

# OPTICS IN LATIN AMERICA, SPAIN AND PORTUGAL.

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## I - INTRODUCTION

Seventeen years after the first Latin-American workshop of optics and nine years after the first meeting where Spain and Portugal also participated, it seems opportune to analyze their results so as to draw some conclusions and be aware of which our state of affairs is and which our goals are from now onwards.

The purpose of this short article is twofold, to give readers a brief idea about the state of the art of optics in Latin-America, Spain and Portugal and to show how is the state of organization of optical communities in some of these countries.

After the first isolated physics activity in Latin-America, for example, Mossotti (1830) and E. Bose (1908), in Argentina or G. Wataghin (1934) in Brazil, there has been a rapid and systematic development since the late 1940s and the early 1950s with strong government support. However, the vedette was at that time atomic physics rather than optics.

This process of growth in Latin-American physics research has carried on the active physicists to organize national societies with the goal of fostering academic activities and promoting the scientific community. The oldest of such associations is the Argentine Association of Physics (AFA-1944).

As a result of a proposal given by the Brazilian government and accepted by representatives from 20 Latin-American countries at the IX UNESCO General Conference, an agreement was signed on October 3<sup>rd</sup>, 1962 and the Latin-American Center of Physics (CLAF) was created. Another main contributor to the development of physics in Latin-America is the Federation of Latin-American Physical Societies (FELASOFI-1984).

Among the physicists working in Latin-America there have always been some group actives in optics. However, after the laser (1959) and the holography (1962), research in optics have increased in the region. It was also in this moment when the physicists working in optics began to organize themselves in physical societies.

In 1948 the International Commission for Optics (ICO) accepted the Territorial Committee (TC) of Spain and after that the Sociedad Española de Optica (SEDO-1968) was organized; in 1972 the Academia Mexicana de Optica (AMO) was accepted as Territorial Committee of Mexico; in 1978 the TC of Portugal was accepted, in 1981 the Comité Argentino de Optica was recognized as TC of Argentina; in 1984 the Comité Brasileiro de Optica was admitted as a new TC; in 1990 the TC of Colombia joined the International Commission; in 1993 the TC of Cuba and finally in 1997 the TC of Venezuela did.

The XI Meeting of ICO (1978) was the first Optical Meeting organized by a member of Iberian and Latin-American community (SEDO-Madrid). In that Meeting those countries have presented 37 communications: Spain, 27 (73%); Venezuela, 5 (13,5%); Portugal and Mexico, 2 (5,4%) and Brazil, 1 (2,7%).

Some years later a group of people working in optics in Latin-America took the decision to organize regularly an optical workshop called Encuentro Latinoamericano sobre Optica, Láseres y sus Aplicaciones (OPTILAS). The first Meeting took place in Colombia (1984), the second, in Niteroi, Brazil (1986). The III OPTILAS was organized by Argentina in Mar del Plata (1988), the IV OPTILAS took place in Oaxtepec, México (1993) and the V OPTILAS in La Habana, Cuba in 1995.

These kinds of meetings were not only workshops but also schools of optics and laser where assistants played a great role.

In 1992, the SEDO organized the I Reunión Iberoamericana de Optica (RIAO). This meeting had the typical characteristics of an optical meeting with oral communications and posters. In 1995 the II RIAO in Guanajuato, México, took place.

During the V OPTILAS (1995) and the II RIAO (1995), the participants have decided to organize both meetings together from then on.

In 1998, for the first time, VI OPTILAS and III RIAO were held together in Cartagena, Colombia and in 2001 in Tandil, Argentina.

Further to the discussion about a Regional Society of Optics, it is undoubtedly certain that the fact of organizing OPTILAS during 17 years and RIAO during 9 years implies the optical community of Latin-America, Spain and Portugal is quite developed. The fact that both meetings recently took place together shows the high level of organization. Although the possibility of creating a Regional Society of Optics

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arose in several meetings, we have not reached any conclusions yet. However, it seems the moment to start discussing it seriously has arrived.

