

Darwin Chang

(1954-2005)



儘管再多的文字和影像
都拼湊不出完整的他

Just Memory

先聽達文說...

我高中時即對數學很有興趣，因為想應用數學了解自然世界而以第一志願進入台大物理系。在台大期間養成對物理及其現象的濃厚興趣與作研究的野心。1978年服完兵役後至Carnegie-Mellon University 與美國科學院院士Lincoln Wolfenstein學習粒子物理，期間養成了隨時思考物理的習慣並培養問重要問題的能力。Wolfenstein是粒子現象學的大師，尤其是在CP對稱性破壞及微中子質量方面，這兩方面從此成為我長期研究的重點，而它們也正是目前粒子物理最重要的課題。1983年畢業後至University of Maryland擔任博士後研究，研究生時累積的創造力在此時發揮了出來。



在Maryland三年中，我與Rabi Mohapatra及其他教授共同發表了三十一篇論文，其中六篇在物理界最受重視的期刊Physical Review Letters (PRL)上登出。在這段期間，我的研究擴及至大統一場論和弦論，因這樣的研究表現使我在1986年被Northwestern University 聘為助理教授。在Northwestern期間，我繼續原來的專業領域、粒子現象學、和我在Maryland時培養出來的領域，大統一場論和弦論。1987年，我訪問美國國家費米實驗室時認識了最要好的長年合作夥伴，UIC的姜偉宜教授 (Wai-Yee Keung)。十三年來，我們共發表了三十六篇論文包括在P.R.L.的九篇。1993年我離開了Northwestern回到清華大學擔任教授；由於台灣的物理學家密度高，我的合作對象和研究領域更加擴展，例如與中研院的學者研究Chiral Perturbation Theory 及CDF物理，與UC Riverside的教授E. Ma研究頂夸克物理，與UC Berkely教授李東海、清華同仁林秀豪及牟中瑜及交大同仁Baruch Rosenstein研究高溫超導體的Vortex lattice 和其他凝態物理性質。目前，除了繼續上述的研究之外，我認為生物物理及計算物理會成為未來的主流領域，因此計劃在這兩方面下工夫，希望發展計算物理的方法來研究生物物理的問題。





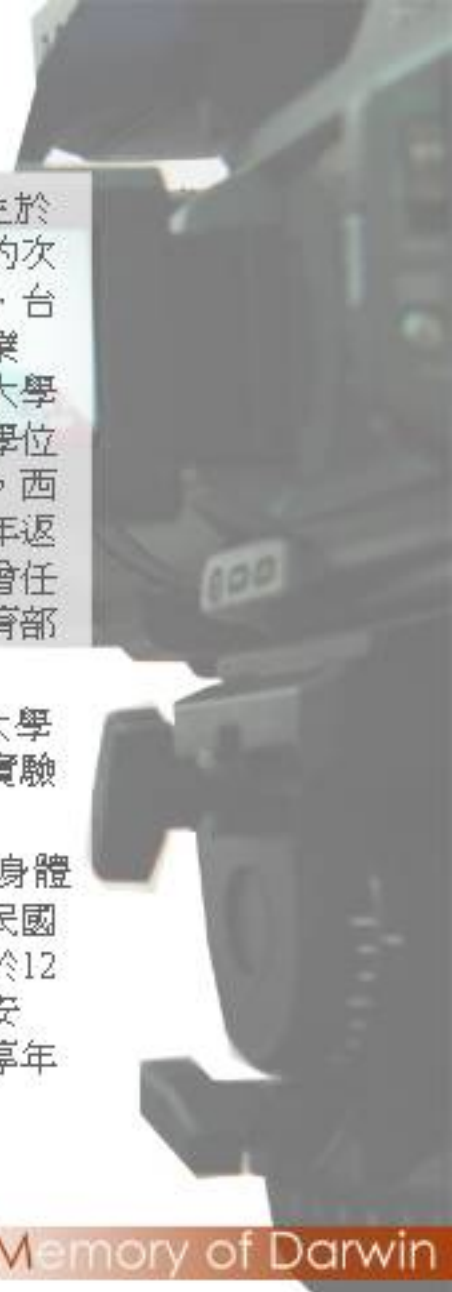


生平簡介

張達文教授於民國43年6月29日生於台中市，為張耀西先生與林精華女士的次子。張教授先後就讀於台中師院附小、台中一中、與台灣大學。台大物理系畢業後，至美國賓州匹茲堡市卡耐基美崙大學深造，先後獲物理碩士(1980)與博士學位(1983)。美國馬里蘭大學博士後研究，西北大學物理系任助理教授。於民國82年返台任教於國立清華大學物理系迄今。曾任物理學會理事長，多次獲國科會與教育部殊榮，清華自然科學講座教授。

與妻林淑端育有二子，長子立揚大學畢業後於美國工作，次子維揚於新竹實驗中學高中部就讀。

張達文教授於民國93年6月底發現身體微恙後，至台大醫院接受手術治療，民國94年再次接受化學治療後體況漸虛，於12月29日子夜在台大醫院由親人相隨下安眠。佛法禪詞隨後移靈至台中故鄉，享年51歲。







Darwin's Favorite quotes

"You know the world is going crazy when the best rapper is a white guy, the best golfer is a black guy, the tallest guy in the NBA is Chinese, the Swiss hold the America's Cup, France is accusing the U.S. of arrogance, Germany doesn't want to go to war, and the three most powerful men in America are named 'Bush', 'Dick', and 'Colon'."

Chris Rock ---- as forwarded to me in an e-mail on April 21 2003, after Bush invaded Iraq, gotten rid of Saddam Hussein and China infested the world with SARS.

There is an artist imprisoned in each one of us. Let him loose to spread joy everywhere.


---- Bertrand Russell's last manuscript "1967". For more from this favorite philosopher of mine, see this great [collections](#) Or [The Bertrand Russell Archives at McMaster](#) or, [collections2](#).

They said sex is the solution to every problem facing mankind.... NO! That is NOT true. Sex is NOT the solution, Sex is the question, and the solution is YES!

---- A street philosopher at Berkeley encounter by Paul Senjanovic (as told to me by Goran).

The true value of a human being is determined primarily by the measure and the sense in which he has attained liberation from the self.

Albert Einstein



寧繁毋略寧下毋高寧近
毋遠寧拙毋巧
胡適
朱子語





Darwin's Favorite quotes



陳進 CHEN CHIN 1907-1998

陳進為台灣第一位留日女藝術家，為日本膠彩畫大師鈴木清弓、伊東深木的高徒。

民國十六年與林玉山、郭雪湖入選展[台展三少年]，並多次入選[台展][帝展]。

陳進膠彩畫作細膩典雅，展現大家閨秀之高雅溫淨。

I was visiting Taipei National Palace Museum on April 14th, 2003 when they had a special exhibit on "History of Taiwan-- Dutch collection" and "Blossoming Through the Ages--- Women in Chinese Art and Culture from Museum collection". But what caught my attention most was a small theater showing videos about three Taiwanese women who each broke new ground in her profession: the first Taiwanese conductor, the first Taiwanese novelist and Ching Chen (陳進), the first female professional Taiwanese painter. I only have time to see one of them.

The one I saw was Ching Chen.

She was the first Taiwanese woman ever to go to Japan to study painting before WWII. After the war, she worked as a professional painter and teacher in Taiwan for the rest of her life.

She died at the age of 92 in 1998.

Near the end of this video about her life story, she appeared in front of the camera... looking 90 years old... and said:

**I AM NOT BEAUTIFUL, BUT I PURSUE MY IDEAL
ALL MY LIFE AND THAT IS BEAUTIFUL!
---- Ching Chen (陳進)**

That is most beautiful indeed!



Darwin's Favorite quotes

WHAT I HAVE LIVED FOR.

Three passions, simple but overwhelmingly strong, have governed my life: the longing for love, the search for knowledge, and unbearable pity for the suffering of mankind. These passions, like great winds, have blown me hither and thither, in a wayward course, over a deep ocean of anguish, reaching to the very verge of despair.

I have sought love, first, because it brings ecstasy -- ecstasy so great that I would often have sacrificed all the rest of life for a few hours of this joy. I have sought it, next, because it relieves loneliness -- that terrible loneliness in which one shivering consciousness looks over the rim of the world into the cold unfathomable lifeless abyss. I have sought it, finally, because in the union of love I have seen, in a mystic miniature, the prefiguring vision of the heaven that saints and poets have imagined. This is what I sought, and though it might seem too good for human life, this is what -- at last -- I have found.

With equal passion I have sought knowledge. I have wished to understand the hearts of men. I have wished to know why the stars shine. And I have tried to apprehend the Pythagorean power by which number holds sway above the flux. A little of this, but not much, I have achieved.

Love and knowledge, so far as they were possible, led upward toward the heavens. But always pity brought me back to earth. Echoes of cries of pain reverberate in my heart. Children in famine, victims tortured by oppressors, helpless old people a hated burden to their sons, and the whole world of loneliness, poverty, and pain make a mockery of what human life should be. I long to alleviate the evil, but I cannot, and I too suffer.
This has been my life. I have found it worth living, and would gladly live it again if the chance were offered me.

---- **Bertrand Russell** in PROLOGUE. WHAT I HAVE LIVED FOR.





達文的學經歷



畢業學校	國別	科系所	學位	起迄年月
Carnegie-Mellon University, Pittsburgh.	U.S.A.	Physics	Ph.D.	1980/07-1983/06
Carnegie-Mellon University, Pittsburgh.	U.S.A.	Physics	M.S.	1978/09-1980/06
National Taiwan University, Taiwan.	R.O.C.	Physics	B.S.	1972/09-1976/06

經歷：

- Professor at National Tsing-Hua University, Taiwan. (August 1993-now)
- Adjunct Professor at University of Illinois at Chicago, Illinois U.S.A. (January 1994-now)
- Adjunct Staff Scientist at Institute of Physics, Academia Sinica, Taipei, R.O.C.. (October 1994-now)
- Assistant Professor at Northwestern University, Illinois. (August 1986-July 1993)
- Postdoctoral Fellow at Center of Theoretical Physics and Department of Physics and Astronomy at University of Maryland. (August 1983 – July 1986)



