experts». The physics laboratory of the University of Lisbon was one of the first group of institutions that received JEN's funding. In 1931, the board of JEN declared that «in future it [JEN] will create or develop laboratories or other centers devoted to new special studies, not yet

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<sup>6</sup> JUNTA DE EDUCAÇÃO NACIONAL. (1931). *Relatório dos trabalhos efectuados em 1928-1929*. Lisboa

available in the country, where grant holders recently arrived from abroad can work»<sup>7</sup>. Indeed, some years later, JEN organized several scientific research centers, in the fields of mathematics, natural sciences, philology and history that were integrated in the three Portuguese universities. These research centers fundamental objective was to support the work of returning grant students from abroad and also to receive scholarships to pursue research and graduation. The JEN board was aware that the country was in a «precarious situation, mainly in industry and agriculture, which are technically very poor, and that a sound technical preparation of engineers and agronomists, it will be a necessary condition to promote the progress of the Portuguese economy». The returning grant students contributed in a very special way to the emergence of new scientific structures that supported technical and scientific research.

Table I<sup>8</sup>

	Scientific domains	Number of grants	France	UK	Germany	Other countries
Grants up to one year	Sciences ( Astronomy, Biology, Chemistry, Mathematics, Geology and Physics)	38	17	11	11	13
	Agronomical Sciences	7	2	4	0	1
	Engeneering	10	3	2	3	2
	Medicine and Biomedical sciences	25	11	2	10	16
	Other	2	1	0	0	1
	<b>Total</b>	82 <sup>9</sup>	34	19	24	33
Grants for periods over than one year	Sciences ( Astronomy, Biology, Chemistry, Mathematics, Geology and Physics)	50	24	12	10	3
	Agronomical Sciences	4	0	2	0	2
	Engeneering	6	4	0	2	0
	Medicine and Biomedical sciences	30	9	3	16	3
	Other	1	1	0	0	0
	<b>Total</b>	91 <sup>6</sup>	38	17	28	8

<sup>7</sup> JUNTA DE EDUCAÇÃO NACIONAL. (1932). *RELATÓRIO dos trabalhos efectuados em 1930-1931*. Lisboa.

<sup>8</sup> Gomes, Emília Vaz, Fitas, Augusto J.S. e Nunes, Fátima. 2009. *The Rebirth of a «Scientific Movement» and the Foundation of the National Board Of Education [Junta De Educação Nacional] During The First Period Of Dictatorship Regime In Portugal*, XVIIIe Congrès International d'Histoire des Sciences et des Techniques (Budapeste)

<sup>9</sup> There were some cases where the same grant was for two countries.

Although up to 1934-1935 JEN budgets were, on relative terms, quite limited, they supported 173 scholarships abroad (**Table I**). Natural sciences (Biology, Chemistry, Geology, Physics) and Mathematics students was the group that received more scholarships (38 and 50), Medicine and Biomedical sciences deserved the second place with 25 and 30 scholarships. France was the preferred country with 34 and 38 grants, followed by Germany and United Kingdom; Belgium, Italy, Spain, Switzerland received also Portuguese grant holders. Also a number of small grants were given for shorter stays abroad, of up to three months. During the same period JEN also awarded 90 grants (for periods over than one year) to be used in Portuguese institutions: the first place in this distribution was for medicine with 43 and the second one was for natural sciences (Biology, Geology, Physics and Chemistry) with 40 grants<sup>10</sup>.

### **3. The «rebirth of a scientific movement»**

In the thirties, an important group of young researchers furthered their studies abroad in renowned European universities and laboratories, where some of them were awarded their PhD degree. the University of Paris was the most sought after school for post-graduation studies in Chemistry, Mathematics and Physics. During this period the Curie laboratory received an important group of Portuguese students. **Table II** lists the Portuguese researchers who worked in Curie Institute<sup>11</sup>, also young physicists who studied in other European institutions and the very special case of a Mathematician who gained his PhD in Paris.

The physicist Manuel Valadares (1904-1982)<sup>12</sup> and the mathematician Antonio Aniceto Monteiro (1907-1980)<sup>13</sup> are two paradigmatic examples of a very special attitude in changing the scientific environment when returning to their Universities in Portugal.

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<sup>10</sup> Gomes, Emília Vaz, Fitas, Augusto J.S. e Nunes, Fátima. 2009. *The Rebirth of a «Scientific Movement» and the Foundation of the National Board of Education [Junta de Educação Nacional] During The First Period of Dictatorship Regime in Portugal*, XVIIIe Congrès International d'histoire des Sciences et des Techniques (Budapeste)

<sup>11</sup> Archives de l'Institut du Radium (Paris)

<sup>12</sup> Salgueiro, Lídia, 1978, Vida e obra de Manuel Valadares, *Gazeta de Física*, vol.VI,2-12; *Portugaliae Physica*.13 (1982): 121-122, I-VII.

