Shifts in knowledge production patterns of Mexican physics in particles and fields

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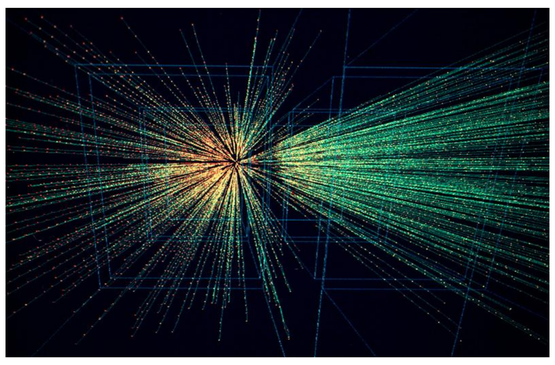
Introduction

Mexican research in the physics area of particles and fields (MPPF) has evolved by diversifying ways of generating knowledge and thus enriching organizational, production and scientific communication structures. Its first significant achievement was to gain continuity in the production of results. This was accomplished on the basis of theoretical research and to a lesser extent, phenomenological, steadily showing more consistent scientific practice which served as a basis for the formation of new research groups and the development of other types of research within the discipline (Collazo-Reyes, Luna-Morales & Russell, 2004). In order to examine this change, we analyze in detail the scientific production of this community in the period 1948-2007 through two different but complementary bibliographic systems: the traditional Science Citation Index Expanded (SCIE) framework and the Stanford Public Information REtrieval System (SPIRES).



NA49 experiment: lead ion collisions. (Copyright CERN) http://www.interactions.org

Material and Methods

Table 1 shows the retrieved papers and citations organized in the following way. The 120 papers and the 793 citations found in SCIE, were used to complete the analysis of the period not covered by SPIRES. The 3,278 papers found in both databases received, 33,387 citations from published papers and 21,803 citations from unpublished work in SPIRES and 40,942 citations in SCIE. The 1,784 unpublished papers in SPIRES received 2,894 citations from published sources and 2,185 citations from unpublished sources. The 677 papers identified in SPIRES published in sources not covered by SCIE, generated 1,315 citations from published sources and 712 from unpublished sources.

The 3, 278 papers found in both databases were disaggregated into the five distinct types of research assigned in SPIRES system: (1) theoretical, (2) phenomenological, (3) experimental, (4) cosmological and (5) other. The publications and citations retrieved from the SPIRES were classified into three types: 1) published in journals also covered by SCIE, 2) published in sources not covered by SCIE, and 3) unpublished.

Results

The 3,278 papers generated 40,942 citations according to SCIE and 55,190 according to SPIRES. Table 2 shows the distribution of these papers and citations by type of research and the respective percentages. We have included both SCIE and SPIRES citations to each type of research. In the latter case we have considered also the citations given in sources not included in the SCIE. The theoretical papers represent the largest share in production but they acquired only 27.7% of the SCIE citations, while the experimental papers represent only 16.1% of total production but received 25.2% of the SCIE citations. On the other hand, “other” papers generated 15.1% of the SCIE citations with just 0.9% of the production. With the sole exception of the experimental papers, publications received more citations in SCIE than in SPIRES.

The first publications in the 70s involved theoretical and phenomenological studies, but in the 80's most of the publications were only on theory. By the early 90´s research had diversified: theoretical, phenomenological, experimental, cosmological, and other types.

Table 1. Papers and citations in SCIE and SPIRES

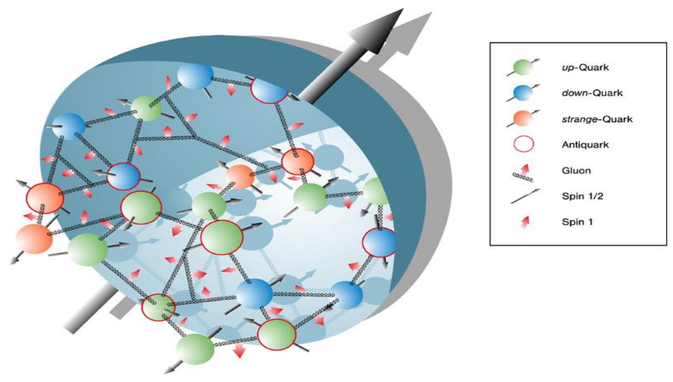
		Citations in SPIRES			
Paper Type	**Nos. of Papers**	**From Published Papers**	**From Unpublished Papers ***	**Total SPIRES**	**Citations In SCIE**
Available in SCIE	120				793
Available in SCIE and SPIRES	3278	33387	21803	55190	40942
Unpublished papers SPIRES	1784	2894	2185	5079	
Published not covered in SCIE	677	1315	712	2027	
Totals	5859	37596	24700	62296	41735

* e-prints, conference papers, conferences, theses.

Discussion and Conclusions

MPPF was developed under two distinct knowledge production structures. (I) A steady state where institutions, academic profiles, financing, professional training, and teaching programmes, all operated within the conditions surrounding the theoretical and phenomenological modes of knowledge production. (II) A period of growth and expansion of the organizational, subject and cognitive boundaries of the scientific practice; characterized by diversification of the types of research and the incorporation of a new generation of Mexican experimental physicists to the collaborative practices of elite, multi-institutional groups (Jones, Wuchty, & Uzzi, 2008) which complemented and enriched the knowledge production patterns of the MPPF.

Our analysis of the 60 year period, showed that a maximum state of growth was achieved when Mexican research in the field was able to form research groups, to provide continuity in results and create the circumstances necessary to carry out different types of research.



HERMES and the spin of the proton. Source: DESY Hamburg http://www.interactions.org

References

Collazo-Reyes, F., Luna-Morales, M.E. & Russell, J.M. (2004). Publication and citation patterns of the Mexican contribution to a Big Science discipline. *Scientometrics*, **60** (2), 131-143.

Jones, B.F., Wuchty, S. & Uzzi, B. (2008). Multi-University Research Teams: Shifting, Impact, Geography, and Stratification in Science. *Science*, **322** (21), 1259-262.

Table 2. MPPF: papers, citations and averages in SCIE and SPIRES

Spires / SCIE	Theory	%	Phenome-nology	%	Experi-mental	%	Cosmo-logy	%	Others*	%	Total
Papers: 1971-2007	1370	41.8	868	26.5	527	16.1	483	14.7	30	0.9	3278
Citations SCIE											
Citations	11353	27.7	8888	21.7	10328	25.2	4211	10.3	6162	15.1	40942
Average	8.3		10.2		19.6		8.7		205.4		12.5
Citations SPIRES											
Total citations	11323	20.5	11246	20.4	19746	35.8	5265	9.5	7610	13.8	55190
From published papers	8595	25.7	6560	19.6	9950	29.8	3716	11.1	4566	13.7	33387
From unpublished papers	2728	12.5	4686	21.5	9796	44.9	1549	7.1	3044	14	21803
Total average	8.3		13		37.5		10.9		253.7		16.8
From published papers average	6.3		7.6		18.9		7.7		152.2		10.2
From unpublished papers average	2		5.4		18.6		3.2		101.5		6.7

• Includes review articles written in collaboration by the Particle Data Group which are the most cited in this subject area.