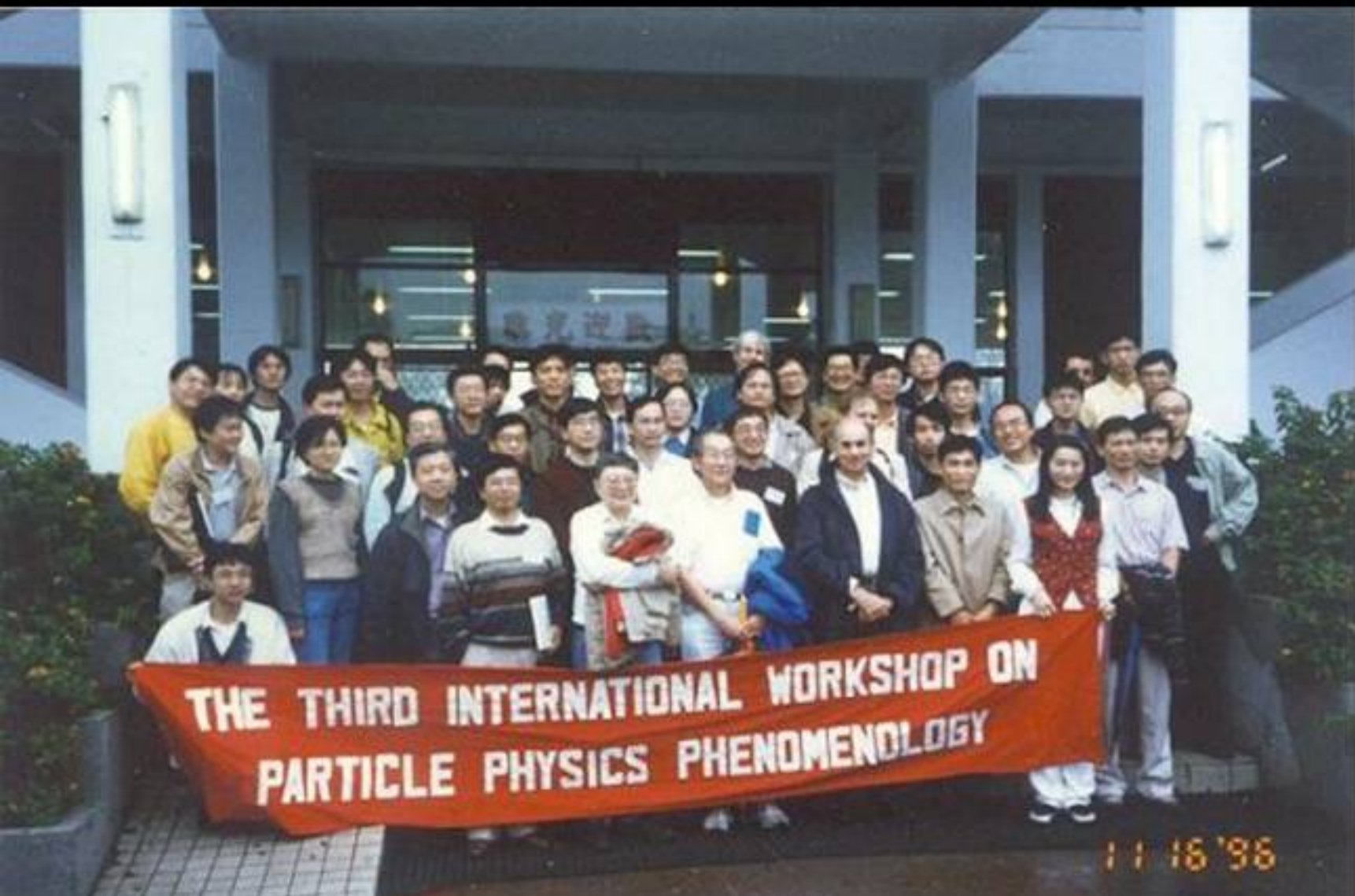


고등과학원 Korea Institute for Advanced Study (KIAS)

2nd International Conference on Flavor Physics

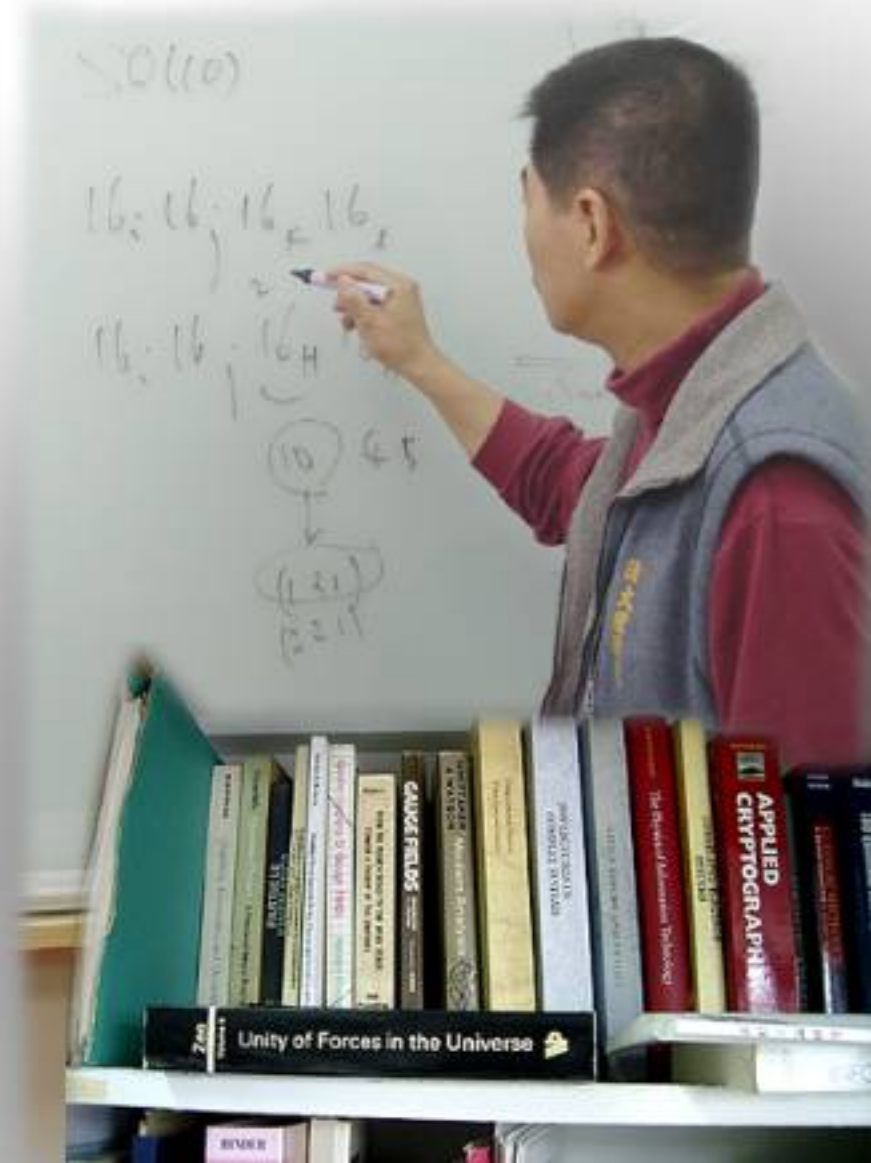
October 6-11, 2003 KIAS International Conference Hall, Seoul, Korea





研究領域

達文於1983年在美國Carnegie-Mellon大學的美國國家科學院院士Lincoln Wolfenstein 指導下拿到理論物理學博士，專攻自然界中CP對稱性破壞的機制。CP對稱性破壞是宇宙中最奇妙的現象，對此現象的了解不但可以了解自然界的組成基本單位，亦可以解釋宇宙中物質的起源。他以豐富的想像力，提出CP對稱性破壞的各種可能的機制，並提供各種機制對未來實驗的預測。他的許多理論及計算現在已是國際廣為接受的權威。







對學術之重要貢獻

- 一、粒子物理模型建構
- 二、CP對稱性破壞之機制
- 三、微中子質量之起源
- 四、其他粒子現象學方面



粒子物理之進展有賴實驗與理論模型之相互激勵；達文是世界知名之粒子理論模型建構專家，從低能量的電弱作用理論之延伸，到高能量的大統一場論及超高能量之超弦理論模型建構皆有所貢獻。另一方面，達文是全球物理界中CP 對稱性破壞專家，他在這方面的論文經常在具有權威性的期刊PRL上發表，並被廣為引用。這些成果對人類在CP 對稱性上的理解有著深遠的貢獻。此外，達文也深入研究微中子質量的起源，其中數篇因1998年日本Super-K實驗發現微中子質量的可靠證據而中心被發掘其重要性。最近幾年，達文開始與幾位傑出的國內外凝態理論家共同研究凝態物理方面的基本課題，反應了不同領域之基礎物理之共通性。對物理界而言，達文之回國為國內理論物理界帶來新的活力、新的研究精神，對物理界之演進有十分衝擊，對年輕一輩有激勵之作用。

1996~1997年任職國科會計劃審議人主持計劃審議會。1998年被物理界選為任期改制為兩年制的理事長（在此之前為一年制），其勇於嘗試新辦法、新方向的作風為物理界帶來新氣象。另外，他於1993年提倡學術網路，促成中研院創設twhepnet，造成今日物理學家以網路相連之風，對於學術界之研究、合作及互動有確實之貢獻。





教育部第四十七屆學術獎頒獎典禮



重要之學術研究成果

代表著作

- Geometric CP Violation with Extra Dimensions, (with R. N. Mohapatra) **Phys.Rev. Lett.** 87 (2001)211601. hep-ph/0103342. (CP 對稱性破壞有可能是因為幾何而引起)
- New Constraint from Electric Dipole Moments on Chargino Baryogenesis in MSSM (with W.-F.Chang, W.-Y.Keung) **Phys. Rev.** D66 (2002) 116008. hep-ph/0205084. (電子的電偶矩對超對稱模型之宇宙質子來源的機制有重大限制)
- An Interpretation of Neutron Scattering Data on Flux Lattices of Superconductors (with Chung-Yu Mou, Baruch Rosenstein and Ching-Long Wu) cond-mat/9708079 **Physical Review Letters** 80, 145 (1998). (我的第一篇凝聚物理的P.R.L.關於D-Wave超導之Vortex格子性質)
- New Two Loop Contribution to Electric Dipole Moment in Supersymmetric Theories, (with Wai-Yee Keung and Apostolos Pilaftsis) **Physical Review Letters** 82 No.5, 900 (1999); Erratum-ibid. 83(1999) 3972.
- A Simple Charged Higgs Model of Soft or Spontaneous CP Violation without Flavor Changing Neutral Currents (with David Bowser-Chao and Wai-Yee Keung) **Physical Review Letters** 81, 2028 (1998).
- Electron Electric Dipole Moment from CP Violation in the Charged Higgs Sector (with David Bowser-Chao and Wai-Yee Keung) **Physical Review Letters** 79, 1988 (1997).
- Triple Pseudoscalar Decay Mode $Z \rightarrow AAA$, (with W.-Y. Keung), **Physical Review Letters** 77, 3732 (1996).
- Proposal for detecting Top Spin Correlation Effects at Tevatron, (with S.-C. Lee and Alexei Soumarokov), **Physical Review Letters** 77, 1218 (1996).
- CP Violation in Hyperon Decays Due to Left-Right Mixing, (with X.-Q. He and S. Pakvasa) **Physical Review Letters** 74, 3927 (1995).
- A Scheme for Radiative CP Violation, (with W.-Y. Keung) **Physical Review Letters** 74, 1928

$SO(10)$

16, 16, 16, 16,

 $16:16:16H$

$\begin{matrix} (10) & 45 \\ \downarrow & \\ (131) & \\ (221) & \end{matrix}$

學術榮譽

- 1987 美國能源總署傑出新進研究人員獎(Outstanding Junior Investigator)
- 1993 中華人民共和國自然科學獎
- 1994~1999 中華民國國科會傑出獎
- 2000~2003 中華民國國科會特約計劃主持人
- 1996、1997 中華民國國科會自然處物理組計劃審議人
- 1998、1999 中國民國物理學會理事長
- 1998 中華民國中山學術獎
- 2003 中華民國教育部學術獎
- 2003~2006 中華民國國科會特約計劃主持人
- 2006 中華民國物理學會特殊貢獻獎





茶 節 師 教



Supervisor of Darwin at Carnegie-Mellon



Lincoln Wolfenstein

University Professor of Physics
Ph.D., University of Chicago

The major area of research is the phenomenology of weak interactions based upon the ideas of modern gauge theories. Among the problems being considered are neutrino masses, the origin of CP violation, lepton number violation and the solar neutrino problem.