## II - OPTILAS AND RIAO EVOLUTION

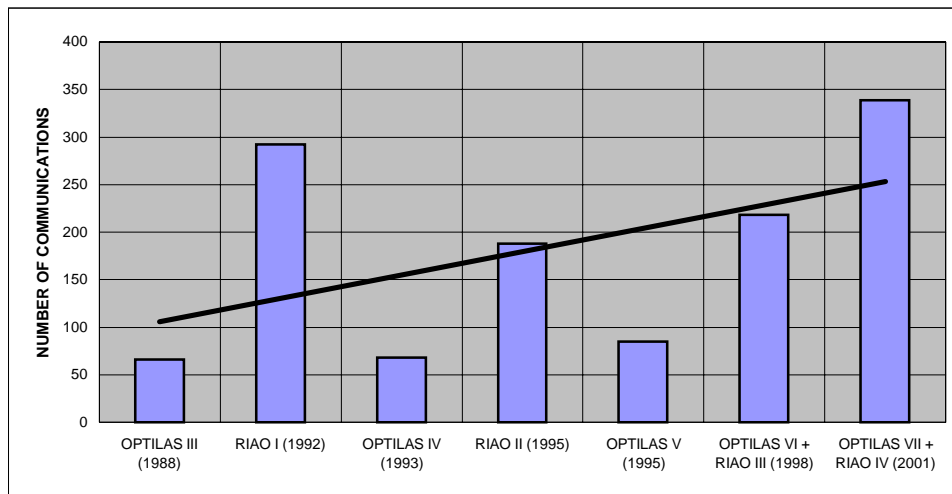
Probably some colleagues have information about the first and second OPTILAS workshops, but I only have data from III OPTILAS.

It will only be discussed here the number of participants, communications, etc. It is well known that this kind of meetings give us much more material to be analyzed. However, it will only take into consideration measurable facts and this will lead us to draw some interesting conclusions.

For example, one of the most important contributions of OPTILAS was the courses of optics and lasers that helped many young people to improve their knowledge in those subjects. A valuable contribution of RIAO was the increasing interaction with our colleagues of Iberian Peninsula.

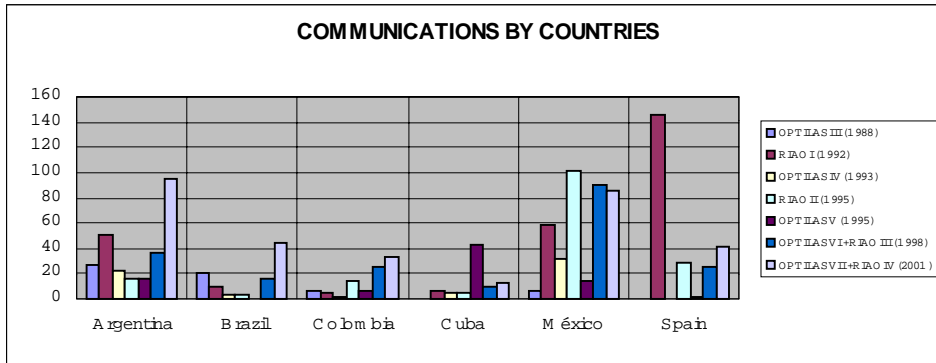
### II.1 - Communications presented in OPTILAS and RIAO Meetings.

MEETINGS	NUMBER OF COMMUNICATIONS
OPTILAS III (Argentina, 1988)	66
RIAO I (Spain, 1992)	292
OPTILAS IV (México, 1993)	68
RIAO II (México, 1995)	188
OPTILAS V (Cuba, 1995)	85
OPTILAS VI + RIAO III (Colombia, 1998)	218
OPTILAS VII + RIAO IV (Argentina, 2001)	339



From the number of communications presented in the meetings we can see an increase in the contributions of the regional optical community. Anyway, there are some evident local and economical influences: Argentina was the country with the largest amount of contributions in III VII OPTILAS and IV RIAO, Spain in I RIAO, Mexico in II RIAO and IV OPTILAS, Cuba in V OPTILAS and recently Argentina in Tandil. The only exception was III RIAO and VI OPTILAS, where Mexico was the country with the largest amount of contribution and not the host country.

