Some recollections of Nati

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I met Nati shortly after he arrived at Princeton for his first postdoc, while I was doing my second at Harvard. As a student, Nati had worked mostly on a particular composite quark model, the Rishon model, with Haim Harari. For some reason I had taken an interest in this model, so after I met Nati I thought of him as 'that Rishon guy.'

Of course, it quickly became clear that Nati was more than just the Rishon guy. With Affleck and Dine in particular, he proceeded to obtain remarkable and beautiful results on nonperturbative supersymmetric theories, a subject that he has continued to lead for more than three decades. I had also worked on supersymmetry and tried to understand its dynamics, but I did not have strong enough tools to make progress. The clarity of Nati's thought, his ability to identify and solve new and important problems, has impressed me time and again.

I continued to refer to Nati as 'that Rishon guy' long after it was relevant. I'm a bit of a tease, and I think it this was something of a defense mechanism. Confession: I have always been a bit scared of Nati. He is a nice guy, but his thinking is so sharp, you really have to bring your A-game when you talk with him.

It is remarkable to look over Nati's record. I believe that it we restrict attention to theorists who have agreed to a 60th birthday celebration, he would rank highest. In spite of that, our direct interaction has been less than you might think (with some notable exceptions that I will mention). I think we work on different kinds of problems, at least over short terms.

I remember a telling comment from him. I was trying to derive one of his early results on nonperturbative field theory, and I wanted to know

what cutoff to use to make the argument rigorous. He said that this was the wrong question. The important thing was not what we could prove, but what was true. Indeed, this kind of attitude has helped produce his phenomenal success.

Actually, in writing this up, I was reminded of a proto-paper on which Nati put both our names. This was generous of him, and surely the paper went much faster without my participation. And indeed, this kind of thinking, of asking the right question, has been one of his hallmarks. Nati is certainly one of the deepest exponents of the Wilsonian path integral, and he has done much to expand the power of the method.

A notable interaction between us was Dine, Huet, Seiberg [1] and Dai, Leigh, JP [2]. The overlapping part which Nati and friends were a few months ahead on, was the discovery that the 2A and 2B strings are T-dual. It is still striking to remember how such simple things were once unknown; one even had to constantly remind oneself which was 2A and which 2B. For Dine, Huet, and Nati, this was part of the general program to understand string vacua. For Dai, Leigh, and me, our program was to look at T-duality beyond the heterotic string, to find new questions that had not been swept up by the Princeton cohort. So this was very much parallel play for Nati and me, with independent and very different motivations and results (for us, this paper also gave rise to D-branes and orientifolds).

Another of Nati's papers that had a big impact on me was [4], *Exact results on the space of vacua of four-dimensional SUSY gauge theories.* I think that this is largely seen as an $N = 1$ precursor to the $N = 2$ Seiberg-Witten theory. This came a few months later and gets several times as many citations. I have never understood this disparity, since $N = 1$ was assumed to be more relevant to the real world.

The full importance of weak-strong duality took many years to become clear. The period 1990-95 was notable. It felt like a slow time for strings, but in retrospect we know that duality and the second superstring revolution were

beginning to marshal themselves. For me, Nati's $N = 1$ paper in particular made me recognize that something powerful had been learned.

The paper [5] is my only published paper with Nati, and has a distinguished author list beyond. Unfortunately it was a mostly indirect collaboration, with the group congealing rather late. I believe (but I'm not certain) that Nati and I had one discussion at KITP, and a few others by email. So counting also the unpublished [1], I guess you could say that we have neither an existence proof nor a no-go theorem for a Polchinski-Seiberg collaboration. Still, be have each managed to influence the other in our respective ways, and physics has managed to progress.

The discoveries of D-branes, Matrix theory, and AdS/CFT duality have opened broad new areas in which we both work. But we still seem to be drawn to mostly different questions, and we have not collaborated again. I must say that whenever I see Nati taking an interest in some of my recent work ([5] is a recent example), I am both honored and challenged. I know that he will look at it with his intense gaze, and I am never sure that I can measure up to his precision of thought.

I was a bit surprised that Nati recently got into condensed matter physics. I have worked in this field in the past, but again we approach these things in different ways, and our papers could not be mistaken for one another. There are subjects, and approaches, that are unique to each of us. In particular, Nati has never taken on the information problem (at least in public). So, what is your take on the Firewall?

References

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[4] Nathan Seiberg, Exact results on the space of vacua of four-dimensional SUSY gauge theories. Phys.Rev. D49 (1994) 6857-6863.

[5] Micha Berkooz, Robert Leigh, Joseph Polchinski, John H. Schwarz, Nathan Seiberg, Edward Witten. Anomalies, dualities, and topology of D = 6 N=1 superstring vacua. Nucl.Phys. B475 (1996) 115-148.

[6] Tom Banks and Nathan Seiberg, Symmetries and Strings in Field Theory and Gravity. Phys.Rev. D83 (2011) 084019 e-Print: arXiv:1011.5120.