It is only a little over 25 years ago that I first met Darwin, a bright new graduate student at Carnegie Mellon. From then on there were so many discussions and so many ideas as he finished his thesis and then went on to Maryland, Northwestern and back to Taiwan. Interestingly we have no joint papers (except for the summary of a workshop on CP violation in 1983). The reason, I think, is that after we discussed an idea he ran away with it so fast that all I could do was make a few comments. We did start working on a book together, but unfortunately we could not get very far.

I am glad that I managed one trip to Taiwan, which I remember very fondly. After a meeting at Tsing-Hua we went to Taipei and Darwin took me on a tour of the city sights. My vision of Darwin always has a smile on his face just as he had when some new theoretical idea was emerging. We will all miss him.

Cooperation with Darwin during Maryland



Rabindra Nath Mohapatra

Professor at University of Maryland
Ph.D. University of Rochester 1969

I first met Darwin in 1983 when he joined Maryland as a post-doc after freshly graduating from Carnegie Mellon. We started an instant collaboration for the next three years and beyond and Darwin became one of my most favorite collaborators. During those three years we would meet and talk many ideas every day and published many papers. It was so much fun and so stimulating to discuss physics with Darwin. He was of course not only an extremely insightful physicist but he was among the hardest working and brilliant collaborator that I have known in my lifetime.

He was always full of joy and physics to him was not about prizes and competitions but about the joys of discovery and that is an example that many could emulate. He always had a cheerful smile and an easy going manner in research that surely endeared many of his collaborators to him.

After Darwin left Maryland, we tried to recruit him many times to the Maryland faculty but my colleagues in the department always complained that he is too much like me and did not want to duplicate talent. Surely, our styles were very similar and we had a lot in common and may be that is why I always enjoyed working with him. Anyway, Darwin flourished wherever he went continuing to write many brilliant papers and a leaving a trail full of high intellect.

Last time we met was in 2001 when he visited Maryland for a seminar and as usual we started talking a new idea as soon as he finished his seminar. It was about extra dimensions and CP violations. We wrote two papers on the idea and still have an unfinished work somewhere in my computer. He invited me several times to visit Taiwan and for one reason or another that did not work out from my side.

Darwin's untimely passing away is a very personal loss to me and not me alone, many physicists will miss him and will for ever remember his smile and personality and passion for physics.



Tony Zee

Permanent Member, Institute
for Theoretical Physics
Professor of Physics,
Department of Physics, UCSB

Dear Shuduan,

Please, please take very good care of yourself and kids-- we believe that is Darwin's wish too. I hope that there will be a chance for me to talk to you more when timing is more appropriate. We are concerned about you and kids very much, from the bottom of our hearts.

Attached are a letter to Darwin, and a few pictures for the possible use of the memorial DVD.

Please be free to let us know if you need any further assistance from us.

Warmest regards,
Janice & Tony

親愛的 Darwin,

你就這樣悄悄離開我們，怎麼可以呢？
不是說好了就要帶著全家來 Santa Barbara 玩？
不是說好了還有好多層樓要共同完成？
好捨不得你，我們真的好捨不得。這幾天
我們難以平復的情緒與無限的感懷。
在燭光中看著你的照片，一切已向你會說。

請你一路保重好，帶著你的堅持、你的勇氣、
你的赤子、你的理想。還有 Bob Dylan 的禱詞，
自在逍遙。還有不時提醒 Shuduan 要常和我們
聯絡，來美國一定帶孩子來玩。Tony 當然繼續
深耕理論物理的研究，我們再會不時掛念
照顧你的家人。請放心。

Darwin，你將永遠永遠活在我們心中。
因為你、Tony 和我們的人生因而閃亮憂悅。無限感激，
請帶著我們豐厚溫暖的愛與祝福，遠走高飛吧！

一鴻 Tony
敬啟 Janice 敬留。

12-31-2005

于 Santa Barbara





Darwin Chang memorial

It is with a deep sense of loss that I mourn the passing of Darwin, a great friend in both my professional and personal lives. Darwin was the first to invite me to visit Taiwan, where I have had a wonderful time discussing physics with Taiwanese colleagues during repeated visits over the last seven years or so. Indeed, during one of those visits I wrote a paper with Darwin on neutrinos. Perhaps even more significantly, when I attended a cosmology conference in Taipei two years ago Darwin introduced me to a lovely young woman Janice Wang who is now my wife. We will all miss Darwin with his boisterous laughter and infectious passion for life.

-- Tony Zee



In memory of Darwin Chang (2-1)

by Ling-Fong Li, Carnegie Mellon University

Darwin came to Carnegie Mellon University in the Fall of 1978 after his bachelor degree from Taida and 2 years of military service. First thing he did when he arrived, was to look up his classmate from Taida, Shien-Uang Jen (now at Institute of Physics, Academia Sinica) who came to Carnegie Mellon a year earlier because Jen was exempted from the military service for his poor eyesight. I remember Darwin mentioned that he has been on his own ever since his college days and felt some sense of isolation and needed someone friends. With his easy going personality he made many friends. He went back to Taiwan a year or so later to get married and brought his newlywed, Shu-Daun, to Pittsburgh. A year later a son, Li-yang was born.

Darwin had decided very early on that he wanted to be a theoretical high energy physicist. Again he did not want to do it by himself. So he went around and tried to recruit his fellow students to do it with him. After some effort, he succeeded in persuading Palash Pal to form a team with him. They can be seen doing many things together including discussing physics. Clearly, Darwin is the leader of the pact. Darwin's enthusiasm about physics is contagious. If he found something interesting he will go around and tried to get every body interested and to work on it. Due to his persistence he succeeded most of the times. He really enjoyed working with other people, the more the better. This had made the working atmosphere of our high energy group here very lively. In 1980 he and Palash started working on the PhD thesis under the supervision of Wolfenstein. He can be seen in Wolfenstein's office very often in long sessions. Even though I was not his advisor, he constantly came to discuss high energy physics with me and we managed to write a couple of papers together.

In memory of Darwin Chang (2-2)

by Ling-Fong Li, Carnegie Mellon University

Darwin left Pittsburgh in 1983 when he finished his PhD. I saw him every few years either in some conferences or when he came back here to do some work with Wolfenstein. His enthusiasm in physics had never diminished. Over the years he had been very productive. The number of papers he had written is quite stunning, around 200 or so. This is two or three times as much as average production in high energy physics. Over the course of his career, he had also very strong influences on the people around him. He was quite generous in giving other people credit for their research contribution.

Another thing I remember is the incident in the summer of 1981. Darwin was house sitting for Professor Wen-chen Chen of Statistics Department, who had gone back to Taiwan to visit his family. Not long after his arrival, he was found dead on the campus of National Taiwan University. Most likely, Prof. Chen was killed by the security agents for his involvement in the group which is in opposition to the government. I think this incident had long lasting influence on Darwin.

Besides doing physics, Darwin liked to swim and swam quite well. One time he went to visit Goran Senjanovic at Virginia Poly Tech and they swam in the lake for more than 2 hours. That is something which can only be done by very experienced swimmer. Over the years he seems to be always in good physical shape, very energetic and active. But he told me when we were in Singapore in 1990 for an international conference that he had very high cholesterol count, more than 300 or so. He did not seem to take it seriously. This was very typical of him, always optimistic and felt that things will work out somehow. I was very surprised last year to hear that he had stomach cancer. Worse yet it was discovered after the surgery that the cancer had spread. When I was back to Taipei last April, I went to see him in Hsinchu. He seemed to be in good spirit and fought the battle with admirable courage even though every body around him realized that his days were numbered.







Made by A-PDF PPT2PDF





I am writing this with complicated feeling of sadness and deep remember. My research environment has been rather isolated and my private history in phenomenologies in particle physics was short. For these reasons, I did not know his brilliant fame when I met him first at ICTP Trieste on 2002 August (I am not sure its exact date). I stayed at Trieste On August 1 to 31 for one month and I have no friend to discuss at Trieste at that time. I happened to enter one room whose door was open, where Darwin presented. I introduced myself without any definite intension and he asked me my concern on research and he suddenly entered to the essence of the reseach.

I was very impressed with his shapness and concentration. I forgot the detail of the arguments at that time but it was surely concerned with $SO(10)$ GUT. After the first encounter I frequently visit his office, whos typical pattern was as follows.

I presented some ideas to him and he defeated it and I went back to my office. One hour later I returned to his office and responded to his claim. He argued against it again and I could not answered to that, and I returned to my room. Again I returned to his room and he argued against it and so on. For several days we repeated these processes.

For these experiences my stay at Trieste got very enriched. On several days after he came back to Taiwan and he proposed me to visit National Tsinghua University.

On 2005 April I visited Tsinghua. Unfortunately he was heavily sicked already at that time but I was once again surprised with his concentration on physics even in such sitution. It is no necessity to mention about it since all colleagues well know it.

I promissed several times with Darwin that we will meet again at ICTP and enjoy discussions in the complete health condition. Unfortunately it became impossible.

I feel very sad with his death especially since I lost my brother one year before his death on the same disease. $\leftarrow B9g \rightarrow 8 \leftarrow (B(gassyou - pray for him)$

--Takeshi Fukuyama

Department of Physics,

Some Words For Darwin



Takeshi Fukuyama

2005 3 9

Dear TC

It is very sad to hear of Darwin's passing.

It is especially sad, as he was such a joyous person, full of life, and it is very hard to imagine that he is not with us anymore.

We will all miss his stimulating and provocative presence and his uninhibited laughter. He was a pleasure to be with, and great company and will be missed sorely by his wide circle of friends and colleagues around the world.

Please convey my condolences to his family as well other colleagues in the department.

Sincerely,

-- **Sandip**

Darwin was a wonderful colleague. So energetic and stimulating. And now, so early in life, it is truly tragic to hear of his passing. He certainly will be missed. Please extend my heartfelt condolences to his family, colleagues, and students.