MEETINGS	Argentina	Brazil	Colombia	Cuba	Chile	México	Perú	Uruguay	Venezuela	Spain	Portugal
OPTILAS III (1988)	27	21	7	0	3	7	1	0	0	0	0
RIAO I (1992)	50	9	4	6	5	58	2	0	12	145	1
OPTILAS IV (1993)	22	3	1	5	1	31	0	0	5	0	0
RIAO II (1995)	16	3	15	5	5	101	4	0	9	29	1
OPTILAS V (1995)	16	0	7	43	2	15	0	0	0	2	0
OPTILAS VI + RIAO III (1998)	36	16	25	10	0	90	4	1	3	26	7
OPTILAS VII + RIAO IV (2001)	95	45	34	13	3	85	9	2	10	41	2



Another interesting conclusion drawn from the communications submitted is that the share of each country has been at least kept: Argentina around a 19%; Spain near 18%; and Brazil, Colombia and Cuba between 7% and 9%. Mexico contributed the most with approximately 33%. The rest of the countries ranged between 0,2% and 2%.

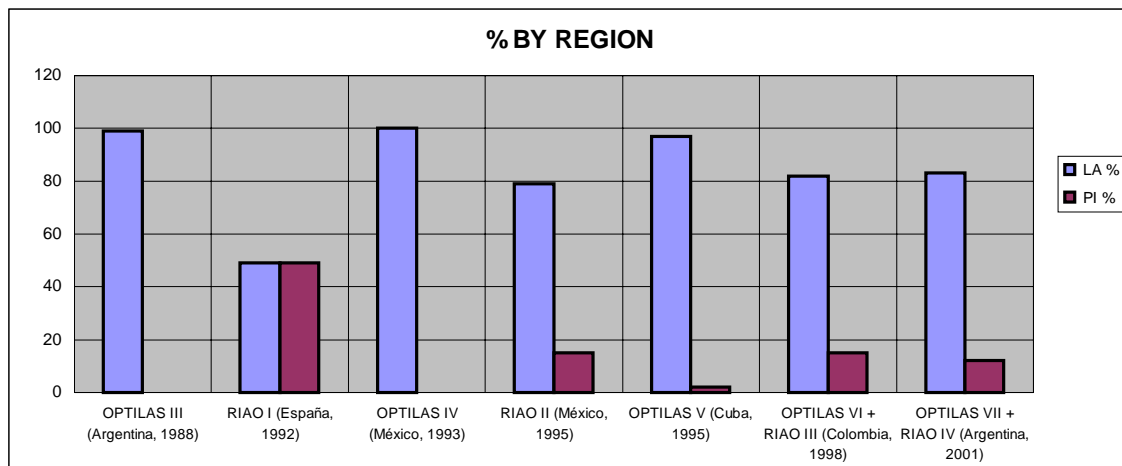
It is relevant to point out the increasing participation of by Brazil in these kinds of meetings. This is very interesting for the Latin-American community since the Brazilian contribution to optical science is rather important. It is also significant the growth of communications from Colombia, Peru, Uruguay and Portugal, Mexico's leadership and the continuity of reports handed in by Spain and Argentina.

In order to have a wider panorama of the optical activities in the whole region, it is essential to take into account the number of publications by those countries. This will be analyzed later on in this paper.

## II.2 - Contribution of Latin-American countries, Spain and Portugal in the OPTILAS and RIAO Meetings.

It is interesting to compare the evolution of the number of communications submitted to OPTILAS and RIAO Meetings by both regions: Latin-America (LA) and the Iberian countries (PI).

MEETINGS	TOTAL	LA	LA %	PI	PI %
OPTILAS III (Argentina, 1988)	68	67	99	0	0
RIA O I (España, 1992)	298	146	49	146	49
OPTILAS IV (México, 1993)	68	68	100	0	0
RIA O II (México, 1995)	201	158	79	30	15
OPTILAS V (Cuba, 1995)	86	83	97	2	2
OPTILAS VI + RIA O III (Colombia, 1998)	225	185	82	33	15
OPTILAS VII + RIA O IV (Argentina, 2001)	356	296	83	43	12
<b>TOTAL in the last 13 years</b>	<b>1302</b>	<b>1003</b>	<b>77</b>	<b>254</b>	<b>20</b>

