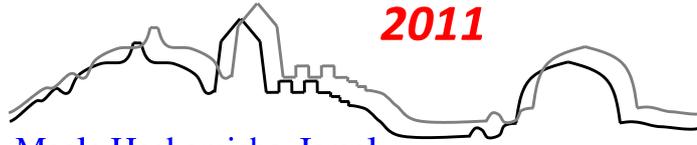


Flavor Physics & CP Violation

2011



Maale Hachamisha, Israel

September 1, 2011

Harry Lipkin, A Pedestrian's View

A. I. SANDA

*Institute for Physics Kanagawa University
Kanagawa ken Yokohama shi Rokkakubashi, 3-27-1
Yokohama 221-8686, Japan*

Abstract

The FPCP 2011 conference banquet was also a birthday celebration for Harry Lipkin. Here I give my pedestrian view of Harry.

PRESENTED AT

The Ninth International Conference on
Flavor Physics and CP Violation
(FPCP 2011)
Maale Hachamisha, Israel, May 23–27, 2011

Thanks

A great tragedy struck Japan and I must first thank all of you in Israel on behalf of all those in Japan. Government of Israel told Japanese government that it can send a rescue team of medical experts within 48 hours! Considering that it takes at least 12 hours, on a jet plane, to get to Japan, these people must be ready to leave in very short notice. We are very grateful and touched by your generosity.

Your medical team was exceptional! They had X-ray, echo, eye and throat instruments, delivery stands, operating table, and prefabricated clinics to house them. They also left everything for our medical team to use when their term was over.



Figure 1: A team of medical experts came for two weeks to help the victims of tsunami. They were stationed at Miyazaki prefecture which was very badly damaged.

1 Prologue

It gives me a great pleasure to talk at this birthday celebration for my long time friend who has also been my mentor, Harry. Let me start by saying that I feel uneasy to call Professor Lipkin "Harry". In Japan we call a person by his/her last name, and with the title - especially when the person is senior to us. I will, however, take advantage of Professor Lipkin's informal nature and call him Harry.

When Harry was born

During the conference, I was astonished to hear from one of the speakers, "I am as old as J/ψ " It's quite consistent. Nevertheless, quite astonishing how time passes.

So, I decided to find out if there are any outstanding discoveries around the year Harry was born.

- 1919 Light bending confirmed
- 1922 Friedmann proposed the expanding univers
- 1923 Stern-Gerlach experiment
- 1925 -1927 Quantum Mechanics

Indeed, when Harry was born, many of the tools we now use everyday as particle physicists did not exist.

2 My first meeting with Harry

Illinois

I did not know till I started to prepare for this talk that I overlapped with Harry back in 1962, when I was a sophomore at University of Illinois - as shown in [1]. I was just a struggling undergraduate trying to see if I can make it as a physicist. Thus I could not take advantage of Harry's presence at that time - so I thought. However, indirectly Harry was responsible for my senior thesis. I did my thesis experiment using Mössbauer effect in Frauenfelder laboratory. I found out this week that Harry introduced the Mössbauer effect to Professor Frauenfelder soon after it was discovered in 1957.

Princeton

I first met Harry during the three o'clock tea at Princeton, where I was a graduate student. Many of us, students, have studied Harry's famous book "Unitary Symmetry for Pedestrians". For us, meeting the author of a book which we are studying was a thrilling experience. While Harry was patient and accommodating to us, we were too shy to take advantage of our unique experience.

Pedestrians

The word pedestrians was so elegant and to the point, it stuck with me for all of my life. Many people have tried to copy Harry's style. For example, there was a book called "Quantum Mechanics for Dummies" or "Quantum Mechanics Even Monkeys can Understand". But nobody came even close to Harry's grace and elegance.

Harry's books: Lie Groups for Pedestrians; Unitary Symmetries for Pedestrians are still in print, after 45 years. Looking through these books recently, I realized that the key to the longevity of a book is: not to put in experimental results. It is surprising to find Harry sticking to this principle in spite of his style of keeping himself close to experiments.

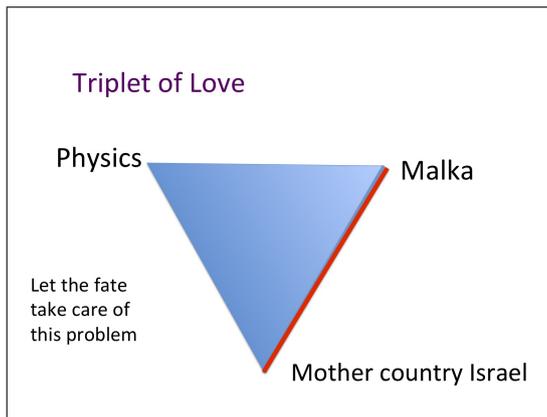


Figure 2: Many forces acted upon Harry. Since none of them truly contradicted each other, Harry managed to hang on to all three.