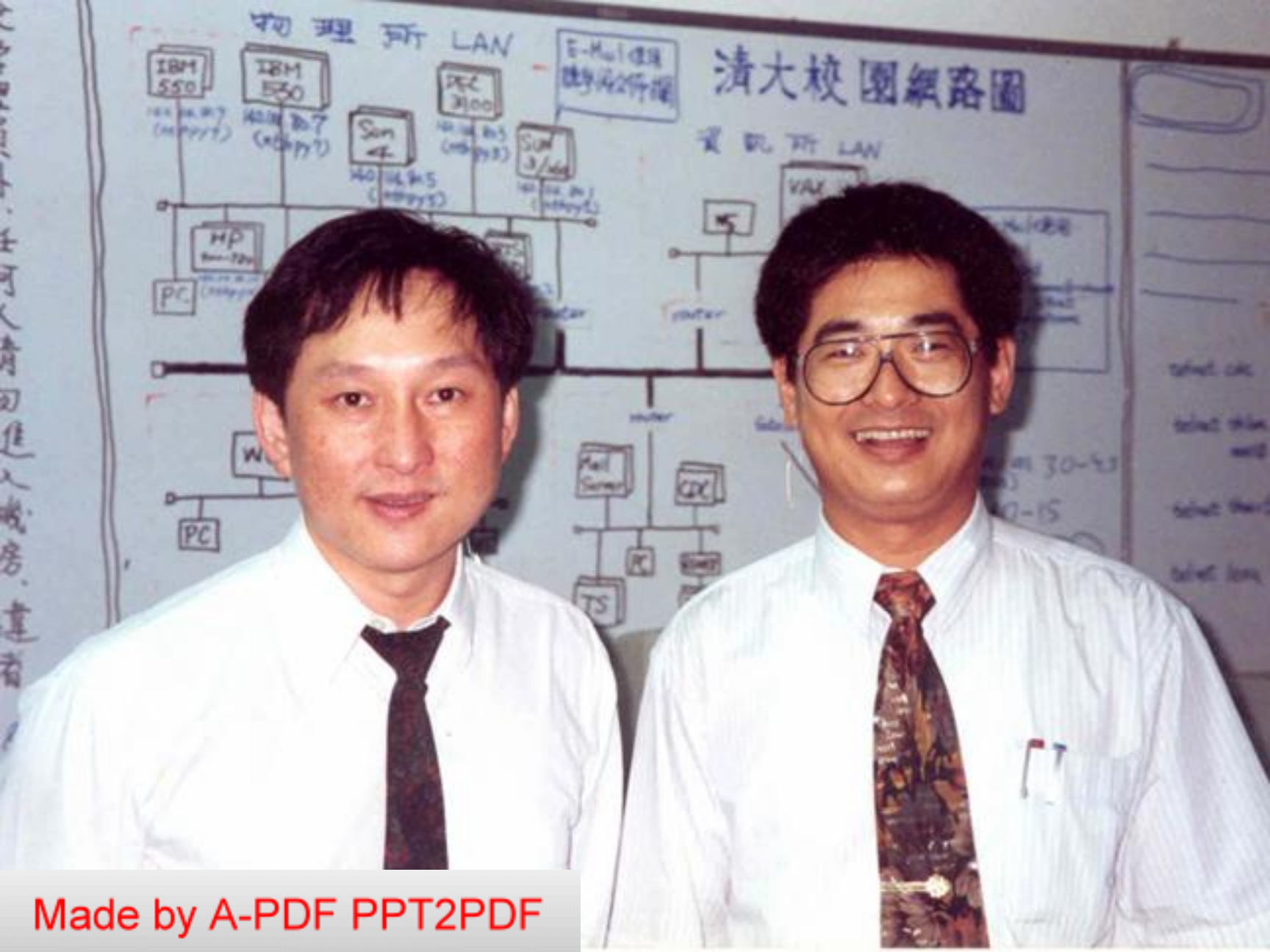
-- **Bob Oakes**

Dear T.C.,

I'm really sad for the loss of a friend and a collaborator. However, the joy and enthusiasm he succeeded to convey to people around him remain.

Please convey my condolences to his family and colleagues.

2019-12-10 22:25



Dear TC,

Thank you for informing Darwin's friend about the sad news. Darwin died at a rather young age. His birthday was June 29, 1954, according to my record. So he was only 51 when he passed away. Please check out the correct data with the physics department of NTHU.

I am still not able to recover from what has happened in the last week.

-- **Wai-Yee**

TC,

That's terrible news about Darwin. I got the word from Yee Keung within hours of his death. I last saw Darwin about 18 months ago at SLAC, during a seminar. I looked for him after the seminar, but he had already vanished.

When is Chinese New Year, moon cakes and all?

-- **Tom**

Thomas J Weiler
Professor at Vanderbilt University

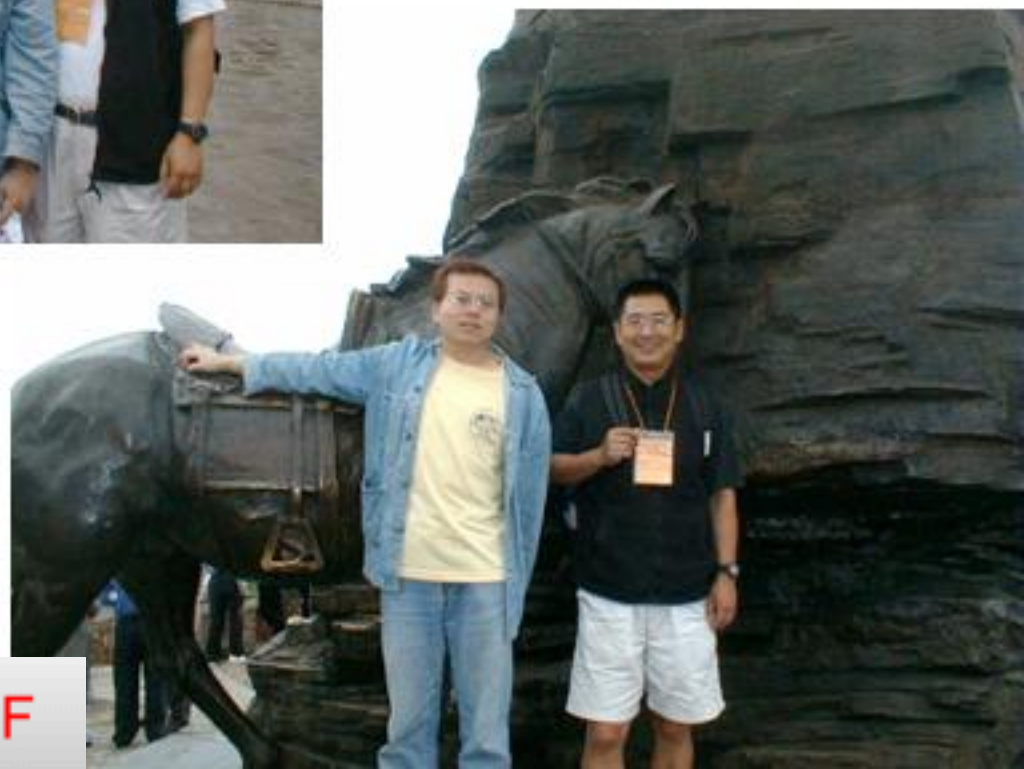
Dear TC

That is very sad news to start the New Year. Darwin was a valuable colleague who could be relied upon to provide new insights on a problem, and was always a delight to work with and be with. Please convey my condolences to his family and his colleague

--**Bruce McK**

Some Words For Darwin











Dear T.C.,

Thanks for the information which I have heard from Tu-Nan. I sent an e-mail greeting card to Darwin a few days before he passed away. I don't suppose he even knew about it. Last summer, we had a long chat at his house. He was quite ill, but not weak (not in appearance anyway). It is indeed very sad to learn that he passed away. It is a sure thing that he will be remembered by many of us.

--- C.P.

Dear T.C.,

I heard about it last week from Wai-Yee. And since then, I have been feeling so miserable that I could hardly talk with anyone about it. I will call up Shu-Duan in a day or two, though I don't know what to say. Can you please send me Shu-Duan's home address?? Some people have asked me for it.

With haunting memories and saddest thoughts for Darwin,

--- Palash.

Palash B Pal
Professor
Theory Group, Saha Institute of Nuclear Physics
1/3, Bidhannagar, Calcutta 700064
e-mail: palash@theory.saha.ac.in
theory/palashbaran.pal/

Some Words For Darwin

Palash B Pal

On the 29th of December, 2005, I got an e-mail message from my friend Wai-Yee Keung. It was very short: only one sentence. And it carried the terrible news: our friend Darwin Chang passed away.

Darwin and I both went to Carnegie-Mellon University for our PhD. He went there in 1978. I joined in 1979, but started taking the second year courses because I thought that the first year courses had already been covered, more or less, by the courses I took in Calcutta earlier. So, from my first day in Carnegie-Mellon, Darwin and I were classmates. Then we worked under the same advisor, Professor Lincoln Wolfenstein. We worked on similar topics, had a lot of discussions together, and finally had our thesis defence on the same day: Darwin in the morning, and I in the afternoon. Our friendship and collaboration continued even after our PhD. We overlapped as post-doctoral fellows at the University of Maryland, and we wrote many papers together. In 1994, I came back to India. Darwin was already in Taiwan at that time. After that, mainly because of the geographical separation, we did not write any papers together. Darwin asked me many times to visit Taiwan. He had elaborate plans which included even the name of the school that my children could go to during my visit there. But, for one reason or other, I could not go. I invited Darwin to visit me in Calcutta. Once, he almost came. I mean, he made all the arrangements, but somehow the Indian Government did not give him the visa to enter India. After that, he promised that he would come some other time. It is now obvious that he would not keep his promise.

Even more than a month after Darwin's demise, it is difficult to put my feelings into words, particularly in a language that is not natural to me. I will not even try that. I will just recount some anecdotes about Darwin that probably some of his closest friends and relatives do not know.

Darwin taught me how to swim. When I came to Carnegie-Mellon, I did not know swimming. After a few months, Darwin volunteered to teach me swimming. Every day, at lunch time, he and I would walk over to the University Gym, where he would give me the basic lessons for floating and kicking. I would practise them at one corner of the pool, and he would do laps. And every now and then he would advise me, "Sometimes pretend that you are drowning. Then the beautiful life-saver girl would come and hold you to rescue you." But at that time, I was such a novice that it was hard for me even to pretend anything while in water. Then came a time when Darwin thought that I should try swimming from one end of the pool to the other. I started from the deeper end and started advancing, with Darwin on my side. Midway, I got nervous and lost my control. I began sinking into water. Darwin quickly sensed it and pulled me to the side. Then he asked me, "What happened? You could have done it! What went into your mind?" I told him, "I was just pretending, hoping the girl would save me. But you could not wait, you pulled me out, and spoiled everything." Darwin said, "Ah! So that's it! Your acting was so perfect that even I did not understand. Next time you pretend to drown, tell me in advance so that I am out of your way."

Palash B Pal

In mid-1983, both of us were writing our PhD thesis. I should point out that this was a time before the advent of personal computers and word processors. The Computer Science Department had put together a program called "Scribe", which, as far as I know, was the first word-processing program. Both Darwin and I decided to use this for writing our thesis. When we were almost done, it turned out that Darwin had to leave town for two days for some family matters. However, the thesis could not wait any longer, it needed to be submitted in a day or two. Darwin came to me and said, "Palash, I do not have time to write the conclusion of my thesis. Why don't you write it?" I tried to reason with him, "Look, I know what you have done. But how am I supposed to know what your conclusions would be?" He said, "Oh, that's very easy. Just copy the file for the Introduction. Any place where I have said "we will show", replace it by "we have shown", and so on. That will be the file for the Conclusions." A beautiful recipe for the computer age, I thought. Fortunately, he could squeeze out some time in the next couple of days, so the final version of the Conclusions contained much more than what was contained in that simple recipe.

Palash B Pal

Once, during our PhD days, I walked into Darwin's office and found him sitting there, obviously extremely depressed. This was nothing unusual, so I asked him, "What's the matter? Is there a new cause for depression, or just the usual one?" He replied, "I was reading Dirac's Quantum Mechanics book." I said, "So, it is quantum depression, hey?" He said, "Don't make fun of me." I said, "Okay, tell me what is depressing in that book. It is a lucid and well-written book, and certainly you are not going to tell me that you are not understanding the book." He said, "No no, I understand it well." I asked, "So what is the problem?" He looked at me and said, "Don't you see it yet? When Feynman read the book, he could not understand it, so he had to invent the path integral method. But look at me! I am understanding everything that Dirac wrote. So what is there for me to do?"