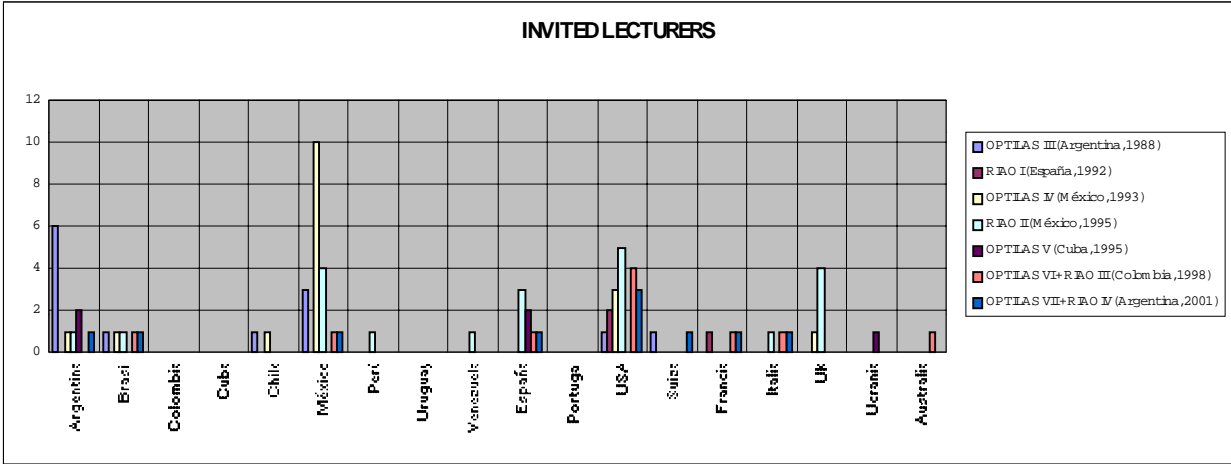


**LA:** Latin American countries, **PI:** Countries in the Iberian Peninsula

From the comparison drawn among the communications submitted by the countries of both sides of the Atlantic, it is clearly seen a preponderance of Latin-America (between 4 to 5 times greater), except in RIAO I, where both regions equaled contributions. It is not easy to draw clear conclusions from this fact. It could either be related to the grants or funds gathered to travel or to the importance given to this kind of meetings.

**II.3 - Lecturers invited to OPTILAS and RIAO meetings.**

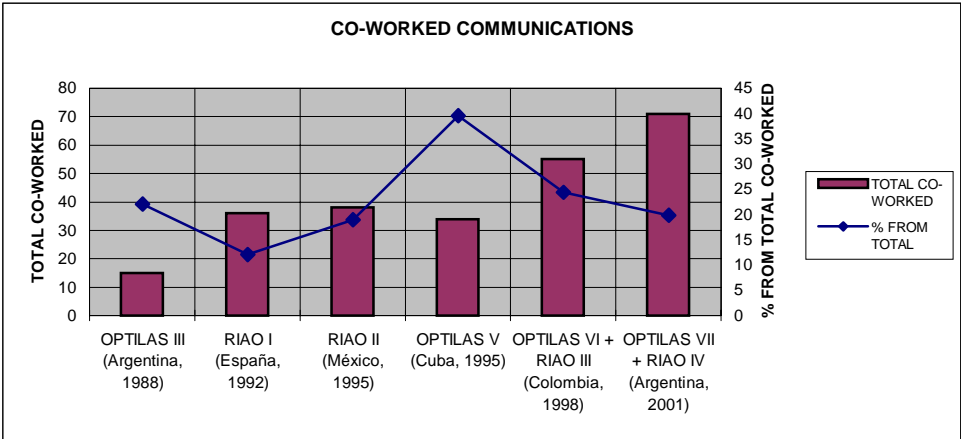
As regards the invited lecturers, it is very interesting to notice the wide variety of nationalities beyond the region. The choice of these lecturers was made either on the basis of their experience as researchers on a specific subject or due to the organizers' need to invite well-known colleagues, recognized in their fields.



**II.4 – Co-worked communications presented in OPTILAS and RIAO meetings.**

Finally, it is interesting to point out the evolution of co-working among colleagues from Latin-America and other different countries (Spain and Portugal included).

