

AKPA Newsletter

재미 한인 물리학자 협회

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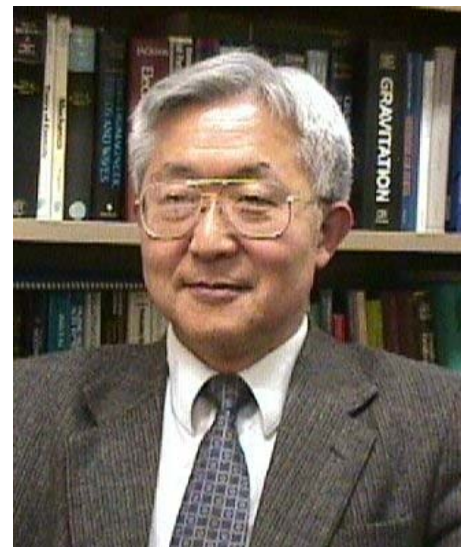
January, 2006

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The current and past AKPA newsletters are found in the AKPA website: <http://www.akpa.org/>.

1. Letter from the President: 2006

The year 2005 has been an eventful year for AKPA. In celebration of the World Year of Physics, AKPA had a joint meeting with the Korean Physical Society in April in Seoul. With a generous support from KUSCO, we have carried out an unprecedented public outreach program to the Korean communities in the United States. Three lectures were given: (1) “Dr. Einstein and the Universe” by Dr. Taeil Bai in the San Francisco Bay Area on October 8, (2) Einstein’s Relativity and the Expanding Universe” by myself in the Greater Washington DC Area on October 15, and (3) “Mysteries of the Universe” again by Dr. Taeil Bai in Los Angeles on November 26. A lot of publicity was generated through newspaper articles and advertisements, and the lectures were very well attended. We would like to



continue such a public lecture program, in more cities, as AKPA’s annual event. The membership dues and contributions received in the first seven months of the new administration topped \$10,000. AKPA’s website had a complete facelift. The dues and donations can now be received electronically.

AKPA owes the outstanding achievement made last year to several loyal members who have carried out various committee duties with such selfless dedication. I am deeply grateful to them. While I rely on their continued support, AKPA really needs active participation of more members to be able to carry out programs like the public lecture series. We need volunteers especially in the New York, Chicago, and Los Angeles metropolitan areas. I would like to see local chapters functioning in major cities and the chapters can meet on the occasion of their public lectures. We are still short of the required active membership (the number of due paying members) to be able to make the needed amendment of our Charter. I hope that more of you will become up to date with your dues and contributions, taking advantage of the new e-payment op-

tion. We would like to be able to carry out the public lecture program in the future with our own funds. I would also like to invite you to contribute articles of general interest, your opinions, and news items to our newsletter.

I have had a lot of fun on my first sabbatical visit to Korea. I taught a graduate seminar course at Seoul National University and visited several research and educational institutions in Korea in the past four and a half months. I happened to visit Seoul National University right in the middle of the Hwang Woo Suk controversy. I will be returning to Maryland in the next few weeks. I may be able to report on what I have observed about Korea and the Korean science in a future issue of our newsletter.

2. OYRA Deadline Extended

The deadlines for the application for 2006 OYRA has been extended to the end of January, 2006. The original deadlines were December 15 for letter of nomination and January 15 for letters of recommendation. The new extended deadline of January 31, 2006 is for *ALL* documents, letters of nomination as well as recommendation.

The rule of candidates being within 5 years of his/her Ph. D. degree remains unchanged, BUT exceptions can be allowed for extenuating circumstances such as unavoidable military services and any extended medical leaves. In such cases, such interruptions will not count toward the 5-year rule.

INVITATION TO NOMINATE THE 2006 AKPA OYRA Award

PURPOSE: To recognize and promote excellence in research by outstanding young ethnic Korean physicists in North America who are working at research universities/institutions, or at industrial/government laboratories in North America. The OYRA has been awarded annually by the Association of Korean Physicists in America (AKPA) since 1994.

QUALIFICATION and NOMINATION: Candidates are limited to those who received the doctoral degree after January 1, 2001 (see the exception described above), and are to be nominated by the Chair or Head of the Department where they are employed or by the candidate's former thesis advisor in a letter detailing the importance and impact of the candidate's work. Supporting documents should include the candidate's curriculum vitae with representative publications and three letters of recommendation.