That epitomizes Darwin Chang for me. Always restless, always eager to find something new to do. It is a pity that the laws of the universe that we all are trying to unravel do not include a law for not stopping such lives at the age of 51. I wish such a law were there!







Dear Prof. T.C. Yuan,

Thank you for informing me the new?
I have known the very sad news from my friends.
I was very shocked...I really miss him...
I pray the peace of Darwin's soul from my heart.

--- **Nobuchika Okada**

Dear T.C.,

It was a profound shock and sorrow that I learned of the death of professor Darwin Chang and I know that these feelings are shared by all who know him and worked with him. Please accept my deepest sympathy and convey my sympathy to his family.

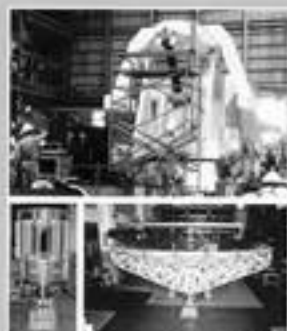
--- **Chong Sheng Li**

Dear T.C.,

This is all very sad. I hope the following is helpful:

It was my good fortune to be Darwin's colleague during his years at Northwestern University. His cheerful and energetic enthusiasm for nearly everything is greatly missed. But we also must celebrate his life, which enriched our own lives so much. I am reminded of a time I was arguing with Darwin about the merits of nearby Chinese restaurants. I finally deferred to his judgement and we went for lunch at his favorite one. After lunch, walking back to the physics department, I told him that I still thought his favorite choice was not as good as my own favorite. Darwin simply laughed and told me "You didn't order wisely", which ended the debate and left me joining him in laughter. He will be missed.

--- **Bob**



本期主題：天文物理
一九九九年十二月
<http://www.phys.ntu.edu.tw>

物理雙月刊

物理
雙月刊

- 張達文教授訪談錄
 - －物理雙月刊 (18卷2期 - 1996年4月) P.264
- 給會員的信
 - －物理雙月刊 (21卷6期 - 1999年12月) P.689







Darwin's Lectures

- Overview on CP Violation
- Dr. Darwin Chang, Colloquia and Special Seminars, SLAC, KAVLI INSTITUTE FOR THEORETICAL PHYSICS, UC Santa Barbara, Nov. 15th, 2000

<http://online.itp.ucsb.edu/online/colloq/chang1/>

01 Overview on CP Violation

02 Introduction to CP Violation

03 CP Violation in the Standard Model

04 CP Violation in the Standard Model

05 CP Violation in the Standard Model

06 CP Violation in the Standard Model

07 CP Violation in the Standard Model

08 CP Violation in the Standard Model

09 CP Violation in the Standard Model

10 CP Violation in the Standard Model

11 CP Violation in the Standard Model

12 CP Violation in the Standard Model

13 CP Violation in the Standard Model

14 CP Violation in the Standard Model

15 CP Violation in the Standard Model

16 CP Violation in the Standard Model

17 CP Violation in the Standard Model

18 CP Violation in the Standard Model

19 CP Violation in the Standard Model

20 CP Violation in the Standard Model

21 CP Violation in the Standard Model

22 CP Violation in the Standard Model

23 CP Violation in the Standard Model

24 CP Violation in the Standard Model

25 CP Violation in the Standard Model

26 CP Violation in the Standard Model

27 CP Violation in the Standard Model

28 CP Violation in the Standard Model

Made by A-PDF PPT2PDF

Darwin in My Memory (4-1)

Chen-Pin

1996 Autumn

As a freshman in Tsing-Hua, I was really excited about my first class in general physics. It was at Room501 in physics building. After the ringing of the class bell, a professor with a crew cut came in. He wore the shorts and sandal, but with the socks on his feet. He is Darwin. At that time, I never knew how important he will be in my life. But as my first physics teacher in the college, he already impressed me. I think not only me but all my classmates can't forget his passion while explaining the physics. And how he explained everything using the metaphor of Jackie Chan's fighting. He was mighty and sometimes made students feel awe. But once in a while I can see the shyness in his smile. After many years later, he once told me that he was very shy as a student. No one believed him. But I can imagine how a shy boy became strong under the beauty of physics palace.

I can remember the first time I made contact with him. Of course I did not dare to knock his door. I sent him an email, asked him about in what situation we can define the potential. He replied me with a question: why don't you ask me in the class? By his threatening email, I asked him in the next class. I can't remember what he answered me. But I knew how he wanted me to learn the way of studying physics. Till now, I am still trying to be "brave" enough, though he must be disappointed at me

Darwin in My Memory (4-2)

Chen-Pin

Physics

Although I was very interested in elementary particle physics, I did not know Darwin's research area at that time. In my sophomore year, for the professor lectures in Physics Camp, I invited him to give a talk to those high school students. Few days later, he gave me a reply with the title of his talk: The Unbearable Lightness of Being. I pondered: what is this? Doesn't he suppose to give a physics talk? Then I saw the subtitle: the mystery of the neutrino's mass. That's first time I noticed that he is a romantic physicist. And also the first time I noticed that this is a problem in elementary particle physics. What I didn't notice is that the neutrino's mass is such a big problem that till now no one gives a satisfactory answer. I attended the lecture and found it really interesting. I said to myself, Darwin is the best choice of the advisor in Tsing-Hua. In the rest of my undergraduate life, I did not take any his class nor had contact with him. Sometimes I can hear from Chung-Hsien about what he was doing with Darwin. But those physics seem to be far-reaching for me. Sometimes I can hear the legend of him about how he taught a class in order to learn that subject. Anyway I didn't get familiar with him until year 2000 when I entered the graduate school in Tsing-Hua. I talked to him and hope him could be my master thesis advisor. But he said no. The reason he gave me was that he will be away for one year. Then that summer he went to US. However I keep bothering him by emails. I don't know how he changed his mind. After winter vacation of 2001, he and Wai-Yee send me an email and we discussed a model about solving the strong CP problem. This is another big problem in physics I first learned from Darwin. He also wanted me to learn the two-loop calculation with We-Fu.

Darwin in My Memory (4-3)

Chen-Pin

It turned out that he was away for one and half year. However, through the occasional talks with him, I do learn a lot from him. He is definitely an expert on CP violation phenomenology. By looking at the equations, he can quickly read what the possible physical consequences are. Through his guide, I saw the Nature express her startling phenomena from equations we wrote down. I like to think: math implies what happen. But he told me the opposite: what happen implies math. He once told me: quantum field theory is nothing sacred, but just a tool. You should throw away the tools if it were not adequate. You may think of him being a practical man as a physicist. However I can't forget one thing happened as I was the first year graduate student. I found a very old quantum field theory book on the shelf of my office. It's Darwin's book. On the back of cover, he wrote down some words: God talks to human using math as the language.

He also wanted me to throw away the books and warned me that books are the necessary evil! Although he did read a lot of books in his college life, he said it was all useless. I don't think it is all useless. But I can appreciate Darwin's words now. The more you throw away the more you can create. Knowing how others are wrong is more important than knowing how they are right. Darwin's words again: you should be a player rather than a reader. It's hard to estimate how much I learned from Darwin. But I'll say, without him I can't have so much fun in physics now. I wish I could be as good as him. To me, he is an artist. Poets describe the world by the poems. Writers use the words. Painters use the pictures. He uses the math.

Darwin in My Memory (4-4)

Chen-Pin

2005 Spring

In retrospect, I found I knew so little about Darwin. The most part of this man is unknown to me. However how much we can know about a person and how long we can live... Only a sparkle of the inspiration between people will be precious.

The last time I saw him was in the spring break last year. Darwin had lunch with me and the "601's" guys, thought he didn't talk much. His little son was there, I can notice that he cared much about his son. I hope he can be my father too. After lunch, I said farewell to him. I felt like to give him a hug. But I didn't. I just said: take care. And he replied me with a smile. Looking at his back, I didn't know that it was the last time I can talk to him.

After I graduated from Tsing-Hua, he always made me think of my father. It's fair to say that till now only two men care about my future. One is my father, one is Darwin. For me, they are the only giants in this world.



Darwin's Favorite songs

- Tom Waits: Time {from Rain Dogs}
May 25th, 2002
- Tori Amos singing Tom Waits: Time
May 25th, 2002
- Leonard Cohen singing One of Us Cannot Be Wrong
1998
- Bob Dylan singing Blowing in the wind,
1975



Darwin's Favorite songs

Time

- Recent Favorites:
- [Tom Waits: Time {from Rain Dogs}](#)
May 25th, 2002
- [Tori Amos singing Tom Waits: Time](#)
May 25th, 2002
- Tom Waits is singing like a drunken sailor stranded on land looking for his sail.... which I feel like I am so often... which you would feel like you are if you really have a good perspective on whatever you are doing...

It is hard to sing Waits' song better than Waits. But Amos is doing a great job... coming close.
- [Lyric](#) is attached below and can be found in [Tom Waits](#) site go to lyrics index and look for "Time".





Made by A-PDF PPT2PDF

Darwin's Favorite songs

Time

Well the smart money's on Harlow and the moon is in
the street
And the shadow boys are breaking all the laws
And you're east of East Saint Louis and the wind is
making speeches
And the rain sounds like a round of applause
And Napoleon is weeping in a carnival saloon
His invisible fiancée's in the mirror
And the band is going home, it's raining hammers, it's
raining nails
And it's true there's nothing left for him down here

And it's time time time, and it's time time time
And it's time time time that you love
And it's time time time

And they all pretend they're orphans and their memory's
like a train
You can see it getting smaller as it pulls away
And the things you can't remember tell the things you
can't forget
That history puts a saint in every dream

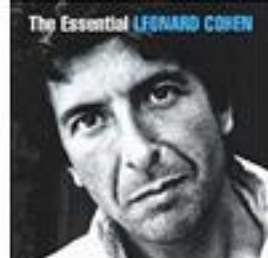
Well she said she'd stick around until the bandages came
off
But these mama's boys just don't know when to quit
And Mathilda asks the sailors "Are those dreams or are
those prayers?"
So close your eyes, son, and this won't hurt a bit

Oh it's time time time, and it's time time time
And it's time time time that you love
And it's time time time

Well things are pretty lousy for a calendar girl
The boys just dive right off the cars and splash into the
street
And when they're on a roll she pulls a razor from her boot
And a thousand pigeons fall around her feet
So put a candle in the window and a kiss upon his lips
As the dish outside the window fills with rain
Just like a stranger with the weeds in your heart
And pay the fiddler off 'til I come back again

Oh it's time time time, and it's time time time
And it's time time time that you love
And it's time time time
And it's time time time, and it's time time time
And it's time time time that you love
And it's time time time

Darwin's Favorite songs



Songs

One Of Us Cannot Be Wrong -by Leonard Cohen from his "Songs"

I lit a thin green candle
to make you jealous of me
but the room just filled up with mosquitoes
they heard that my body was free
Then I took the dust
of a long sleepless night
and I put it in your little shoe
and then I confess
that I torture the dress
that you wore for the world to look through

I showed my heart to the doctor
He said I'd just have to quit
Then he wrote himself a prescription
and your name was mentioned in it
Then he locked himself
in a library shelf
with the details of our honeymoon
and I hear from the nurse
that he's gotten much worse
and his practice is all in a ruin

I heard of a saint who had loved you
so I studied all night in his school
He taught that the duty of lovers
is to tarnish the Golden Rule
And just when I was sure
that his teaching was pure
he drowned himself in a pool
His body is gone
but back here on the lawn
his spirit continues to drool

An Eskimo showed me a movie
he'd recently taken of you
The poor man could hardly stop shivering
His lips and his fingers were blue
I suppose that he froze
when the wind tore off your clothes
and I guess he just never got warm
but you stand there so nice
in your blizzard of ice
Oh please let me come into the storm

Darwin's Favorite songs

Blowing in the wind, Bob Dylan

How many roads must a man walk down
Before you call him a man?
Yes, 'n' how many seas must a white dove sail
Before she sleeps in the sand?
Yes, 'n' how many times must the cannon balls fly
Before they're forever banned?
The answer, my friend, is blowin' in the wind,
The answer is blowin' in the wind.

