

Institution Reports

Physics in the Philippines Today

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The state of physics in the Philippines is presented focussing on the areas of human resource development, research capabilities, and research funding and incentives. Eighteen schools in the Philippines provide undergraduate training in physics and applied physics with three of them offering a Ph. D. degree program in physics. As of April 2003, the number of Ph. D. degree holders in physics in the country does not exceed 70. Most research publications in ISI-abstracted journals originate from the National Institute of Physics of the University of the Philippines although research activities are starting to take root in other schools. Research funding is primarily provided by the Philippine government through its various agencies although the semiconductor and electronics industry have begun supporting research initiatives in condensed matter and instrumentation physics.

1. BACKGROUND

The Philippines is a country with a population of 76.5 million (2000 census, annual growth rate $\approx 2.34\%$) with an unemployment rate of 10.6% (January 2003)-12.98% of the population is concentrated in the National Capital Region which includes the cities of Manila and Quezon [1]. The literacy rate is 92.28% among household population 10 years and above. The GDP per person is USD 1,050 in the year 2001 [2]. In terms of the human development index, the country occupies the 77th position in year 2000 (rank in GDP per person: 97) [2].

Registered earnings from merchandise exports for the year ending February 2003 is \$2.72B. Receipts from electronic components, accounts for 53.7 percent of the aggregate export revenue representing an increase of 4.5 percent to \$1.464 billion from \$1.4 billion in the previous year [3].

University life begins at seventeen years of age after four years of high school and six to seven years of elementary education. Schooling at any level may be obtained from a state or private institution — numbering at least 65 universities in the Philippines today [4]. The medium of university instruction in the natural sciences and engineering is English. The academic year starts in June of each year and ends in May of the following year.

2. HUMAN RESOURCE DEVELOPMENT

An undergraduate degree in physics or applied physics may be obtained from one of 18 schools, 10 of which are state institutions. The Commission on Higher Education which regulates all universities and colleges in the Philippines, classifies four of these physics departments as centers of excellence (Ateneo de Manila University, De La Salle University, Iligan Institute of Technology in the Mindanao State University, National Institute of Physics in the University of the Philippines, Quezon City) and another four as centers of development (Siliman University, University of San Carlos, Institute of Mathematical Sciences and Physics of the University of the Philippines in Los Baños, University of the Philippines in Baguio). Regular undergraduate programs in physics or applied physics takes four years to accomplish except at the state-owned National Institute of Physics (NIP) where it is a 5-year course [5].

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In the second semester of the academic year 2002-2003, the undergraduate physics/applied physics population in the centers of excellence and development is 876 which is distributed as follows [6]: Ateneo (120), De La Salle (100), Iligan Institute (72), NIP (350), Siliman (19), San Carlos (69), UP Los Baños (120), and UP Baguio (26). Up to academic year ending Summer 2002, the average annual graduation rate in NIP is below 20 which is less than 20% of the freshman class [7].

The gender ratio in the undergraduate population is close to unity. A good source of promising physics students is the Philippine Science High School System which has seven campuses all over the country. The system is operated by the Department of Science and Technology which also provides college scholarships for physics and applied physics students [8]. The University of the Philippines administers a number of academic scholarships to physics students. Recently, Intel Philippines has also provided a number of scholarships to NIP graduate students.

At present, there are 66 Ph. D. degree holders in physics in the Philippines and 52 of them are with the academe — 26 are with NIP. The physics departments of the privately-owned Ateneo and De La Salle each have 10 Ph. D. faculty members. Each center of excellence offers an M. S. degree program in physics with Ateneo, De La Salle and NIP also offering Ph. D. degree programs. The average graduate population is one hundred twenty-seven [Ateneo (20), De La Salle (20), Iligan Institute (25), NIP (62)]. About 90% of NIP graduate students study full-time. One publication in an ISI-abstracted science journal is a minimum requirement for graduation in the Ph. D. program of NIP.

3. RESEARCH CAPABILITIES

Figure 1 plots the annual number of physics publications in ISI-abstracted journals with Philippine-based authors. Steady

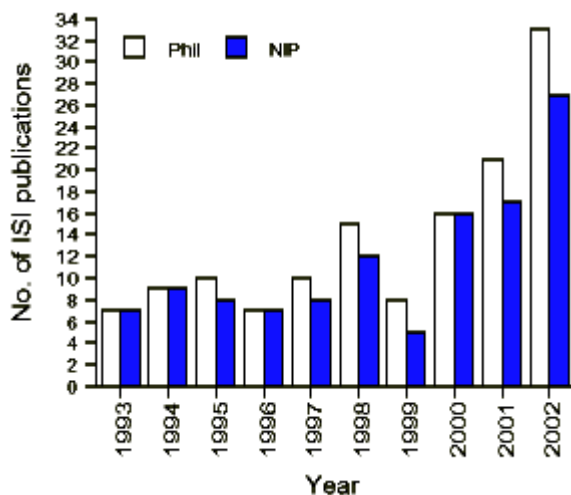


Fig. 1: Number of ISI publications in physics by Philippine-based authors. Source: <http://gateway.ovid.com/>.

growth is observed in the last three years (2000 - 2002). Between 1995 and 2002, 86% of the ISI publications were authored by researchers who are or have been affiliated with NIP. Of the ISI publications that emanated from NIP, 53% were in optics, signal processing, and complex systems (see Fig. 2). Researchers in complex systems have recently published a number of papers in the Physical Review Letters [9]. It is worth mentioning that researchers from the privately-owned Research Center for Theoretical Physics in Jagna, Bohol [10], have also produced a number of ISI publications in mathematical physics over the years.