PRESENTATION: The award of \$1,500 with a plaque will be presented at the AKPA annual meeting, which will be held in conjunction with Wednesday evening dinner, on March 15, 2006 during the American Physical Society March Meeting in Baltimore, MD. The exact location of the annual meeting and time will be announced later.

Nominations and supporting letters are to be sent electronically, preferably in PDF form, to Professor Kyungsik Kang, Chair, AKPA OYRA Committee at kang@het.brown.edu and a copy to Professor Ho Jung Paik, President, AKPA at hpaik@physics.umd.edu.

3. Korean-American Physicists: Profile

Participation of Korean Americans in Mainstream Physics: The Current Patterns and Future Prospect

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Abstract

Korean American physicists came to being in significant numbers beginning in the fifties following the Korean War. The new influx in the recent years follows more varied routes: in addition to the standard graduate studies route as foreign students, some are American born and educated, and a few arrive with doctoral degrees earned in Korean universities. Many have returned to Korea after their education, training or work life in the U.S. but continue their professional life as a member of the American Physical Society. This paper examines the breadth and depth of Korean American participation in mainstream physics and presents some quantitative measures for their impact and standing within the physics community. The direction of the future development as a loosely identifiable ethnic group is aired in the light of the progress made in the recent decades.

Introduction

Physics is a universal science by way of its focus on the most fundamental principles of the physical world. The ways to unearth new physics, disseminate, test, debate and to celebrate it transcend the ethnic, regional, economic, cultural and historical divides. There is no physics that is true and appropriate only within a particular part of the world. This basic nature of physics has been the driving force that has influenced the development of the population of Korean American physicists. The breaking edges of physics are driven by the interesting questions of the moment, in contrast to the physics as a discipline. This mode of operation has tangible consequences, one of which is in the membership makeup of the American Physical Society: it includes individuals who may have been educated or trained in other allied sciences and engineering as well as in physics. The same holds true for Korean American physicists as a subgroup.

In this context, it is natural to ask whether the distribution of Korean American physicists by sub-fields of specialization tracks the distribution of those member physicists within the American Physical Society. It is also of interest to examine how such a distribution has evolved over time. I have attempted to derive some measures of how the physics community values the contributions of Korean American physicists on several hierarchical levels. This line of analysis segues into some reasonable speculations about how the evolution will unfold. Wherever possible, lessons for the next generation are identified.

Distribution of Korean American Physicists by Specialization

Physicists by nature are intensely independent and single-minded in their pursuits. Consequently, mainstream physics is defined post fact by the aggregate studies pursued by the large number of such individuals, not by any *a priori* design. I have thus reasoned that the membership directory of the American Physical Society (APS) would be the best place to cull for the patterns of interests among Korean American physicists. Similar constructions have been made for two other subgroups as reference. One subgroup is composed of APS members of Anglo-Saxon background, and the other comparison group consists of Chinese American physicists. Two APS membership directories were used for this purpose, one from 1988-1989 and another from 2001-2002 [1].

The Korean American physicists were sampled by using the common Korean last names: Ahn, Chang, Cho, Choe, Choi, Chung, Han, Hong, Jeon, Kang, Kim, Lee, Park, Shin, Yoo, and Yoon. It was found that some of these names were not exclusively Korean. By examining the full name of each entry in the initial sample, the list was further refined. Of the resulting 586 member physicists of Korean extraction appearing in the 2001-2002 APS directory, I have found that 284 resided in the United States while 302 were associated with institutions located in the Republic of Korea.

The U.S. reference group was constructed according to the following Anglo-Saxon last names: Armstrong, Brown, Davis, Johnson, Smith, Thompson, Williams, and Williamson. These names were chosen as physicists who are highly likely to have been long-time Americans. A small fraction of them was found to have non-US affiliations but no attempts were made to further refine the list of 688 names.

The APS directory entries include divisional affiliation, which identify the member's specialization within physics. The divisional affiliation is elected as an option, however, and therefore, the field of specialization can be found for some of the members in each of the above three subgroups but not for all. By the same token, a member may have more than one divisional affiliation. In any event, the divisional population, when compared with that of the U.S. reference group, can provide an aggregate profile of how Korean American physicists have branched into mainstream physics. To facilitate direct comparisons, the divisional populations are converted into percentages of the total number of members within each subgroup. Figure 1 shows the 2001-2002 data, consisting of three sets of percent divisional populations, one for each of three different subgroups: 204 Korean physicists residing in the U.S., 152 Korean physicists who are residing in Korea but active APS members, and the 489 U.S. reference group members.