How many times must a man look up
Before he can see the sky?
Yes, 'n' how many ears must one man have
Before he can hear people cry?
Yes, 'n' how many deaths will it take till he knows
That too many people have died?
The answer, my friend, is blowin' in the wind,
The answer is blowin' in the wind.

How many years can a mountain exist
Before it's washed to the sea?
Yes, 'n' how many years can some people exist
Before they're allowed to be free?
Yes, 'n' how many times can a man turn his head,
Pretending he just doesn't see?
The answer, my friend, is blowin' in the wind,
The answer is blowin' in the wind.



Darwin's Recent Poems

YOU ANGEL YOU

JAN 9, 2002

YOU

NOV 20, 1999

ALL MY LIFE

JUNE 24, 2000

IF I don't have your love

Sept 29, 1996

To a Friend

September 23, 1996

Who are you? (a poem on neutrino in Chinese)

written for NSC report in 1998

But Only Me

Spring 1999

Missing you

February 1997


Two poems: Old Pine Tree and Bitter Melon

(Ancient Poems in chinese)

Poetry Journal in June issue 1975

You Angel You

Jan 9 2002



You knocked on my door
and questioned the frozen heart
You angel you ...
you angel on the horse ...
And I have to stop working to talk to you ...
You lifted your fingers to open windows and light rushed
in like speeding trains
You angel you ...
you angel on the horse ...
And I have to stop talking to see you ...
You opened your rope and revealed a beautiful bleeding
soul
You angel you ...
you angel on the horse ...
And I wonder when will I stop crying I wonder ...







Made by A-PDF PPT2PDF



Made by A-PDF PPT2PDF

YOU

Nov 20 1999

You come from the sky.
You have no wing but you can fly.
You are married to sadness and grounded by thy.
You dream about sunshine in the darkest night.

You are the Nova ready to blow.
You have the energy ready to show.
You live with sparks, arts, sounds and works.
But the only thing that can trigger you is love.

There are many faces to live
many stages to act
many lies to take
many sighs to let

The joy comes and joy goes.
With a kiss of sadness, the joy was born,
the joy grows older and sadness takes over.

But it is this up and down
we really enjoy it all!







All My Life

lazy afternoon of June 24, 2000, rev. June 25
to the music of "The Promise" by Springsteen

All my life,

I've been trying to find,
under the rocks, or
under every thought,
a jet of gushing flow
to cleanse the holes in my soul

All my life,

I've been trying to find,
behind every broken promise
behind every selfish sadness,
a glimpse of persistent romance
to light a corner in my loneliness

All my life,

I've been trying to find,
despite every passing prejudice,
despite every insecure hatred,
a little more passion for the living
to burn deeper in my being

All my life,

I've been trying to find,
after every beautiful soul I
encountered
after every unfulfilling dream I
blundered
a joyful peace in my human weakness
to accompany me to my willing
decease

All my life,

I've been trying to find,
beyond my childish ego,
beyond my dreamy passion,
a beautiful way to live,
a joyful way to die.





Made by A-PDF PPT2PDF



IF I DON'T HAVE YOUR LOVE, LOVE!

Sept 29 1996

If I don't have your love, Love!
mountains are just rocks,
oceans are just waters,
birds are only making
sounds, and life...
life is nothing but
a drama to bore.

If I don't have your love, Love!
books are just words,
knowledges just tools,
music can only echo in
darkness, and life...
life is nothing but
a passage to death.

If I don't have your love, Love!
festivals are just temporal
escape from loneliness,
laughters are just transient
breaks from sadness,
sexes are just intercourses
for the ejections of
frustration, and life...

.....
what is the point of life?









To a Freind

-- Mon Sep 23 22:30:09 1996 by Darwin Chang
-- slightly revised Sun Oct 18 1997

Dear Goran,
..... my model,
..... my sample of beautiful being,

So beautiful you are as a human,
why bother to think more children
don't let the past makes you sadden
health is the only youthful garden

When shall we, you asked, meet later?
Why don't we go skiing together
when your broken parts' better.
We can flying over some powders
somewhere in Europe this winter!

Regarding the poetry in my life,
it is as tiny as distant star light,
while the only sweet collection of my night
is still living with fighting illini.
If memory of you is forever on my mind,
day dreaming of love is my only delight.

I am still living with pain...
and joy in some kind of sense,
as if life will be in vain
if I stop running like a train.

Bad habit is hard to quit,
bad physics with no wit,
bad attitude that doesnot fit
eating at your soul bit by bit....

Dear Goran,
..... my model,
..... my sample of beautiful being,

when we shall meet again,
let there be sun, be thunder and be rain!

just
Darwin

Darwin's Poem



我是微中子

written for NSC report in 1998

若情愛，你是永遠的龍罩
你是正午中天的直視
是午夜徹地的餘溫
若單戀，你是暗夜的冰冷
你是不理不睬的穿透
是掩天蓋地的雪崩
若春陽，你是熱情的暗示
你是永恆再生的支柱
是金山熱力的呼吸
若少女，你是變身的隱形人
你是曇花一現的羞澀
是不可捉摸的五彩
是顫顫輪轉的青春
你的質量
你的身影
你的身份
但是，
你以女媧的纖纖細手
撐住盤古的漫長歲月
平撫新星的狂暴
調和春日的煦久
吸引銀河無盡的環繞
你是哲學過客們永恆的思考
你是誰？

若有若無
時隱時現
似真似假





But only me

written in summer 1999

revised July 10 2000

Every man can give you sweeties,
can tell you he loves you, needs you.

But only me, babe,
only me
can tell you how to live!

Every man can throw you engagement
can sign you marriage, contracts or rules.

But only me, babe,
only me
can give you your freedom!

Every man can cook for you,
can clean your dishes, do your laundry,

But only me, babe,
only me
can turn your night into heaven
give you wings like angel!

Every man can admire your beauty,
can play with your body, make you high

But only me, babe,
only me
can dig into your heart
expose the beautiful character beneath!

Every man can discover you.
But only me, babe,
only me can create you!

Every man can say he loves you.
But only me, babe,
only me know how!







Missing You

February 1997

Missing you is like sunlight at the break of day
It came from nowhere, everywhere slowly, warmly
And suddenly it covered everything the blue sky the fresh air
the sweet earth and reached deeply into my heart
Missing you is like the waterfall being formed
It came from little droplets in the air, on the leaves
And gradually, it gathered into streams beneath the trees into rivers
between the valleys into the roaring white waters and eventually
surging over cliff under the weight of your beauty

敬請排隊
PLS, IN A LINE

Darwin's Office

Darwin in a nap.
beauty

T.C. 借了
Mathematica Book

放在 613 室
討論杯理

去圖書館
馬上回來

Darwin's Ancient Poems in Chinese



two poems: Old Pine Tree and Bitter Melon

(老松及苦瓜五千年)

**published in chinese Blue Stars 藍星 Quarterly Poetry Journal
in June issue 1975**

老松

九千里的寒風子
數不清的松針松果松針
在碎落的羽化中
就這樣垂垂老了
盤成一尊尊棘皮披髮的
老和尚
在世紀與世紀之外
朦朧冥想當年如何
避雷龍去沼熱而上 -----
當
山歌不唱
在謐靜得冰瑩的黑鴉鴉裡
只有髮霜 似雪
晶晶點點 點點低落



苦瓜五千年

——有感於「白玉苦瓜」而作

一顆光光的頭
幾根捲捲的鬚
一個扭曲的笑臉
一粒苦苦的哀哀的瓜
皺著皮 老在五千年的自憐裡
藤架之上 有蟲有蜂有夏日
咬螫捶打老瓜蒼白的頭
仍然 老瓜笑著
歪歪垂似蝶化的聯想
藤架之外 嬉戲的童子叫
苦瓜苦瓜苦辣辣
苦瓜苦瓜苦辣辣
老瓜低者頭，聽著，想著，落了——

Darwin's Favorite Poem



Under the Harvest Moon

----- From Carl Sanburg's Chicago Poems

Under the harvest moon,
When the soft silver
Drips shimmering
Over the garden nights,
Death, the gray mocker,
Comes and whispers to you
As a beautiful freind
Who remembers.
Under the summer roses,
When the flagrant crimson
Lurks in the dusk
Of the wild red leaves,
Love, with little hands,
Comes and touches you
With a thousand memories,
And asks you
Beautiful, unanswerable questions.



達文的朋友製作的追思投影片

Darwin 語錄

— 金振山提供

In memory of Darwin (張達文)

— Wai-Yee Keung 提供

羅亦安對達文的回憶 (Video)

Journal Paper

- Mass Matrix in the Higgs-Boson Model of CP Violation, *Physical Review D* 25, 1318 (1982).
- CP Properties of Light Neutrinos and Double Beta-Decay in $SO(10)$, (with P. Pal), *Physical Review D* 26, 3113 (1982).
- A Minimal Model of Spontaneous CP Violation with the Gauge Group $SU(2)_L \times SU(2)_R \times U(1)_{B-L}$, *Nuclear Physics B* 214, 435 (1983).
- Decoupling of Parity and $SU(2)_R$ -Breaking Scales: A New Approach to Left-Right Symmetric Models, (with R.N. Mohapatra and M.K. Parida), *Physical Review Letters* 52, 1072 (1984).
- New Mechanism for Baryon Generation in $SO(10)$ Models with Low Mass W_R -Boson, (with R.N. Mohapatra and M.K. Parida), *Physics Letters B* 142, 55 (1984).
- Possibilities for Finite Grand Unification with $N=2$ Supersymmetry, (with S. Kalara, R.N. Mohapatra and A. Gangopadhyaya), *Physics Letters B* 145, 323 (1984).
- Connection between Cosmological Matter-Antimatter Asymmetry and CP Nonconservation in K-Decays, (with R.N. Mohapatra and G. Senjanovic), *Physical Review Letters* 53, 1419 (1984).
- A New Approach to Left-Right Symmetry Breaking in Unified Gauge Theories, (with R.N. Mohapatra and M.K. Parida), *Physical Review D* 30, 1052 (1984).
- Muon Polarization in $K_L \mu^+ \mu^-$ Decay as a Test of CP-Violation models, (with R.N. Mohapatra), *Physical Review D* 30, 2005 (1984).
- Comment on KL-KS Mass Difference in the Left-Right Model, (with J. Basecq, L.F. Li and P. Pal), *Physical Review D* 30, 1601 (1984).
- Superspace Ward Identities in Supersymmetric Gauge Theories, (with A. Gangopadhyaya), *Pramana* 23, 631 (1984).
- Experimental Tests of New $SO(10)$ Grand Unification, (with R.N. Mohapatra, J. Gipson, R.E. Marshak and M.K. Parida), *Physical Review D* 31, 1718 (1985).
- Axions from Chiral Family Symmetry, (with P. Pal and G. Senjanovic), *Physical Letters B* 153, 407 (1985).
- Orthogonal and Unitary Matrices in Any Dimension, (with P. Pal), *Physical Review D* 32, 3294 (1985).
- Nonrenormalization of Phases, Softly Broken Peccei-Quinn Symmetry and Strong CP Problem, (with R.N. Mohapatra), *Physical Review D* 32, 293 (1985); also in *Quantum Field Theory and Quantum Statistics 2* PP51, I.A. Batalin, C.J. Isham and G.A. Volkovisky (Editors) Adam Hilger (1987).
- No-go Theorems in Minimization of Potentials, (with A. Kumar), *Physical Review D* 31, 2698 (1985).
- $SO(18)$ Unification of Fermion Generations, (with R.N. Mohapatra), *Physics Letters B* 158, 32 (1985).
- Grandunification of Three Light Generations, (with T. Hubsh and R.N. Mohapatra), *Physical Review Letters* 55, 673 (1985).
- On a Mechanism for Small Neutrino Masses, (with R.N. Mohapatra), *Physical Review D* 32, 1248 (1985).

