The Antiphysical Review

Founded and Edited by M. Apostol **207** (2017)

ISSN 1453-4436

My way into NQR

M. Apostol
Department of Theoretical Physics, Institute of Atomic Physics,
Magurele-Bucharest Mg-6, POBox Mg-35, Romania
email: apoma@theory.nipne.ro

About 2013 I was hired by Mira Technologies, a private high-tech company in Romania, to advise its technical staff on the Nuclear Quadrupole Resonance (NQR). Mira was committed to build by itself from scratch an NQR detector for explosive and drugs. In my opinion this was a completely unrealistic enterprise. There exist in the world a very few companies which built such detectors with a tradition of tens of years, and nobody sane enough can compete with them; it is useless and hopeless to engage yourself in such a competition; besides, an NQR detector is notoriouly difficult. If Mira would have asked for my advice before, I would certainly have given one in the negative. But their decision was taken, they already pushed a lot of money in the project and nothing was left to be changed. Soon I discovered that Mira staff was young, bright, naive and astonishingly competent in electronics. My task was to teach them the physical principles of the NQR; it seemed hopeless, because that would needed quantum mechanics, a subject far away from them. In addition, they faced special challenges. In order to NQR detect a substance, one needs a certain, specific, sequence of electromagnetic signals, precisely ordered in time according to a special rule, one for each substance. Expert companies automatically include such sequences in their detectors; if you want to build an NQR detector you need such temporal sequences, and nobody tells you them; you should proceed empirically by many trials and errors, which is enormously time consuming. The time can be reduced if you know how to compute the quantum transitions; this may serve as a guide in the empirical work. So, I saw myself in the position to teach these people how to compute quantum transitions, a hopeless task.

Desperate, I sought help from my expert friends from abroad; I hoped they might give me some clues. A company from England was secretive and did not respond to my querries. My friends from Ljubliana, a famous school of three generations of the late professor Blinc, were, I discovered, experts in theory only. There seems to be several groups conversant with the subject in Russia, but it was difficult to reach them. There are a few expert labs in the USA, but I realized that attempting to approach them would be a waste of time; I knew nobody there, and no stranger would reveal his secrets. I am in academia, and have not many acquintances in industry. I have approached my friend PA, director of a big lab of applied physics in Geneve. He told me that they have had indeed an NQR lab, ran by a Greek who unfortunately died, and there was nobody to continue so they closed the lab. He redirected me to some experts in Tallin; who, on hearing my problem, told me that this is an impossible task and declined any help. So, I was alone.

I decided to look into the problem to see whether I could find a poor man's way of computing quantum transitions. In a couple of months (during which the Mira staff was stagnating), I discovered that there exists indeed such a way: it is the quasi-classical approach to quantum mechanics. I quickly sketched out the method and taught the Mira staff in two months how to use it. The Mira people succeeded brilliantly in managing it rapidly, and started the work. It only remained for me to polish the problem; this took me for the next two years into the deepest depths of the quantum mechanics. It was a delightful experience, which I never foreseen, and I decided to write it up into a book, including magnetic, nuclear quadrupole, electric and all the other, related, resonances. Working on the book I discovered that new results can be obtained in electric resonance, a less known subject. It was so that I discovered the quenched dipoles, the parametric resonance and have introduced a new kind of elementary excitations in solids, as a consequence of the dipolar interaction, which I called dipolons; with a possible explanation of the origin of the ferroelectricity, a long-living mystery of the solid state and condensed matter physics. This particular subject turned out to be extremely difficult and I asked my ex-PhD student LC for help. Together we succeeded to clarify the subject and published the results, with great difficulty, in Chem. Phys. **472** 262 (2016). About that time I received a phone call from Mira who told me that they got the first NQR detection signal. Of course, we celebrated.

Now I am not with Mira anymore; my job there has long since ended; meantime Mira succeeded to build up a fine NQR detector, which works perfectly; it is about to be put on the market. In addition, people there have many ideas of improvement and diversification. I go from time to time to Mira labs, people show me their new NQR equipments, but I am not able anymore to understand much of their work. Meanwhile, my book on Resonance is finished and I prepare myself to publish it. This was my way into NQR. It is unlikely that I will ever return to the subject. I am not sure if I would like to. It was like a new, splendid path into the Wonderland, a path that better remains forever in my memories. Sometimes, I doubt that, being so marvelous, it was real.