The overall profile of the breadth and depth of physics engagement by the Korean American physicists as a subgroup approximates the mainstream profile of physics as a discipline. In detail there are notable differences, however. For example, both Korean subgroups have greater percent concentrations than the U.S. reference subgroup in condensed matter physics and high polymer physics. Comparing between the two Korean subgroups, Korean physicists in Korea are even more heavily concentrated in the area of condensed matter physics than those working in the U.S. On the other hand, significantly smaller fractions of both Korean subgroups are engaged in the areas of astrophysics and nuclear physics than the fraction of the U.S. reference group.

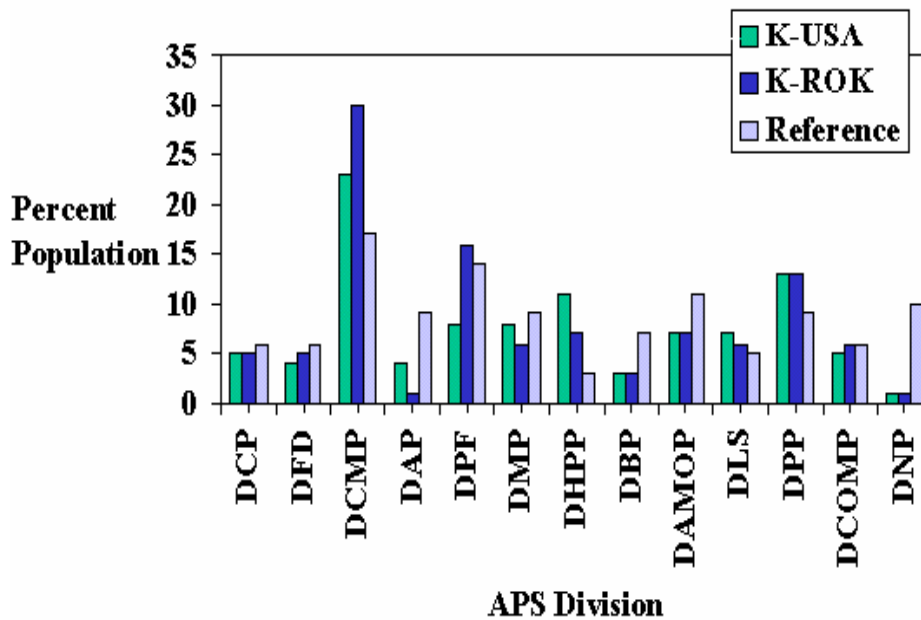


Figure 1. Percent divisional populations in 2001-2002 for the three sample groups: Korean physicists residing in the U.S. (K-USA); Korean physicists residing in Korea but active APS members K-ROK); and the U.S. reference group (Reference). APS divisions are indicated by divisional acronyms: DCP (chemical physics); DFD (fluid dynamics); DCMP (condensed matter physics); DAP (astrophysics); DPF (particles and fields); DMP (mathematical physics); DHPP (high polymer physics); DBP (biophysics); DAMOP (atomic, molecular and optical physics); DLS (laser science); DPP (plasma physics); DCOMP (computational physics); and DNP (nuclear physics).

These differences appear to be well above the margins of errors in name counting and statistical sampling. The support for this conclusion comes from analysis of the entries in the 1988-1989 APS directory. A group of 385 Korean physicists was constructed by following the same procedure described above. Here, no attempts were made to separate the Korean physicists in the U.S. from those in Korea. The U.S. reference group contained 322 names. The percent divisional populations for the two subgroups are plotted in Fig. 2. The similarities and differences between the two subgroups are essentially the same in the 1988-1989 profiles as in the 2001-2002 profiles. There are some noticeable changes over the 13-year period: The area of plasma physics has grown to be more heavily populated by the Korean American subgroup and the reverse trend is evident in nuclear physics.

In the leading order, I am forced to conclude that the stationary nature of the divisional distribution of the Korean subgroup, as contrasted against the distribution of the U.S. reference subgroup, is indicative of the maturation of the process of Korean American participation in mainstream physics. The differences in the two distributions seem intentional in that the areas of condensed matter physics, high polymer physics and plasma physics are viewed to be of importance for Korean interests. These sub-fields are closely aligned with the forces of economic development of Korea as a nation. It is not difficult to see that such forces affect the profile of the Korean American subgroup because the majority of new entrants into the ranks of practicing physicists are first educated in Korean universities before coming to the U.S. for doctoral studies.