學術著作

Journal Paper

- Grandunification of Fermion Generations: Neutrino Masses and Cosmological Constraints, (with A. Kumar and R. N. Mohapatra), Physical Review D33, 1777 (1986).
- Renormalization-group Equations in Broken Super-symmetric Theories Using Super-space Method, (with A. Gangopadhyaya), Physical Review D33, 1771 (1986).
- Could Goldstone Bosons Generate an Observable $1/R$ Potential?, (with R.N. Mohapatra and S. Nussinov), Physical Review Letters 55, 2835 (1985).
- Symmetry Breaking of $SO(10)$ with 210 Dimensional Higgs Boson and Michel's Conjecture, (with A. Kumar), Physical Review D33, 2695 (1986).
- Spontaneous Breakdown of Parity as the Origin of Isospin Breaking, (with R.N. Mohapatra, P. Pal and J.C. Pati), Physical Review Letters 55, 2756 (1985).
- The Electric Dipole Moment of the Electron in Left-Right Symmetric Theories, (with J. Nieves and P. Pal), Physical Review D33, 3324 (1986).
- On the Normal Ordering Prescription for the Evaluation of the Central Charge of the Kac-Moody Algebra, (with A. Kumar and R.N. Mohapatra), Physical Review D33, 2472 (1986).
- Constrained Fermionic System and its Equivalence with the Free Parafermionic Theory and Nonlinear Sigma Model, (with A. Kumar and R.N. Mohapatra), Z. Physik C31, 417 (1986).
- Successive Symmetry Breaking of a Compact Lie Group by a Single Irreducible Multiplet of Higgs Boson, (with A. Kumar), Physical Review D34, 666 (1986).
- A Superstring Inspired Low Energy Electroweak Model, (with R.N. Mohapatra), Physics Letters B175, 304 (1986).
- Heterotic String $O(a')$ Corrections to $D=10$, $N=1$ Supergravity, (with H. Nishino), Physics Letters B179, 257 (1986).
- BRST Quantization of Superconformal Theories, (with A. Kumar), Physical Review D35, 1388 (1987).
- Small and Calculable Dirac Neutrino Mass, (with R.N. Mohapatra), Physical Review Letter 58, 1600 (1987).
- On Axion and Fanailons, (with G. Senjanovic), Physics Letters B188, 231 (1987).
- Representations of $N = 3$ superconformal algebra, (with A. Kumar), Physics Letters B193, 181 (1987).
- Uniqueness of 10-Dimensional Superstring Models in the Fermionic Construction, (with A. Kumar), Modern Physics Letters A3, 81 (1987).
- Radiative-induced Fermion Masses, (with J. Liu), Physical Review D38, 327 (1988).
- Anomaly-induced Amplitudes of New Gauge Bosons, (with W.-Y. Keung and S.-C. Lee), Physical Review D38, 850 (1988).
- Gauge Symmetry Breaking by Thirring Interaction in Fermionic Construction of Superstring Models, (A. Kumar), Physics Letters B211, 76 (1988).

學術著作

Journal Paper

- Mechanisms of Spontaneous Symmetry Breaking in the Fermionic Construction of Superstring Models, (with A. Kumar), Physical Review D 38, 1893 (1988).
- Twisted Thirring Interaction and gauge symmetry breaking in $N = 1$ Supersymmetric Superstring Models, (with A. Kumar), Physical Review D 38, 3734 (1988).
- Spontaneous Lepton Number Breaking at Electroweak Scale, (with W.-Y. Keung and P. Paj), Physical Review Letter 61, 2420 (1988).
- Hidden Higgs Boson Models and Stellar Energy Loss, (with W.-Y. Keung), Physics Letters 217B, 238 (1989).
- Higgs-Mediated Neutrinoless Double- β Decay and Neutrino Mass in a Majoron Model, (with W.-Y. Keung), Physical Review D 39, 1386 (1989).
- Some Special Points in the Moduli Space of $n = N$ Conformal Field Theory, (with A. Kumar), Modern Physics Letters A4, 1055 (1989).
- Constraints on Muon-to-Antineutrino Conversion, (with W.-Y. Keung), Physical Review Letter 62, 2583 (1989).
- Gauge Hierarchy and Attractive Feeble Long Range Force, (with W.-Y. Keung and P. B. Pal), Physical Review D 42, 630 (1990).
- Neutrino Transitional Magnetic Moment and Nonabelian Discrete Symmetry, (with W.-Y. Keung and G. Senjanovic), Physical Review D 42, 1599 (1990).
- On Neutron Electric Dipole Moment in Left-Right Symmetric Models, (with C.S. Li and T.C. Yian), Physical Review D 42, 867 (1990).
- Heterotic Conformal Field Theory and Gepner's Construction, (with A. Gangopadhyaya, A. Kumar and J. Wang), Physical Review D 42, 2694 (1990).
- Heterotic Map on Type II Models and Uniqueness of the Partition Functions, (with A. Kumar and B. Roestad), Physical Review D 43, 80 (1990).
- QCD Corrections to CP Violation from Color Electric Dipole Moment of b Quark, (with W.-Y. Keung, C.S. Li and T.C. Yian), Physics Letters B 241, 589 (1990).
- Search for Extended Conformal Algebra, (with A. Kumar and J. Wang), Modern Physics Letters A5, 1511 (1990).
- Chromo Electric Dipole Moment of the Light Quark Through Two Loop Mechanism, (with W.-Y. Keung and T.C. Yian), Physics Letters B 251, 608 (1991).
- Two Loop Contributions to the Electron Electric Dipole Moment, (with W.-Y. Keung and T.C. Yian), Physics Review D 43, R14 (1991).
- The Electric Dipole Moment of W Boson, (with W.-Y. Keung and J. Liu), Nuclear Physics B355, 295 (1991).
- Neutrino Magnetic Moment in the Dihybrid Group, (with W.-Y. Keung, S. Lipouova and G. Senjanovic), Physical Review Letters 67, 953 (1991).
- Induced Contribution to the Neutron Electric Dipole Moment, (with K. Choi and W.-Y. Keung), Physics Review D 44, 2196 (1991).
- Solving Strong CP Problem Through Parity Doubling, (with S. Barr and G. Senjanovic), Physical Review Letters 67, 2765 (1991).
- R-Matrix Approach to Quantum Superalgebra $su_q(m|n)$, (with I. Phillips and L. Rozanski), Journal of Mathematical Physics 33, 3710 (1992).
- Chromo-electric Dipole Moment of Heavy Quark and Pseudoscalar CP Violating Operators, (with T.W. Keppeler, W.-Y. Keung and T.C. Yian), Physical Review Letters 68, 439 (1992).
- An Effective Field Theory for Neutron Electric Dipole Moment, (with T.W. Keppeler, W.-Y. Keung and T.C. Yian), Nuclear Physics B364, 147 (1992).
- Simple Mechanism for Large Neutrino Magnetic Moments, (with K.S. Babu, W.-Y. Keung and Iuan Phillips), Physical Review D 46, 2268 (1992).
- Anomalous Dimensions for the Complete Set of Dimension eight CP Violating Operators with Photons and Gluons, (with W.-Y. Keung, I. Phillips and T.C. Yian), Physical Review D 46, 2270 (1992).
- Neutron Electric Dipole Moment due to Higgs Exchange in Left-Right Symmetric Models, (with X.-G. He, W.-Y. Keung, B.H.J. McKellar and D. Wyler), Physical Review D 46, 3876 (1992).
- CP Violation in the Decay of Neutral Higgs Boson into t - and $W + -W -$, (with Wah-Yee Keung), Physical Letters B305, 261 (1993).

學術著作

Journal Paper

- CP Violation in the Top Pair Production in a e^+e^- Collider, (with Wei-Yee Keung and Iuan Phillips), Nuclear Physics B408, 286 (1993).
- Two Loop Contributions to mass by Flavor Changing Neutral Higgs Bosons, (with Wei-Shin Hsu and Wei-Yee Keung), Physical Review D48, 217 (1993).
- CP-odd Correlation in the Decay of Heavy Neutral Higgs Boson, (with Wei-Yee Keung and Iuan Phillips), Physical Review D48, 3225 (1993).
- CP Violation Observables in $e^+e^- \rightarrow \mu^+\mu^-$, (with Wei-Yee Keung and Iuan Phillips), Physical Review D48, 4045 (1993).
- A Class of Models with Large Neutrino Magnetic Moments, (with W.-Y. Keung and I. Phillips), International Journal of Modern Physics A9, 2013 (1994).
- Number Theory and Quantum Mechanics, (with Pankaj B. Pal), Modern Physics Letters A9, 1845 (1994).
- Transfer Matrix Method in Sandpile, (with C.-S. Chiu and S.-C. Lee), Models Chinese Journal of Physics 32, 405 (1994).
- CP Violation in the Cubic Coupling of Neutral Gauge Bosons, (with W.-Y. Keung and P.B. Pal), Physical Review D51, 1326 (1995).
- A Scheme of Radiative CP Violation, (with W.-Y. Keung), Phys. Rev. Lett 74, 1928 (1995).
- CP Violation in Hyperon Decays Due to Left-Right Mixing, (with X.-Q. He and S. Pakvasa), Phys. Rev. Lett 74, 3927 (1995).
- Exact Solution of A one Dimensional Deterministic Sandpile Model, (with S.-C. Lee and W.-J. Tzeng), Phys. Rev. E51, 5515 (1995).
- Baryon Chiral Perturbation Theory Up to Next-To-Leading Order, (with J.W. Bos, S.-C. Lee, Y.C. Liang and H.H. Shih), Physical Review D51, 6308 (1995).
- Two Methods of Obtaining Solvable Potentials, (with W.-F. Chang), Chinese Journal of Physics 33, 493 (1995).
- CP Violation in Hyperon Decays, (with Chia-Hsing Chien), Chinese Journal of Physics 34, 831 (1996).
- Interference Effect of Top Quark Polarizations in Hadronic Collider, (with S.-C. Lee and P. T. Hooley), Chinese Journal of Physics 34, 748 (1996).
- Proposal for detecting Top Spin Correlation Effects at Tevatron, (with S.-C. Lee and Alexei Sornmarokul), Physical Review Letters 77, 1218 (1996).
- Hyperon Weak Radiative Decay in Leading Order Chiral Perturbation Theory, (with J.W. Bos, S.-C. Lee, Y.C. Liang and H.H. Shih), Physical Review D54, 3321 (1996).
- Implications of bag in the Weinberg Three Higgs-Doublet Models, (with Chia-Hsing Chien and Chao-Qiang Ge), Prog. in Theor. Phys. 95, no. 6 (1996).
- Solutions to the Rb, Rc and π puzzles by vector fermions, (with Chia-Hsing Chang and Wei-Yee Keung), Physical Review D54, 7051 (1996).
- Dynamical Analysis of Simulational of Kosterlitz-Thouless Pairs due to Pinning, (with Baruch Rosenstein and Ching-Long Wu), Physical Review B55, 1162 (1997).
- Triple Pseudoscalar Decay Mode $Z \rightarrow AAA$, (with W.-Y. Keung), Physical Review Letters 77, 3732 (1996).
- New Limits on R-Parity Breakings in Minimal Supersymmetric Standard Model, (with W.-Y. Keung), Physics Letters B389, 294 (1996).
- SU(3) Breaking and Baryon Magnetic Moments, (with J.W. Bos, S.-C. Lee, Y.C. Liang and H.H. Shih), Chinese Journal of Physics 35, 150 (1997).
- Heavy-baryon chiral perturbation theory and reparametrization invariance, (with J. W. Bos, S.-C. Lee, Y.C. Liang and H.H. Shih), Phys. Rev. D57, 4101 (1998).