<sup>13</sup> Fitas, A.J., 2008, As relações entre António Aniceto Ribeiro Monteiro e a Junta de Educação Nacional ou um bolseiro português na cidade de Paris (do Outono de 1931 à Primavera de 1936), *Boletim da Sociedade Portuguesa de Matemática*, Número especial AARM: 89-128.

They were the main players in the «*rebirth of a scientific movement*»<sup>14</sup> which was characterized by a full-time dedication to the research beyond the allotted time for classes, when researchers were university teachers, the maintenance and strengthening of ties with the international scientific community, the publication of their scientific research results in international journals and by a strong commitment to encourage other young researchers with the purpose of creating a research group (replicating their own practice abroad).

Table II

NAME (Born/Univ./ Grant period)	PhD dissertation
Herculano Amorim Ferreira (1895/Lisbon/ 1929-31)	Scientific work in Imperial College on Opticks and <b>PhD by the University of Lisbon.</b>
Amaro Monteiro (1898/ Lisbon / 1937-8)	Scientific work in Paris (lab. Maurice Curie) and <b>PhD by the University of Lisbon.</b>
Branca Edmée Marques (1899/ Lisbon / 1931-5)	<b>PhD by the University of Paris.</b> (supervisors Mme Curie e J. Debieerne). <i>Nouvelles recherches sur le fractionnement des sels de Barium radifère</i>
Manuel Valadares (1904/ Lisbon / 1930-3)	<b>PhD by the University of Paris.</b> (supervisors Mme Curie). <i>Contribution à la spectrographie, par diffraction cristalline, du rayonnement gamma</i>
António da Silveira (1904/ Lisbon / 1929-32)	Scientific work in Collège de France (lab. Paul Langevin) he did not get his PhD.
Manuel Teles Antunes (1905/ Lisbon / 1933-5)	<b>PhD by the University of Madrid.</b> (supervisor Miguel Catalan). <i>Estructura del esoectro del cobalto neutro</i>
Aurélio Marques da Silva (1905/ Lisbon / 1935-8)	<b>PhD by the University of Paris.</b> (supervisor F. Joliot): <i>Contribution à l'étude de la materialization de l'energie</i>
João Almeida Santos (1906/ Coimbra/ 1930-5)	<b>PhD by the University of Manchester</b> (supervisors: W.L.Bragg e J. Welsh) <i>An X-ray investigation into the structure of anhydrous cobaltous chloride, CoCl<sub>2</sub> – at room and very low temperatures – and caesium, rubidium and thallium salts of certain 12-heteropoly acids</i>
António Aniceto Monteiro (1907/ Lisbon / 1933-6)	<b>PhD by the University of Paris.</b> (supervisor: Maurice Fréchet). <i>Sur l'additivité des noyaux Fredholm</i>
Armando Gibert (1914/ Lisbon / 1942-6)	<b>PhD by the Suiss Federal Polytechnic School in Zurique</b> (supervisor.: Scherrer). <i>Effect de la temperature sur la diffusion neutron-proton</i>

These two young scientists started this movement with a very specific task: to re-unite in the country their fellow colleagues who had studied in Paris with scholarships. This group, the so-called «Physics, Mathematics and Chemistry Group», operated as a private Association whose members were young scientists that have furthered their studies in Paris and senior professors of Portuguese universities that were really interested in promoting scientific research (a very small group of iconoclasts full professors). This scientific association promoted in Portuguese universities, open courses on contemporary physics and mathematics topics that were not taught in

<sup>14</sup> This «*movement*» extended to other domains of pure and applied sciences, although this study only relates to physics, mathematics and chemistry.

university graduation courses. This initiative caused a strong perturbation in the conservative Portuguese *academia*<sup>15</sup>.