Figure 3: Malka and Harry in 1950, shortly before they left for Israel

3 Harry and Malka - Early Years

Since I am a pedestrian, I am limited to what I can say about Harry and Malka. I try to be as accurate as possible but I must depend on my imagination when I go from one fact to another.

Harry graduated from Cornell in 1942 with a degree in Electrical Engineering. While he studied Electrical Engineering, he knew that he would like to continue his studies in Physics.

But, there was a war. He was asked to go to MIT Radiation Laboratory during the war. Probably, Harry learned the American way of doing research while he was there. Very informal, where professors and young researchers are considered equal. This is the style Harry practiced throughout his career.

After the war, Harry went back to Princeton. There, Harry and Malka met when Malka was at Hightstown (a town near Princeton), getting ready to join the Kibbutz movement.

In Harry's mind, there was a complicated triangle. Nothing like the triplet of quarks which he will meet sometime later. There were his love for physics, love for Israel, and finally, but not necessarily in this order, love for Malka. So, there was a choice to be made. But, Harry wanted all. Harry thought that he could get married to Malka, serve Israel, and do physics at the same time. He decided to let the fate take care of the timing.

In 1951, shortly after they arrived in Israel they went to Kibbutz Sasa. At the kibbutz, Harry and Malka helped clear the stones from the field for vegetation. Harry

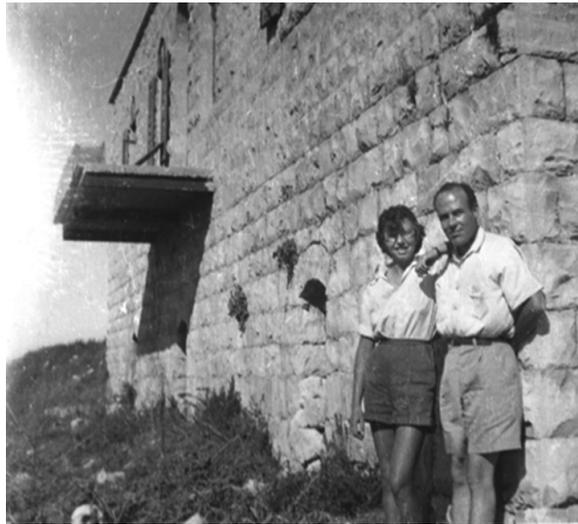


Figure 4: Malka and Harry at Kibbutz Sasa shortly after their arrival in 1951. Their room was in this building.

also fixed all the broken radios at the kibbutz. Harry was not sure if this is something he wanted to do for the rest of his life, but again he let the fate take care of this problem.

Harry's new job

Of course leaders of the new nation had many plans for this well educated couple. Finally the word came. They were invited to visit Weizmann Institute. They wanted to make better use of Harry's nuclear physics expertise which he obtained at Princeton. They sent Harry and Malka to French Atomic Energy Commission in Saclay, in order to learn about nuclear power plants. This is in support of the planned opening of Israel's first nuclear reactor.

As a postdoc at Saclay in 1954, learning about nuclear reactors, Harry did a calculation showing that if the French reactor at Chatillon was turned on and left alone, the temperature would rise but the effect of the increased temperature on the reaction would stabilize the reactor and it wouldn't blow up.

In a reactor using water, the rising temperature slows down the reaction (this is called a negative temperature coefficient). If the water reaches the boiling point, the nuclear reaction is completely turned off.

Harry showed the result of his calculation to the director. "Very interesting. Why don't you see this is really true," said the director. So, Harry was assigned two technicians to help him with the experiment to answer the question, "What happens to a reactor when it is turned on and left alone?"

Since they were working at night, they were in overtime. They were treated with



Figure 5: Malka and Harry were invited to visit the Weizmann Institute.

dinner which was brought into the control room of the reactor. The dinner in France must be accompanied by a carafe of wine. But since they were on overtime, each person was treated with two carafes of wine. So, they had a good time in the control room - doing an experiment to see if the reactor would not blow up.

After this valuable experience, Malka and Harry returned to Weizmann. In 1955, Harry established the first nuclear physics program at Weizmann Institute. In 1956, he returned to Princeton for as a visiting professor.

4 Harry's specialities

Harry is a specialist in 4 fields.