學術著作

Journal Paper

- New Findings of the Electromagnetic Response in Superconductors, (with Ching-Yi Mox, Baruch Rosenstein and Ching-Long Wu) Chinese Journal of Physics 36, 180 (1998).
- Electron Electric Dipole Moment from CP Violation in the Charged Higgs Sector, (with David Bowser-Chao and Wei-Yee Kening) Physical Review Letters 79, 1988 (1997).
- The Effect of Anisotropy on Vortex Lattice Structure and Flux Flow in d-Wave Superconductors, (with Ching-Yi Mox, Baruch Rosenstein and Ching-Long Wu) Chinese Journal of Physics 36, 238 (1998).
- Explicit Four-fold Symmetry Breaking Effect on the Vortex Lattice in D-Wave Superconductors, (with Ching-Yi Mox, Baruch Rosenstein and Ching-Long Wu) Chinese Journal of Physics 36, 245 (1998).
- The Static and Dynamical Anisotropy Effects in Mixed State of d-Wave Superconductors, (with Ching-Yi Mox, Baruch Rosenstein and Ching-Long Wu) Physical Review B 57, 7955 (1998).
- An Interpretation of Neutron Scattering Data on Flux Lattices of Superconductors, (with Ching-Yi Mox, Baruch Rosenstein and Ching-Long Wu) Physical Review Letters 80, 145 (1998).
- Interplay between Strong and Weak CP Phases, (with David Bowser-Chao and Wei-Yee Kening) Chinese Journal of Physics 35, 842 (1997).
- The Okubo relation for the baryon magnetic moments and chiral perturbation theory, (with J.W. Bao, S.-C. Lee, Y.C. Lin and H.H. Shih), Chinese Journal of Physics (1998). hep-ph/9702272
- Shifting RB and ABFB, (with Ernest Ma), Physical Review D58, 097301 (1998).
- Solution to the BSL and IC controversy of inclusive B Decays, (with C.-H. Chang, W.-F. Chang, H.-N. Li and H.-L. Yu), Physical Review D58, 094019 (1998).
- A Simple Charged Higgs Model of Soft or spontaneous CP Violation without Flavor Changing Neutral Currents (with David Bowser-Chao and Wei-Yee Kening) Physical Review Letters 81 2028 (1998).
- CP Violation in the Partial Width Difference of the Scalar Electron Decay due to the Complex Gargano Masses (with Fred Browning and Wei-Yee Kening), Physical Letters B444, 142 (1998).
- Alternative Interpretation of the Tevatron Top Events, (with Ernest Ma), Physical Review Letters D59, 091503 (1998)
- New Two Loop Contribution to Electric Dipole Moment in Supersymmetric Theories, (with Wei-Yee Kening and Apostolos Pilaftis), Physical Review Letters 82, 900 (1998).
- Preformed Pairs, SU(2) Gauge-Boson Theory and High Tc superconductors, (with C.-L. Wu, C.-Y. Mox and X.-G. Wu) Submitted to Physical Review Letters (1998).
- Spontaneous CP violation from high-dimensional operators (with Chien-Hung Chen and Chao-Qiang Ge) Prog. in Theoretical Physics 101 Feb. Issue (1999).
- Fitting Precision Electroweak Data with Exotic Heavy Quarks (with W.-F. Chang and Ernest Ma) Physical Review D61 (2000) 037301.
- Vector Quark Model and B Meson Radiative Decay, (with C.-H. Chang and W.-Y. Kening) Physical Review D to appear (2000).
- Ruling out the Weinberg Model of spontaneous CP Violation (with Xiao-Gang He, Bruce McKellar) submitted to Physical Review D, hep-ph/9909357.

學術著作

Conference Paper

- Additional two-loop contributions to electric dipole moments in supersymmetric theories (with W.-F. Chang and W.-Y. Keung) Physics Letter B to appear (2000). hep-ph/9912268
- Radiatively Induced Neutrino Majorana Masses and Oscillation (with A. Zee) Physical Review D Rapid Communication to appear (2000). hep-ph/9912380.
- Pseudo-Dirac Neutrinos (with Otto C. W. Kong) Physical Letter B to appear (2000). hep-ph/9912268.
- Summary of Workshop on CP Violation (with L. Wolfenstein) in Symposium of Intense Medium Energy Source of Strangeness PP73, T. Goldman, H.E. Haber and H.F.-W. Sadrozinski (Editors), A.I.P. (1983).
- Symmetry Breaking and Enlargement by Thining Interaction in superstring Models (with Alok Kumar) in Proceedings of the Storms Meeting, PP817, K. Haller et. Al. (Editors) World Scientific (1989). Paper presented at APS DPF Meeting, Storms, Connecticut, 1988.
- Fermionic Tools in Superstring Model Construction (with Alok Kumar) in Strings '88, s. J. Gates Jr, C. R. Preitschopf and W. Siegel (Editors), World Scientific (1989).
- Neutrinoless Double Beta Decay and Neutrino mass (with W.-Y. Keung) in Rare Decay Symposium, PP444, D. Bryman, J. Ng, T. Numao and J.-M. Poutissou (Editors) World Scientific (1989).
- Lepton Number Breaking at Electroweak Scale (with W.-Y. Keung and P. B. Pal) in Beyond the standard Model, pp224, K. whisnant and B.-L Young (Editors), world Scientific (1989).
- Gauge Hierarchy and Long Range forces (with W.-Y. Keung and P. Pal) in Proceedings of Rice Meeting-1990 Meeting of Division of Particle and Field of the American Physical Society, Ed. B. Bonner and H. Miettinen, world Scientific (1990).
- The Neutron Electric Dipole Moment and the Weinberg Mechanism, in 2D Physics-Proceedings of Moriond 1990, Ed. J. Tran Thanh Van, Editions Frontieres (1990).
- The Gluon Color-Electric Dipole Moment and the Neutron Electric Dipole Moment (with C. S. Li and T. C. Yuan) in Particle, String and Cosmology-Proceeding of PASCOS-90 Symposium, Ed. P. Nath and S. Reucroft, World Scientific (1990).
- Neutrino Magnetic Moment (with Goran Senjanovic), in Proceedings of Conference on Particle Astrophysics at Moriond-90, Ed. J. Tran Thanh Van, Editions Frontieres (1990).
- Recent Developments in Neutron Electric Dipole Moment and Related CP Violating Quantities, in Proceedings of 25th International Conference on High Energy Physics, Ed. K.K. Phua and Y. Yamaguchi, World Scientific (1991).
- Mechanisms of CP Violation in Gauge Theory and the Recent Developments, in The Standard Model and Beyond - Proceedings of Ninth Symposium on Theoretical Physics, Ed. Jihn E. Kim, World Scientific (1991).

Conference Paper

- Some Theoretical Issues in Neutron Electric Dipole Moment, in Proceedings of the Joint International Lepton-Photon Symposium & European Conference on High Energy Physics in 1991, pp. 217, Eds. S. Hegarty, K. Potter and E. Quercigh, World Scientific (1992).
- Top and CP Violation, contribution to proceedings of Workshop on Studies of Top Quarks at colliding-Beam Facility at University of Wisconsin, Madison, WI.
- Recent Progress in CP Violating Gluonic Operators and Neutron Electric Dipole Moment, contribution to proceedings of APS Division of Particle and Field Meeting 1992 at Fermi National Lab., Batavia, Illinois.
- mReg and flavor changing Neutral Couplings of Neutral Higgs Bosons, contribution to proceedings of APS Division of Particle and Field Meeting 1992 at Fermi National Lab., Batavia, Illinois.
- CP Violation in High Energy collisions, contribution to proceedings of Moriond Meeting 1993 on Electroweak Physics at Les Arc 1600, France.
- Some Potential CP Violating Observables at LEP II, contribution to proceedings of Rencontres du Vietnam Meeting 1993 on Particle Physics and Astrophysics, december 13-18, 1993, at Hanoi, Vietnam.
- Radiative CP Violation, contribution to proceedings of Beyond Standard Model IV December 13-18, 1994, Lake Tahoe USA.
- CP Violation in Hyperon Decays, contribution to proceedings of Joint JINR-ROC(Taiwan) Workshop on Intermediate and High Energy Physics June 26-28, 1995, Dubna, Russia.
- How to Observe the Interference Effects of Top Quark Polarizations at Tevatron, in Proceedings of Topics in Electroweak Physics - Lake Louise Winter Institute Feb. 18-24, 1996, Lake Louise, Canada.
- CP Violation as a Perturbative Quantum Mechanical Effect, (with Wai-Yee Keung) contribution to proceedings of Shantou Conference July 1995, Shantou, P.R.C..
- Inclusive Decays of Heavy Quarkonium, (with Chia-Hung Chang) contribution to Kroll Symposium 1996.
- Opening Talk, in Proceedings of Third International Workshop on Particle Physics Phenomenology Nov. 1996, Taipei R.O.C., Published by World Scientific (1997).
- Two Loop Induced Electron Electric Dipole Moment due to Charged Higgs, in Proceedings of Second International Conference on B Physics and CP Violation March 23-27, 1997 Honolulu Hawaii, Published by World Scientific (1998).
- A New Class of Models of CP Violation (With D. Bowser-Chao and W.-Y. Keung) in Proceedings of International Conference on High Energy Physics 1998 July, 1998 Triumf, Vancouver, Canada.
- Alternative CP Violation (with D. Bowser-Chao and W.-Y. Keung) Proceedings of Fourth Taiwan Workshop on Particle Phenomenology at N. Sun-Yat-Sen University, Kao-Shiung., Taiwan, R.O.C.. to be published by World Scientific (1998).

Last e-mail from Darwin

Subject : Fwd 珍惜生命!

Still fighting cancer.....
and the side effect of chemo.....
can not plan for anything else....

Darwin