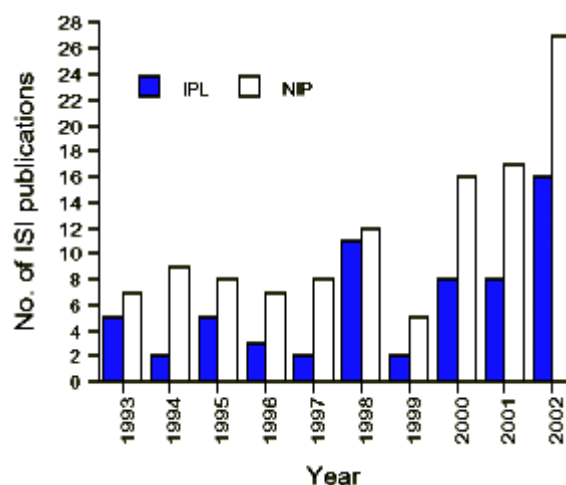


Fig. 2: Number of ISI publications in physics by NIP-based authors in optics, signal processing and complex systems (IPL). Source: <http://gateway.ovid.com/>.

Most physicists who have remained active in research are members of the Samahang Pisika ng Pilipinas (Physical Society of the Philippines) which was founded in 1979 [11]. The Society which had 250 members in 2002, holds a scientific conference each year where researchers from all over the country meet to present their latest findings. All papers for presentation are peer-reviewed before acceptance in the conference. All approved presentations are published as full papers in the conference proceedings.

The Society has experienced continuous growth in the number of conference presentations from 101 in 2000, 119 in 2001, to 133 in 2002. The research areas covered in the past conferences were in condensed matter physics, superconductivity, lasers & its applications, optics & photonics, image & signal processing, plasma physics, liquid crystals, statistical physics, field theory, complex systems, and physics education. The number of presentations by NIP researchers has remained at 60% of total in each of the conferences in the last three years. This implies an increasing number of technical contributions from other Philippine schools.

4. RESEARCH FUNDING AND INCENTIVES

The basic salary range of a professor at the University of the

Philippines (UP) is USD5,438 - 6,752 (USD = PhP53.52) per annum before tax which is at 30% of gross income. A regular faculty has a workload of 12 units — one unit is equivalent to one lecture-hour a week. A Ph. D. faculty at NIP could also apply for a 3-unit research load credit. The basic salary of a professor at the privately-owned Ateneo de Manila is higher with a regular teaching load of 30 units per academic years — the student tuition in the Ateneo is almost five times higher than that in UP.

UP also awards research grants to qualified faculty members in the amount equivalent to their annual salary. Since 1998, a cash award of USD1000 is given to a publication in an ISI-abstracted journal, which is divided equally among the authors — only those who use the affiliation of UP in their papers qualify for the awards. Similar incentive schemes for ISI publications are also implemented at the Ateneo de Manila and De La Salle. Recent Ph. D. graduates of NIP could also avail of postdoctoral fellowships from the UP System that allow them to do research at foreign laboratories for a period of one year.

For researchers in the physics community, the most important source of research grants for personnel and equipment is the Philippine Council for Advanced Science and Technology Research and Development (PCASTRD) of the Department of Science and Technology. The PCASTRD provides research funding in the areas of biotechnology, electronics, instrumentation & controls, information technology, materials science, photonics, and space technology application [12].

Figure 3 plots the total amount of financial support that

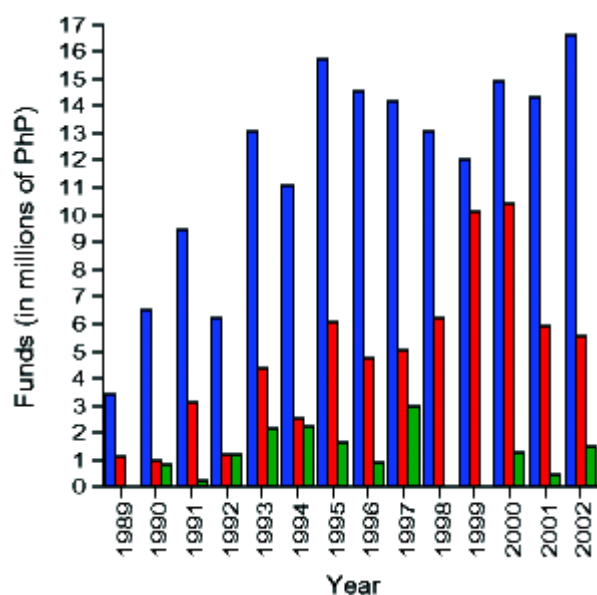


Fig. 3: Annual financial (grants-in-aid) support given by PCASTRD (in blue) to materials science (red) and photonics (green).