1. Nuclear Physics
2. Group Theory, Unitary Symmetry, and Quarks
3. Symmetry, Coherence and Weak Decays
4. Education

Nuclear Physics

Harry's interest in nuclear physics sprouted out when he lost interest in the old fashioned electrical engineering at Cornell. He attended Professor Bethe's lectures in stead. I guess this was the frontier of physics at the time.

Being trained as a nuclear physicist, group theory and unitary symmetry came quite naturally for him. This also explains why Harry was able to write text books on group theory methods in particle physics even before the dust has settled - at the time, there was much confusion about group theory among particle physicists.

Group Theory, Unitary Symmetry, and Quarks

According to Harry, Goldberg and Néeman had a premonition of the quark model already in 1962. They had triplets of fractionally charged quarks, nonets of mesons. Just at that time, new experimental result was announced. Later this result was shown to be wrong. Naturally, they could not explain this result and they hesitated. They were clearly ahead of their time. Then came the quark model of Gell-Mann and Zweig in 1964.

In Israel, Néeman, a co-inventor of the Eight fold way tried to convince others to work on the quark model. The first to accept the challenge was Harry. The rest is history! Harry became the main evangelist of the quark model, spreading it all over the world.

Symmetry, coherence and weak decays

In detecting **CP** violation in B decays, we have to rely on

$$e^+e^- \rightarrow \Upsilon(4S) \rightarrow B_L B_S. \quad (1)$$

Many years ago, I found out that Harry was first in pointing out that the ϕ meson has to decay to $K_L K_S$ as it has spin 1.

$$e^+e^- \rightarrow \phi \rightarrow K_L K_S. \quad (2)$$

Harry's idea of making use of coherence in the pair produced neutral K meson system has lead to a very successful experiments by KLOE collaboration at DAFNE. Many years later, the same physics became crucial for detecting large **CP** violation in B decays.

In 1987, I was a convener of a session at Workshop on High Sensitivity Beauty Physics at Fermilab. Harry and I got an idea of forming a time independent **CP** violating observable. This should make it easier for experimentalists to observe **CP** violation. Since I was running around organizing the sessions, Harry performed the calculation and wrote the paper and showed it to me.

I mention it only to show you that: Harry treats his younger collaborators as his equal, and is perfectly happy to carry on the tedious details when his junior collaborator is tied up. Probably, Harry picked up this style at MIT Radiation Laboratory during the war.

Education

When the 10th International Symposium on High Energy Spin Physics was held in Nagoya back in 1992, Harry, Malka came to Nagoya, and three of us had an

opportunity to go for a sight seeing trip. While I was driving, I heard Harry and Malka talking Japanese. I was astonished and looked back. It turned out that they were reading street signs.

In Japan, you see three kinds of writings on street signs. Chinese characters, and two kinds of Japanese characters. Latter two are hiragana and katakana. Katakana is used, now a days, almost exclusively for foreign words. There are only bit more than 50 sounds we can make with hiragana or katakana. So, when we try to write a foreign words it is strainful to say the least. For example when we teach electricity and magnetism, there is Kirchoff's law. We write "Kirchoff" as "KI-RU-HI-HO-TSU-FU". No non-Japanese can understand what we are talking about.

Since katakana is exactly phonetic, I could understand what Harry and Malka were reading. Not only that they could understand what they were reading since what ever they are reading corresponds to English words. (The complication that I mentioned above is very rare, as Kirchoff is hardly mentioned on street signs.) I thought it was very smart of them to learn katakana. It is easy to master and it is immediately useful.

Independent of Harry, Malka is deeply involved in Education. They have written papers on an efficient method for teaching children to read. Harry mentioned, in his short birthday comment, that in a country like Israel, where there are large number of immigrants from all over the world, educating every citizen to read should be of upmost priority.

Harry's foresight on this point should be taken seriously first by people around him and spread it, so that it becomes a national policy.

Prizes

There is a long list of awards which Harry has received on his life long work on physics, Israel, education. Awards which he so richly deserves:

- 1970 National Academy of Science
- 1973 Kaplun Prize
- 1980 Rothschild Prize
- 1983 Weizmann Prize of the City of Tel Aviv
- 1992 Sackler Scholarship
- 2002 Wigner Medal
- 2009 EMET Prize

5 Harry and Malka's Friends

Obviously Harry and Malka have many friends and I am not the person to undertake a complete study of this subject. After all, I am a pedestrian.

So, I just mention what I know.

Sakharov

Andre Sakharov (1921-1987) had managed to smuggle his physics papers to Harry during Sakharov's confinement. This was important because, around that time, the Soviet Union tried to convince the world that Sakharov is no longer capable of thinking clearly. Harry showed the papers to relevant people and convinced them that the Sakharov's condition mentioned by the Soviet Union was a mere propaganda.