Table III

	Antonio Aniceto Monteiro	Manuel Valadares
1937	<i>Portugaliae Mathematica</i> (Portuguese international Journal on mathematics. Ongoing publication to the present day)	Research group on Physics strongly related with the research he had done in Paris
	The <b>Physics, Mathematics and Chemistry Group</b> , a private Association of young researchers and senior researchers really interested in promoting research in pure science...	
1938	Organization of the Mathematics Seminar in Lisbon	Research group on Physics, strongly related with the research he had done in Paris
1939	<i>Gazeta de Matemática</i> (A mathematics journal publishing papers on the teaching of mathematics and on topics such as contemporary mathematics, applied mathematics—all aimed at the introductory-level teacher; ongoing publication to the present day)	
1940	<b>Mathematics Seminar becomes the Mathematical Research Center of Lisbon supported by JEN/ IAC.</b> Five young Mathematicians who started working in this Center went abroad with scholarships (Zurich and Rome)	<b>The research group on Physics becomes the Physics Research Center of Lisbon supported by JEN/IAC.</b> Armando Gibert, a young researcher of Valadares' group got a scholarship to study in Zurich
1943		<i>Portugaliae Physica</i> (Portuguese international Journal on physics. Ongoing publication to the present day)
1945	<b>António Monteiro leaves Portugal for South America</b>	
1946		<i>Gazeta de Física</i> (A physics journal publishing papers on the teaching of physics and on topics such as contemporary physics, applied physics—all aimed at the introductory-level teacher; ongoing publication to the present day)
1947		<b>Manuel Valadares leaves Lisbon for Paris</b>

It is important to compare the activities of these two young «scientific agitators» after their return to Portugal which is chronological and briefly shown in **Table III**<sup>16</sup>.

#### 4. The physics group in Lisbon

Of all these young researchers, the physicist Manuel Valadares is undoubtedly one of the main characters in this story. In a very meticulous and organized way and with total dedication, Valadares built the first Physics Laboratory Group for experimental research

<sup>15</sup> GIL, Fernando Bragança (2003). Núcleo de Matemática, Física e Química: uma contribuição efémera para o movimento científico português, *Boletim da SPM*, 49: 77-92

<sup>16</sup> Fitas, Augusto J. S. and Videira, António A.P.(2004). *Cartas entre Guido Beck e Cientistas portugueses* (Introdução e organização). Lisboa: Instituto Piaget.

in Portugal. An enormous tenacity, the use of a strategic plan and with an excellent talent for organization characterized his work. He never complained about the deficient conditions in which he had to carry out his research work, instead he always tried to do high quality and up to date research in the real conditions he had to face. The strategy he developed with total agreement of the full professor of Physics Lab in Lisbon<sup>17</sup> was, in his own words, the following: «The experience I gained abroad showed me that it was the specialized research laboratory that gave higher yield, particularly in research centers that had limited funding and insufficient scientific staff»<sup>18</sup>.

After returning from France in 1933, Valadares tried persistently to keep strong links with the Curie laboratory and to broaden his connections with the scientific international community network. The scientific results of his research group were always submitted to French scientific journals. In 1940-41 he moved to Italy where he carried out research at the «Istituto di Volta» — Pavia, with Rita Brunetti, from February to May 1940 — and in the «Laboratório di Fisica dell'Istituto di Sanità Pubblica» —Roma, with G. C. Trabacchi, from June 1940 to May 1941. In Rome he made contact with the Amaldi group and established important links with Italian physicists<sup>19</sup>.

After 1940, as senior members of a Research Center financed by the JEN/IAC<sup>20</sup>, Valadares and Aurélio Marques da Silva (1905-1965) (another PhD from Paris who worked with Frederic Joliot (1900-1958)) supervised the PhD dissertations of four young assistant professors in three years — *Lídia Salgueiro* (1917-2009) from the Physics Laboratory in Lisbon, *Marieta da Silveira* (1917-2004) from the Chemistry Laboratory in Lisbon, *Carlos Braga* (1899-1982) and *José Sarmiento* (1899-1986) from the Physics Laboratory in the University of Oporto — a very remarkable work, indeed. Because of the communication difficulties during the war and the need to inform the scientific community of their scientific results, Valadares and the group from the Lisbon Physics Laboratory edited in 1943 the *Portugaliae Physica*, a relevant initiative at international level.

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<sup>17</sup> Armando Cyrilo Soares (1883-1950)

<sup>18</sup> In Salgueiro, Lídia, 1978, Vida e obra de Manuel Valadares, *Gazeta de Física*, vol.VI,2-12.

<sup>19</sup> Gaspar, Júlia (2009). *A investigação no Laboratório de Física da Universidade de Lisboa (1929-1947)*. Lisboa: CIHUCT.

<sup>20</sup> After 1936 the JEN had a new designation «*Instituto para a Alta Cultura*» (IAC) [Institute for High Culture].

**Table IV**<sup>21</sup> summarizes the scientific activity of the Research Center in Physics, University of Lisbon, in the period of 1930 to 1946.