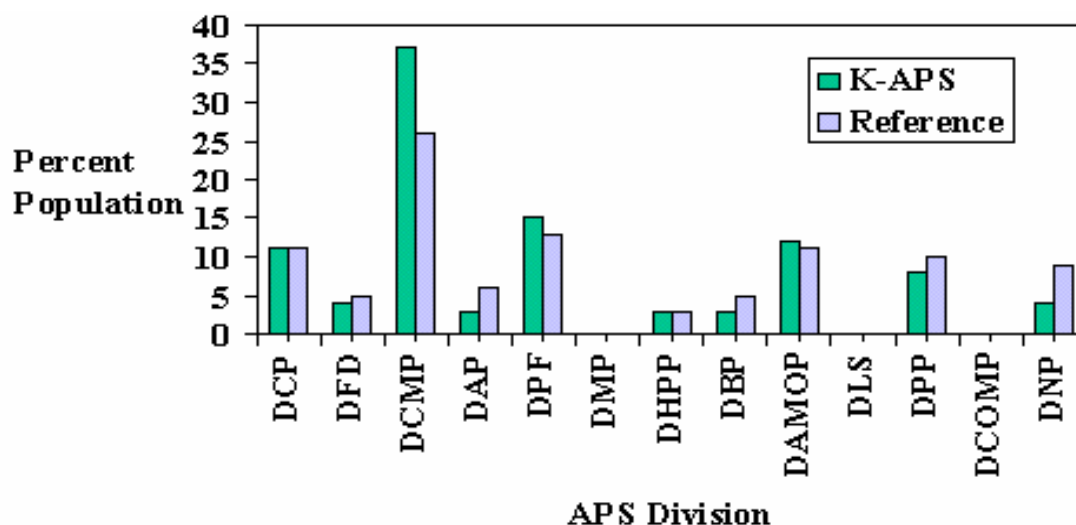


Figure 2. Percent divisional populations in 1988-1989 for the two sample groups: Korean subgroup of physicists listed as active APS members, regardless of the country of institutional affiliation (K-APS); and the U.S. reference group (Reference). APS divisional acronyms are the same as in Figure 1. DMP, DLS and DCOMP show zero percent population because these divisions came to being after 1988-1989.

Influence of Korean American Physicists in Mainstream Physics

I have analyzed the publication activities in Physical Review Letters, which is undisputedly the single most influential journal of the American Physical Society [2]. The per capita publications by the Korean Americans over the entire life of the journal through June 5, 2002 were compared with that of the U.S. reference subgroup. A total of 1,994 articles were found that were attributed to one or more of the following names: Ahn, Choe, Choi, Hong, Jeon, Kang, Kim, Shin, Yoo, and Yoon. This gives 2.68 articles per person for the duration. The corresponding number for the U.S. reference subgroup was 7.07. The U.S. reference group consisted of the following names: Armstrong, Brown, Davis, Johnson, Smith, Thompson, Williams, and Williamson.

On the other hand, the total output per decade revealed a telling trend over the intervening decades. During the sixties a total of only 59 papers appeared of Korean American authorship. During the nineties, this had jumped to 1,110 publications, which is an 18.8-fold increase from the total of the sixties. The U.S. reference subgroup had 470 articles published during the sixties and 1,888 during the nineties, a 4.0-fold increase. These figures can be compared with those of the second reference subgroup, namely, of Chinese extraction. The total number attributable to the names of Chan, Chen, Cheng, Chu, Fung, and Wang was 111 during the sixties and 1,610 during the nineties. This translates to a 14.5-fold increase. The pace of change relative to those of the two reference groups indicates a strong credible emergence of Korean Americans as a significant force in mainstream physics. This is consistent with the earlier observation that the ramp-up phase of the Korean American participation has been completed.

The number of the Korean American physicists elected to the ranks of fellows of the American Physical Society paints a different picture. According to the 2001-2002 APS directory, 18 of 284 Korean physicists

in the U.S., or 6.3 % of the subgroup, are fellows, whereas 2 of 302 residing in Korea, or 0.7 %, are fellows. The U.S. reference subgroup shows 100 fellows out of 688 members, 14.5 %. The Chinese reference subgroup, on the other hand, shows 38 fellows out of 390 members, 9.7 % of the subgroup.