Harry and Malka were in Moscow on their way to the Pugwash meeting - a meeting attempting to diffuse the tension of nuclear test ban. Sakharov suggested that they meet at Migdal's house. I didn't know that Harry and Sakharov are the same age!



Figure 6: Mr and Mrs Lipkin, Mr and Mrs Sakharov (Mrs Sakharov is on left side of the picture), Mrs Migdal, and the picture was taken by Mr Migdal.

Friends in Japan

BCP meeting is a precursor of FPCP. I had pleasure of having Harry and Malka attend BCP4 meeting which I organized in Ise sima. Harry knows essentially every particle physicist involved in flavor physics.

Even if restrict ourselves to Harry and Malka's friends in Japan, I am not in a position to make a complete study. I just asked Hosaka san and Masaike san to comment.

A. Hosaka

When I asked Hosaka san to write few words, he sent me the following:



Figure 7: BCP4 meeting 2001 held in Ise sima(BCP series is the precursor of FPCP). Left: Harry, Malka, Vela Luth, and myself on the old street in Ise. Right: Harry and myself during the conference. At least it is a good picture of Harry!

”In the fall of 2006, there was a meeting in Kyoto. My wife and I asked Prof. Lipkin and his wife to join us for a walk from Yukawa Institute. The walk consisted of: Yoshida yama; Sinnyodo; Philosopher’s path. At the time I was not aware that Prof. Lipkin was already over 85. But they were full of energy and always smiling - fully enjoying the foriage. Thinking back, I feel that I should have been more considerate.”

A. Masaike

When I asked Masaike san to write few words, he sent me the following:

”About 40 years ago, I was having supper at Sacly with a young man from Weizman Institute. He was talking about Professor Lipkin’s passion for Israel, physics, and education.

Much later, he accepted my invitation to give a summary talk at Intersection between Particle and Nuclei, High Energy Spin Physics - PANIC(1987). I was stunned by his diligent approach - working on his talk until the very end.”

He has dignity of an ancient samurai - like a old fashion giant professor with conviction.

He was almost always accompanied by his wife. My wife has always been deeply impressed by their kindness and thoughtfulness.

Harry at the age of 89

I must say the travel between Japan and Israel is not without any stress. It is hard. But Harry and Malka do this regularly. Here is a photograph taken during their last visit in December 2010.



Figure 8: Left: Harry giving a toast at the banquet of BARYONS ' 10 conference. Right: With his friends. Front: from left Toki, Nambu, Harry. Behind: Oka, Malka. Back: from left Hosaka, Suganuma, Hyodo.

6 Final comments

Again, it certainly gave me a great pleasure giving this birthday talk about my old mentor. It gave me an opportunity to step back and find out more about Harry and Malka. I learned how one should pursue ones passion for physics without sacrificing other interests. Harry's other interests were certainly not negligible. Family, Israel, and education. There may be other interests which I missed. But, again, I am only a pedestrian.

One thing I am very sure is that, Harry could not have accomplish all he has done in the past, and accomplish all that he will do in the future, without the help, support and understanding of Malka. So, the day he met Malka in Hights Town was Harry's luckiest day.

Suggestion

I close with a suggestion for the Israeli physics community:

De Shalit, Lipkin, Néeman and Talmi are founding fathers of nuclear and particle physics in Israel. They played a crucial role in performing research at the highest level, in a nation with much growing pains. It is important to preserve their high spirits towards research - and to implant them in to minds of young researchers.

Here is what we do in Japan. Nishina is the founding father of nuclear physics in Japan. We honor Nishina by awarding Nishina prize to young promising physicists every year. The award ceremony is always held on his birthday December 6.

Happy 90th birthday Harry! Congratulations Malka!

ACKNOWLEDGEMENTS

I thank Harry and Malka for many interesting discussions. I have also learned a lot from my friend for many years Shmuel Nussinov.

References

- [1] Verification of the Tenfold Assignment of the Baryon Resonances S. Meshkov, (NIST, Wash., D.C.) , C.A. Levinson, (Weizmann Inst.) , H.J. Lipkin, (Illinois U., Urbana). April 15, 1963. Phys.Rev.Lett.10:361-364,1963.
- [2] Isospin Invariance, CP Violation and B anti-B Mixing. ANL-HEP-PR-87-115, DOE/ER/40325-13, Nov 1987. Phys.Lett.B201:541,1988.
Use Of Isospin Invariance In B Decays. ANL-HEP-CP-88-02, DOE/ER/40325-25, Jan 1988. 5pp. Proc. of Fermilab Workshop on High Sensitivity Beauty Physics, Batavia, IL, Nov 11-14, 1987.