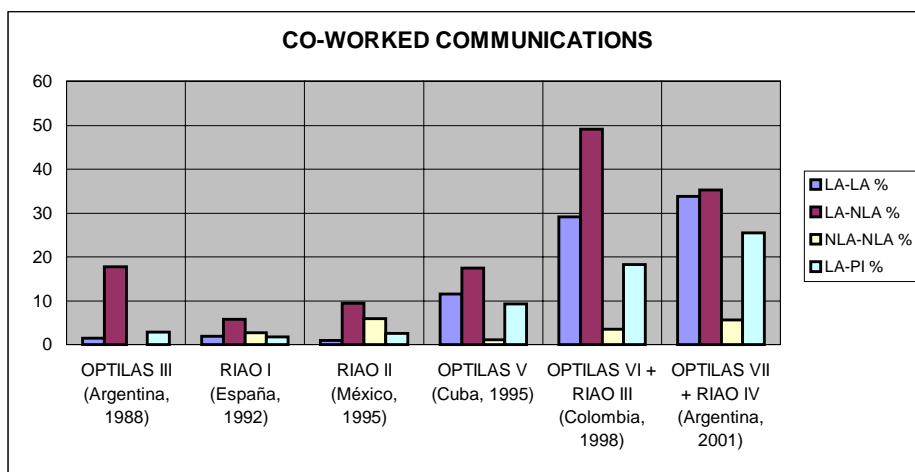
MEETINGS	TOTAL COMMUNICATIONS	CO-WORKED PAPERS	% FROM TOTAL
OPTILAS III (Argentina, 1988)	68	15	22,1
RAIO I (Spain, 1992)	298	36	12,1
RAIO II (Mexico, 1995)	201	38	18,9
OPTILAS V (Cuba, 1995)	86	34	39,5
OPTILAS VI + RIAO III (Colombia, 1998)	225	55	24,4
OPTILAS VII + RIAO IV (Argentina, 2001)	356	71	19,9



MEETING	LA-LA %	LA-NLA %	NLA-NLA %	LA-PI %
OPTILAS III (Argentina, 1988)	1,5	17,7	0	2,9
RIAO I (Spain, 1992)	2	5,7	2,7	1,7
RIAO II (Mexico, 1995)	1	9,5	6	2,5
OPTILAS V (Cuba, 1995)	11,6	17,4	1,2	9,3
OPTILAS VI + RIAO III (Colombia, 1998)	29,1	49,1	3,6	18,2
OPTILAS VII + RIAO IV (Argentina, 2001)	33,8	35,2	5,6	25,4

DEFINITIONS:

**LA-LA** = Co-worked communications carried out between Latin-American colleagues. **LA-NLA**= Idem between Latin-American and non-Iberian colleagues. **NLA-NLA** = Idem between non Latin American nor Iberian colleagues. **LA-PI** = Idem between Latin-American and Iberian colleagues.



Interesting conclusions may arise from the analyzed results:

- There has been a noticeable increase in the collaboration among Latin-American countries.
- There has also been a systematic rise in the collaboration among groups from Latin-America and from Spain and Portugal.
- The collaboration among colleagues in the region and outside it, seems to be decreasing.

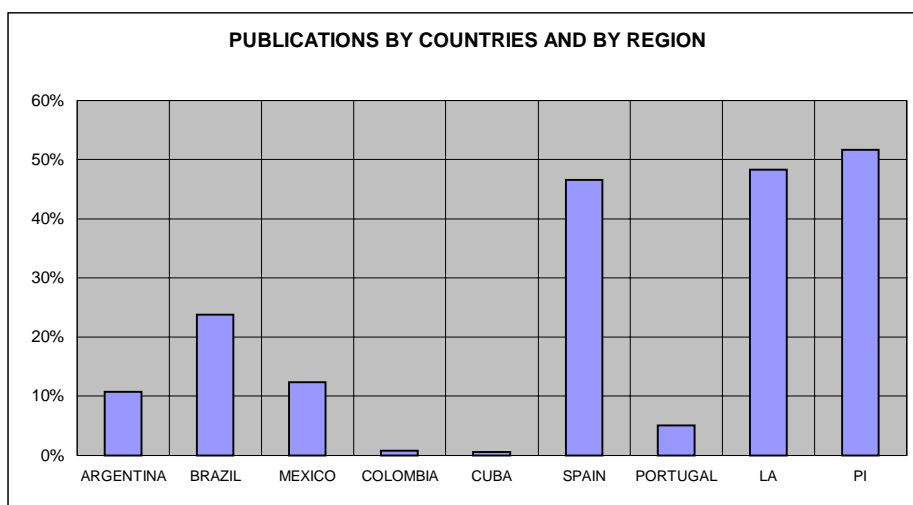
## II.5 – Publications from Latin American, Spanish and Portuguese authors from 1974 to 2000.