During the war, this Research Centre made serious efforts to support the stay in Portugal of Physicists from France, Italy and Austria who were escaping from the Nazi occupation: Salomon Rosenblum (1896-1959), Guido Beck (1903-1988) and Sergio de Benedetti (1913-1994). The Curie Laboratory in Paris was the link of these three physicists to Portugal, especially in their relationship with two young researchers Mário Silva (1901-1977) (from the University of Coimbra who was in Paris from 1925 to 1929 with a grant of this university) and Manuel Valadares (from the University of Lisbon).

**Table IV**

Years	Scientific papers			PhD	
	National Journals	Intern. Journals	TOTAL		
30-34	9	6	15	2	Herculano Amorim Ferreira, Manuel Valadares
35-38	8	10	18	2	Manuel Teles Antunes, Aurélio Marques da Silva
39-42	16	11	27	1	Amaro Monteiro
43-46	25	5	30	5	Lídia Salgueiro, Marieta da Silveira, Carlos Braga, José Sarmento Armando Gibert
Total	59	32	90	10	

Salomon Rosenblum had a close relationship with both of them (Mario Silva invited him to come to Portugal in 1933) and he had done research work with Valadares in Paris. Beck has been in France since 1937 and during his escape he was informed by French colleagues about the possibility of getting a position in Portugal. Beck had sent a plea for help to Mário Silva in Coimbra through a contact in Paris. During his stay in Portugal he started a cooperation with Valadares (Lisbon Physics Research Center) and they both helped a small group of physicists and mathematicians from Oporto University to start with the Oporto Theoretical Physics Seminar activity<sup>22</sup>. Sergio de

<sup>21</sup> Gibert, Armando (1950). O Centro de Estudos de física da FCL. *Gazeta de Física*. 2(4):86-89

<sup>22</sup> Fitas, Augusto J. S. and Videira, António A.P.(2007). Guido Beck, Alexandre Proca, and the Oporto theoretical physics seminar. *Physics in Perspective*, 9(1): 4-25.

Benedetti, an Italian of Jewish origin working at the Paris Institute of Radium, also sought refuge in Portugal. Physicists and mathematicians from Coimbra, Lisbon and Oporto universities tried to get funding to help these scientists stay Portugal. However, the university was generally resistant to change, extremely reticent in its dealings with foreigners and therefore notorious for its lack in receptivity to academics from abroad bringing new ideas into Portugal. This also explains why the Portuguese academic community never made a great effort to ensure that a warm welcome was extended to renowned scientists fleeing to Portugal.

## **5. An unhappy ending...**

As we have pointed out, the Portuguese university was generally resistant to change and extremely reticent in its dealings with foreigners who brought new ideas to the country. The great part of Portuguese Academia ostensibly showed a similar attitude towards the young researchers who arrived from a stay of several years abroad. Very few full professors of Portuguese universities were really interested in promoting scientific research and also in supporting new initiatives. This general attitude of the university and the political repressive response of government to the general hope of a shift to a democracy explained the end of the story.

After arriving in Portugal holding a PhD, António Aniceto Monteiro was unable to secure a lecturer position in a Portuguese university because he refused to sign the anticommunist declaration which was compulsory for a civil servant (a very unusual and courageous attitude). In 1945, the Brazilian government offered him a position in Rio de Janeiro and he left Portugal. The five young Mathematicians, who had started working with him and then went abroad with scholarships, were unable to reopen the Mathematical Research Center of Lisbon when they returned to Portugal after the war. The university never gave Manuel Valadares a position of full professor during his near fifteen years of scientific activity in the laboratory of physics; beyond the scientific papers he published in scientific journals, he was the author of a book which appeared,

in 1935, in a prestigious French publisher<sup>23</sup>. For Valadares, like for Monteiro, to be a scientist was a cultural attitude towards the world and life, an attitude supported in some philosophical ideas. Firstly, a unitary representation of the world in which science has a fundamental influence on the material, spiritual and moral evolution of humanity; secondly, the supremacy of reality over the ideal, of the objective over the subjective, and of scientific knowledge over the metaphysical; thirdly, the firm belief in man's capabilities and in the power of his rationality. A set of ideas that opposed the political and social orientation of Salazar's *Estado Novo* («New State»)...

After the war Manuel Valadares was forced by Salazar's regime to interrupt his scientific career at Lisbon University, he abandoned Portugal and started doing research at the Joliot Laboratory in Paris. In spite of the distance between Paris and Lisbon, Manuel Valadares continued to participate in the scientific life of the Lisbon laboratory through permanent contact with Lídia Salgueiro, one of his former PhD students and then professor at the Faculty of Sciences in Lisbon.

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<sup>23</sup> Valadares, Manuel (1935). *Transmutation des éléments par des particules accélérées artificiellement*. Paris: Ed. Hermann et Cie.