I have also looked at the total number of invited speakers at the APS divisional and annual meetings, which had taken place in the year of 2001. There were 10 speakers from the Korean American subgroup residing in the U.S., or 3.52 % of 284 members. The U.S. reference group also had 10 invited speakers, 1.45 % of 688 members. This suggests that the Korean American physicists are more heavily concentrated in the new high-interest areas of mainstream physics than the U.S reference subgroup.

There are altogether 830 winners of various APS prizes, awards, medals and lectureships over the entire life span of the American Physical Society, spanning more than one hundred years. There are two Korean Americans among them or 0.7 % of 284 names in the Korean American subgroup, whereas there are 16 out of 688 in the U.S. reference group, 2.33 %. Interestingly, both of the two Korean American winners are affiliated with non-physics institutions.

Concluding Remarks

Korean American participation in mainstream physics can look back at the past five decades, which represents only one half of the century of Korean immigration into the U.S. In the short span, the growth has been of strong monotonic expansion. The available measures show that the participation in number is fully on par with the long-term American subgroup. In view of the strong growth rate seen in the recent decades, the latest short-term productivity may exceed that of the establishment subgroup. The formal recognition of their contributions is lagging significantly behind the U.S. reference subgroup, however. This lag is in part due to the long period of gestation for the scientific confirmation process and, probably in part, due to the smallness of the Korean American physicists represented in the establishment population of the American Physical Society.

The evidence that Korea's focus on economic development has influenced the divisional population is significant and may deserve some attention. If this is interpreted as a predisposition toward applications of physics, the distribution may be at odds with the popular aspirations for producing Nobel-prize caliber physics. Historically, the physics of widest impact have been so recognized. Maximization of such impact is always associated with the genius of identifying the physics at the most fundamental level. It will pay to cultivate the culture of supporting young physicists to imagine and pursue new ideas freely, unencumbered by worldly expectations.

References

- [1] Membership directories, 1988-1989 and 2001-2002, American Physical Society, College Park, Maryland.
- [2] Electronic archives of Physical Review Letters, American Physical Society, PROLA (accessible on www.aps.org) and American Institute of Physics, SPIN Search (accessible on pinetplus.aip.org).



Dr. Yong W. Kim is Professor of Physics at Lehigh University. Dr. Kim was educated in Seoul National University (B.S. in Physics, 1960; and M.S. in Physics, 1962). After the military service in Korea, he completed his doctoral studies at the University of Michigan (Ph.D. in Physics, 1968). First joined the Lehigh University faculty in 1968, he has been a professor of physics since 1977. He also was chairman of the Physics Department from 1984 to 1987. Dr. Kim served as the 12th President of AKPA for 1990-91 and in 2003-04 as a Distinguished Foreign Visiting Professor of Physics at Seoul National University.

[ED. This paper by Professor Y. W. Kim is one of several invited papers presented at the Centennial Conference of Korean Immigration to the U.S., Falls Church, VA, August 16-18, 2002. The contents of the paper are as timely today as they were in 2002. Other invited papers in that session of the conference are posted in the Korean-American Forum at www.skas.org.]

4. OYRA Recipients (4)

Dr. Insu Yi was the 1997 recipient of the OYRA award. At the time of the award, Dr. Yi was a researcher at the Harvard-Smithsonian astrophysics lab as well as the Johns Hopkins University's astrophysics group. He has since then returned to Korea to join the Korea Institute for Advanced Studies. He then moved Ewha Women's University. According to an unconfirmed report, Dr. Yi has since returned to the States, and pursuing a career completely outside physics. His current whereabouts remains unknown to us.

5. Quantum Mechanics and Life

A Quantum Recipe for Life

By Paul Davies

Nature 437, 819 (6 October 2005)

[Paul Davies is a physicist in the Australian Centre for Astrobiology, Macquarie University, Sydney, and the author of *The Origin of Life* (Penguin, 2003).]

Sixty years on, Erwin Schrödinger's prediction that quantum mechanics would solve the riddle of how life started has not been fulfilled. But the appeal of using quantum theory to solve the mystery persists.

One of the most influential physics books of the twentieth century was actually about biology. In a series of lectures, Erwin Schrödinger described how he believed that quantum mechanics, or some variant of

it, would soon solve the riddle of life. These lectures were published in 1944 under the title ‘What is life?’ and are credited by some as ushering in the age of molecular biology.

In the nineteenth century, many scientists thought they knew the answer to Schrödinger's rhetorical question. Life, they maintained, was some sort of magic matter. The continued use of the term ‘organic chemistry’ is a hangover from that era. The belief that there is a chemical recipe for life led to the hope that, if only we knew what it was, we could mix up the right stuff in a test tube and make life in the lab.