PCASTRD extended to research projects from 1989 to 2002 [13]. Also plotted are the corresponding amounts given to researchers in materials science and photonics, who are all from the physics community. Within a 14-year period, the PCASTRD has released a total amount of PhP164,909,776.42 in research grants of which PhP 67,340,254.11 (40.83%) and PhP 15,524,343.04 (9.41%) went to the materials science and photonics sectors, respectively. The biotechnology sector received 27.45% of the total financial disbursements for research and development.

Other possible source of research funding is the National Research Council of the Philippines through its Physics Division. Typical grants amount to USD5700 or less. UP has also embarked on an aggressive drive to involve the private sector in research collaborations with its researchers. In 2002, Intel Philippines gave an equipment grant to NIP in the amount of 155,000 euros.

5. PROSPECTS AND CHALLENGES

Physics research in the Philippines has never been in a better state than it is today. ISI Essential Science Indicators revealed that after the 10.17 year-period, from January 1992 to February 2002, the Philippines has been able to enter into the rank of countries with the highest citations in physics [14].

Filipino physicists are acquiring the competence and confidence to recognize more interesting research projects and publish in high-impact journals like the Physical Review Letters. This trend is critical if the number of available Ph. D. supervisors is to increase in the country. Noticeable improvement in the research infrastructure and facilities and in the number of publications in ISI journals, has turned the NIP graduate school into a viable option where young talents can pursue advanced careers in physics. As a consequence, a slowdown is happening in the migration of valuable BS Physics graduates leaving for abroad.

The quality of college freshmen who are entering NIP has been improving steadily. The number of BS graduates is also increasing — 22 were produced in the academic year ending May 2003. A steady stream of BS graduates is crucial for the continued growth of the NIP graduate school. The physics community is also relatively young — about 66% of the members of the Samahang Pisika ng Pilipinas is below 40 years old.

The semiconductor and electronics industry in the Philippines is recognizing the indispensable element of R&D for survival in a fiercely-competitive environment. The high cost of conducting R&D in terms of equipment and manpower requirements, leads to the conclusion that it is best carried out in the universities and there is now a conscious effort on both

industry and academe to interface with each other. The primal need to thrive and prosper is forcing the industry to financially support R&D efforts in the academe. On the other hand, the private sector's obsession with the bottom line, is certain to reduce if not eliminate, boondoggling in the academe.

The Philippine physics community must capitalize on its current gains to bring its scientific capability into greater heights and enable a majority of Filipinos to enjoy the benefits of science and technology. Success in R&D depends not only on talent, technical capability, and determination on the part of researchers but also on the infrastructure and financial support mechanisms in the environment.

There is a pressing need to improve state auditing and customs regulations governing R&D expenditures. Regulations should be designed to promote urgency and efficiency in R&D activities (rather than to curb corruption in government). Conscientious effort is also needed to heighten public understanding on the true nature of the scientific inquiry. Among those who are literate, many still harbor the misconceived notion that scientific knowledge is static and that all information is already available (for free) in the Internet. To them, investment in science is therefore not essential.

An overhaul of the system of incentives in the academe is overdue to make successful scientists abroad to even consider working in the Philippines — the basic salary of a UP professor is lower than the US federal minimum wage of USD 10,712 per annum. To make ends meet, a typical UP faculty has to take extra workload that inevitably jeopardizes his performance as a teacher and researcher.

At least in the near future, the state will remain to be the main sponsor of scientific R&D. There is a clear need for the state to increase its level of R&D funding if only to match the deleterious effects of inflation. Between January 1990 (USD = PhP24.46) and December 2002 (USD = PhP53.52), the Philippine peso has depreciated by almost 120% against the USD [15]. In the same 12-year period, the R&D budget (in USD terms) of PCASTRD increased by only 7.31% — an average rate of less than 1% a year. To put things in perspective, the 2003 budgets of the National Science Foundation and the National Institutes of Health of the US, have increased by 5% and 17% (year-to-year) respectively [16]. In 1992, the Philippines spent 0.22% of its gross national product on R&D while Israel, Japan and South Korea devoted 2.86%, 2.17% and 2.1% of theirs, respectively [17]. Singapore spent 1.13% of its GNP for the same purpose in 1995.

In the Philippines, the odds of meeting a Filipino with a Ph. D. in physics is one in a million (literally). However, there

are signs that this rarity is going to change for the better.

6. REFERENCES

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