SOME SELECTED COUNTRIES.

Sources from the Science Citation Index from 1974 to 08/31/2000 (09/22/2000). A paper is considered from a country if at least one of the authors belongs to that country.

REVIEW	ARGENTINA	BRAZIL	MEXICO	COLOMBIA	CUBA	SPAIN	PORTUGAL	TOTAL
OPTICAL ENGINEERING	32	12	67	6	0	84	5	206
APPLIED OPTICS	128	98	216	6	0	394	28	870
JOSA A (*)	9	5	22	0	0	53	2	91
JOSA A (**)	15	7	50	4	4	95	4	179
JOSA B (***)	16	47	27	0	0	91	4	185
OPTICS LETTERS	21	70	70	1	0	149	10	321
JOURNAL OF MODERN OPTICS	62	22	57	4	0	143	4	292
IEEE J. OF QUANTUM ELECTR.	23	52	6	0	0	60	4	145
OPTICS COMMUNICATIONS	94	140	141	12	0	340	13	740
OPTICS AND LASER TECHNOLOGY	15	13	7	4	2	11	0	52
PURE AND APPLIED OPTICS	4	1	1	0	0	12	1	19
JOURNAL OF OPTICS A	0	0	0	0	0	4	0	4
JOURNAL OF OPTICS B	0	3	1	0	0	8	0	12
JOURNAL OF OPTICS	8	0	1	0	0	44	0	53
OPTICS AND LASER ENGINEERING	3	3	11	0	0	4	0	21
OPTICAL AND QUANTUM ELECTR.	3	26	7	0	0	46	7	89
OPTIK	100	3	32	16	0	74	0	225
<b>TOTAL 1</b>	<b>7</b>	<b>502</b>	<b>716</b>	<b>53</b>	<b>6</b>	<b>1612</b>	<b>82</b>	<b>3504</b>
APPL. PHYS. A	12	30	20	0	2	122	6	192
APPLIED PHYSICS B (LAS. & OPT.)	7		7	0	1	26	2	43
B (PHOTOPHYS. & LASER)	5	26	1	0	0	14	0	46
APPLIED PHYSICS LETTERS	21	244	94	3	9	413	27	811
APPLIED SPECTROSCOPY	8	18	3	0	2	87	5	123
CHEMICAL PHYSICS	25	57	13	0	0	243	24	362
CHEMICAL PHYSICS LETTERS	104	214	113	2	2	598	81	1114
EUROPHYSICS LETTERS	41	85	20	6	1	241	31	425
IEEE TRANS. ON PLASMA SC.	18	21	4	0	0	5	13	61
J. OF QUANT. SPECT. & RAD. TRANSF.	16	48	4	0	0	67	10	145
JOURNAL OF APPLIED PHYSICS	80	609	186	24	35	863	110	1907
JOURNAL OF CHEMICAL PHYSICS	187	249	294	2	7	992	71	1802
JOURNAL OF LUMINESCENCE	8	62	21	1	1	119	44	256
JOURNAL OF MODERN OPTICS	62	22	57	4	0	149	0	294
JOURNAL OF PHYSICAL CHEMISTRY	123	624	69	0	6	514	73	1409
J. OF PHYSICAL CHEMISTRY A, B	41	68	55	2	5	359	57	587
J. OF PHYSICS A, B, C, D, E, F, G	414	624	308	13	16	1183	207	2765
OPTICS AND SPECTROSCOPY	0	0	1	0	0	0	2	3
SOLID STATE COMMUNICATIONS	141	596	149	15	17	430	26	1374
<b>TOTAL 2</b>	<b>1313</b>	<b>3597</b>	<b>1419</b>	<b>72</b>	<b>104</b>	<b>6425</b>	<b>789</b>	<b>13719</b>
<b>TOTAL</b>	<b>1846</b>	<b>4099</b>	<b>2135</b>	<b>125</b>	<b>110</b>	<b>8037</b>	<b>871</b>	<b>17223</b>