Most research on biogenesis has followed that tradition, by assuming that chemistry was a bridge — and a long one at that — linking matter with life. Elucidating this chemical pathway has been a tantalizing goal, spurred on by the famous Miller–Urey experiment of 1952, in which amino acids were made by sparking electricity through a mixture of water and common gases. But the concept has turned out to be something of a blind alley, and further progress with pre-biotic chemical synthesis has been frustratingly slow. The origin of life remains one of the great outstanding mysteries of science.

To take up Schrödinger's suggestion, a radical solution to the problem, ‘What is life?’ could be that quantum mechanics enabled life to emerge directly from the atomic world, without the need for complex intermediate chemistry. Life must have a chemical basis: organic molecules provide the hardware for biology. But what about the software?

When Schrödinger asked, ‘What is life?’ he could already glimpse the central significance of the cell's information storage and replication processes, even though the role of DNA and the genetic code was yet to be discovered. Today, the cell is regarded not as magic matter but as a computer — an information-processing and replicating system of astonishing precision.

When life is viewed in terms of information processing, the problem takes on a different complexion. Biologists have always regarded reproduction — one of the defining characteristics of life — as being about replicating structures, whether they be DNA molecules or entire cells. But to get life started, all you need is to replicate information.

Information can be processed at the quantum level orders of magnitude more rapidly than it can be processed classically, which is why the race is on to build a quantum computer. Furthermore, quantum systems can make use of phenomena such as superposition, entanglement and tunnelling to enhance their performance.

A quantum replicator need not be an atomic system that clones itself. Indeed, there is a quantum no-cloning theorem that forbids the replication of wavefunctions. Rather, the information content of an atomic system must be copied more or less intact — not necessarily in one step, but maybe after a sequence of interactions. This information might well be in binary form, making use of the spin orientation of an electron or atom, for example. Quantum mechanics thus provides an automatic discretization of genetic information.

What is this atomic Adam, this quantum replicator that begets life? I confess I haven't a clue about the best environment in which to find such a thing, although I know it would not be in a traditional primordial-soup setting. It might even be a frigid location such as an interstellar grain. Wherever it was, once a popu-

lation of information replicators became established, quantum uncertainty provided an inbuilt mechanism for variation. Throw in a selection mechanism and the great darwinian game could begin.

How, then, did organic life arise? Information can readily be passed from one medium to another. At some stage, quantum life could have co-opted large organic molecules for back-up memory. Eventually the organic stuff would literally have taken on a life of its own. The loss in processing speed would have been offset against the greater complexity, versatility and stability of organic molecules, which in turn would have enabled organic life to invade many environments.

Something is missing from the account so far — complexity. Replicating a single bit of information is one thing; generating and replicating long concatenations of bits is quite another. How complexity emerges in quantum systems is a subject still in its infancy, but the principles involved could be illuminated by applying algorithmic complexity theory to quantum information theory.

When Schrödinger published his book, quantum physicists were flushed with the success of explaining the nature of matter. Life is, after all, just a state of matter, albeit a weird one. Sixty years on, Schrödinger's expectation has not been fulfilled. Molecular biologists are content with ball-and-stick models based on classical concepts. But so long as they cling to that, the origin of life will remain mysterious.

Even if we can't reconstruct the precise details of life's emergence, knowing the general principles would be a huge advance. Proving a quantum-mechanical theorem that puts a bound on the probability that such-and-such a system can replicate to a certain accuracy, and evolve to a particular level of complexity, might answer astrobiology's burning question: Was the origin of known life a freak accident, or the expected outcome of intrinsically bio-friendly laws of physics? Momentous implications would flow from the answer, as the issue addresses one of the deepest questions of existence: Is life a cosmic phenomenon, or are we alone in the vastness of the Universe?

6. Dues and Contributions

As of December 31, 2005, dues and contributions received: \$10,125.

You can now pay your due or send your contribution *electronically*. Please go to www.akpa.org, register as a member, and follow the instruction for electronic payment. Or if you prefer, you can still mail your check to our Treasurer, Professor Eun-Suk Seo at the Institute for Physical Science and Technology, University of Maryland, College Park, MD 20742. The annual membership fee for regular members is \$25. If you are a student, do not worry about the fee because we are in the process of eliminating the \$5 fee for the associate membership.

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