ARGENTINA	BRAZIL	COLOMBIA	CUBA	MEXICO	SPAIN	PORTUGAL	TOTAL	LA	PI
1846	4099	125	110	2135	8037	871	17223	8315	8908
10,72%	23,80%	0,73%	0,64%	12,40%	46,65%	5,06%	100,00%	48,29%	51,71%



If we take a look at the publications from Latin-American countries, Spain and Portugal, we can see that the amount of Latin American contributions is almost identical to those of Spain and Portugal.

Other important conclusions drawn from the comparison made between the participation of Latin-American countries in the regional meetings and the contributions in specialized reviews are the following:

- An important contribution from Brazil to specialized reviews in optics and photophysics, that has no relation with its participation in regional meetings. Brazil has reached 24 % of the publications while contributing only 7 % in the regional meetings
- Mexico, whose publications have not reached 13%, has presented a 33% of communications.
- Argentina contributes to the regional events with 19 % and publishes somewhat less than 11%.
- Spain hands in 18% of the communications to the regional meetings and publishes somewhat less than 47%.
- Colombia and Cuba show similar results. They contribute with 0.7% and 0.6% of the published papers whereas 7.5% and 8.5% of the communications have been presented to regional meetings.
- Portugal contributes with 5% of the publications and 0.8% of its communications.

These comparative results show how each national community decides to spread their achieved results.

Besides, it seems rather relevant to point out the fact that the Brazilian and Portuguese optical communities have realized that the regional events are activities in which they are welcome rather than feeling that these activities were only for the Spanish speakers.

All the countries involved in these meetings agree with the fact that Brazil must be considered as a Latin-American country and Portugal must be considered as an Iberian countries.

### III – LATIN-AMERICAN OPTICAL SOCIETY OR REGIONAL SOCIETY OF OPTICS?

Before answering this question, we must have a look at the organizational level of the optical communities in the Iberian countries. As far as we know, the countries mentioned below have active groups that work on optics or photophysics.

<b>COUNTRY</b>	<b>Creation of a Society, Division, etc.</b>	<b>ICO Member</b>
Argentina	CAO-1982; DFFAFA-1993; DOAFA-1994	1981; CTO-1997
Brazil	CBO-1984	1984
Colombia	RCO	1990
Cuba	SCF	1993
Chile	SOCHIFI	
Spain	SEDO-1968;CEO-1950	CTO-1948
Mexico	AMO	CTO-1972
Peru	SOPERFI	
Portugal		CTO-1978
Uruguay	SUF	
Venezuela		1997

As mentioned above, a system of organization with academic goals was established in Latin-America 17 years ago. Moreover, a new system somehow different was set up 9 years ago. The latter aims at all Latin-America and Iberian countries. Both scientific meetings were held in 1998 with the following objectives:

- Both events would meet again but keeping their identities
- Argentina was chosen as the next organizer.
- In each meeting the organizers for the two forthcoming meetings must be chosen.
- To propose the creation of a Regional Society of Optics.

Is important to point out other attempts to create regional organizations which had relative success:

- Red de Aplicaciones de la Optica y el Laser (RAOL, 1997) (comprised of researchers from Argentina, Brazil, Uruguay and Venezuela).
- Multipurpose Optical Network (MON, sponsored by the ICTP).

Anyway, it seems this is the moment to start discussions that will lead to the organization of a society which would get together all the people working in optics that attend regularly to these kinds of meetings.

Undoubtedly, this society ought to have a important degree of freedom and at the same time it should guarantee not only to maintain the level of commitment in the national groups, but also to foster the level of commitment towards the development of the optics in their own countries and in relation to the region.