Dinesh Srivastava: Some Observations and Recollections*

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Abstract

Dinesh Srivastava has made exceptional contributions to the hydrodynamical theory of the quark gluon plasma and done seminal work on the theory of electromagnetic particle production. He is also man of extraordinary vision and energy. This talk contains some reminiscences of happy times we have shared, and is in honor of his 60th birthday

1 Introduction

I met Dinesh Srivastava as a consequence of seminal work he did together with Bikash Sinha on electromagnetic probes arising from the Quark Gluon Plasma[1]-[5]. I was struck by the quality and imagination of this work, and I invited Dinesh to come to the University of Minnesota for a seminar. During that seminar, Dinesh demonstrated a deep understanding of field theoretical methods and the phenomenology of high energy nuclear physics. This was very unusual at the time, since the discipline was in its infancy, and also because Dinesh had his training in low energy nuclear physics. A few others have made the transition successfully from low energy nuclear physics to high energy, but it is a difficult leap, as it involves learning entirely new concepts

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and methods. At the time Dinesh made this transition , he was within a group in India which was then without a major effort in high energy physics. We became friends, and have remained so. I subsequently invited him to visit for a year at the University of Minnesota where I was, at that time, the director of what was to become the Fine Theoretical Physics Institute. A picture of Dinesh and his family during this visit are shown below in Fig. (1).

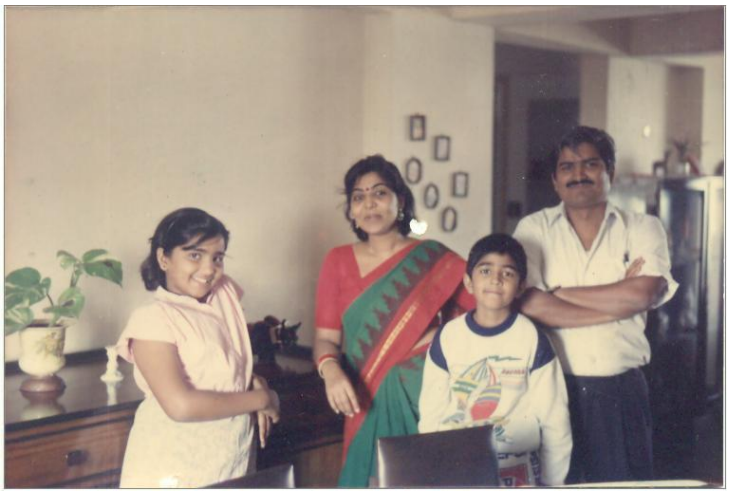

Figure 1: Dinesh Srivastava, his wife Rekha, his son Mehul and his daughter Richa. (His daughter is on the far left, and his wife beside Dinesh.)

2 A Few Comments about Dinesh

To quote Mark Twain:

People fall into three categories:
Those who make things happen.
Those who watch things happen.
Those who are left to ask what did happen.

Dinesh is definitely someone who makes things happen:

Figure 2: **He is stronger than a locomotive.**

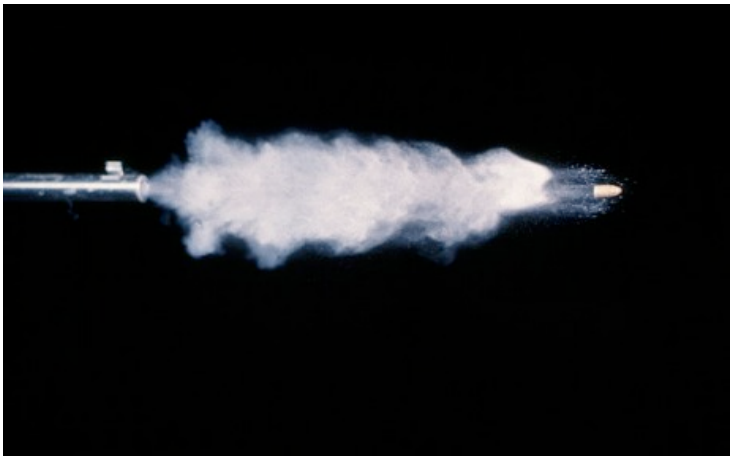

Figure 3: **He is faster than a speeding bullet.**

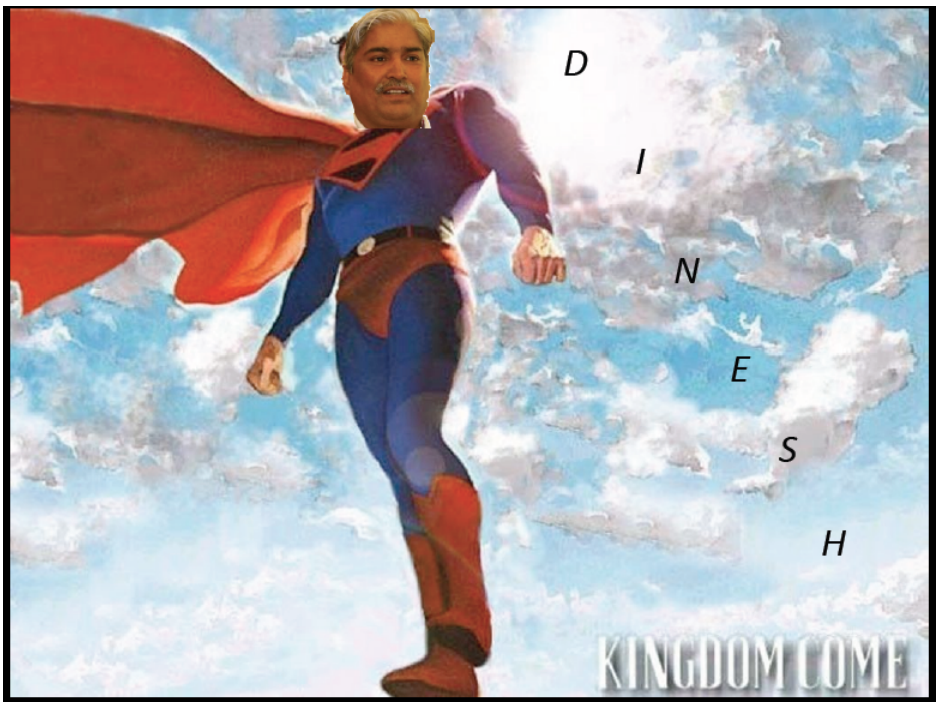

Figure 4: **He's SuperDinesh!**

3 Life at the University of Minnesota

While at the University of Minnesota, Dinesh and I collaborated on a paper on di-lepton production[6]. He also began work on hydrodynamic computations that he would develop in various contexts later in his career[7]-[10]. Dinesh was the first to use the uncertainty principle argument that the initial time matter is formed in heavy ion collisions is when the typical energy scale, $< p >$ times the initial time scale t_0 satisfies $< p > t_0 \sim 1$. This argument led to what were considered at the time to be extraordinary high temperatures at RHIC. Many do not consider such high temperatures to be so extraordinary now. I think his computations based on this idea built in a lot of correct physics, such as geometric scaling of particle distributions, when one interprets the initial momentum scale to be the gluon saturation momentum. I think also that flow patterns begin to be driven at such early times, and that there is probably a hydrodynamic description or some good approximation to it. His insights proved very useful. I think more modern thinking will eventually revise the idea that the systems evolving at such early time are in local thermal equilibrium, but this is largely irrelevant for attaining the qualitative and semi-quantitative features of the Quark Gluon Plasma. Dinesh's work is a good counter-example to the "Little Steps for Little Feet" paradigm. Dinesh took a very big and controversial step at Minnesota, and like most such steps, it left a deep and lasting impression even if the outlines of his footprint become refined with time.

Dinesh was, of course, always thinking about photons and dileptons. While in Minnesota, Raju Venugopalan was a postdoctoral fellow. As a result of talks I had heard about the growth of the gluon density at small x as seen in the HERA experiments, and the excitement we had over the possibility of using ultra relativistic heavy ion collisions to make high energy density states of matter, I became interested in understanding the earliest times in heavy ion collisions: the time before the collisions even begin, and the time before one forms a thermalized Quark Gluon Plasma. I began talking with Raju and Dinesh about this. Dinesh lost interest in this problem, I think, because he had a lot of physics he was actively working on and this would have diverted him, and also because he listened too attentively to skeptical arguments. The "nattering nabobs of negativism" had concluded that one would never have the energy density where the ideas we were developing could be applied. These ideas eventually developed into the

Figure 5: Dinesh and Tapan in the soup.

theory of the Color Glass Condensate and the Glasma, and now have a quite successful phenomenology at RHIC and LHC energies..

It is unfortunate that we went separate paths at this time, although to be honest, I think Dinesh chose the better path for developing science for young people in India. The Color Glass Condensate idea went unnoticed for 5 years, and then was very controversial for another ten before it is more or less accepted as main stream. I could afford to take on more risk than Dinesh as I was not involved developing an entire community, which – in order to be taken seriously– needs to have substantial involvement with mainstream ideas.

I think that Dinesh can be very satisfied with the work that he has done on the hot quark soup. In Fig. 5, Dinesh, and Tapan are relax-

ing and thinking about their accomplishments, while from a distance, Rekha is supervising. It is important for Rekha to supervise, as it is easy for a man of Dinesh's age to over exert himself. He needs, more than anything else, a quiet soak in the hot tub.

4 Wild Life in Minnesota

Figure 6: On the left is an illustration of a jackalope from Animalia Quadupedia et Reptilia by Joris Hoenagel, circa 1575. On the right are two photographs of jackalopes.

When we were not busy doing physics, I discovered that Dinesh had much natural curiosity about native American wildlife. I found Dinesh most intrigued by the jackalope. To paraphrase Wikipedia, the source of all knowledge,

The jackalope is an animal of North America (a so-called "fearsome critter") described as a jackrabbit with antelope horns or deer antlers and sometimes a pheasant's tail (and often hind legs). The word "jackalope" is a portmanteau of "jackrabbit" and "antalope", an archaic spelling of "antelope". It is also known as Lepus temperamentalus.

In Fig. 6, I show pictures and illustrations of jackalopes.

I gather Dinesh desperately wanted to take a picture of the jackalope, but unfortunately, east of the Rocky mountains, they are about as rare as an honest politician.

I tried to get Dinesh's interest concerning the Minnesota catfish. I had learned the story of the Minnesota Catfish while fishing and drinking with friends along the Mississippi River. With enthusiasm, I shared this story with Dinesh.

In spite of its name, this legendary creature is a mammal. It in fact has warm blood and fur. It is believed to have been originally discovered by French trappers around 1740, and misnamed a fish because its primary habitat is the Mississippi river. My good friend Dinesh would sometimes go off for a weekend well supplied with food and drink in search of this elusive creature. He was either occupied with other things, or he had bad luck, as he never returned with a Minnesota catfish.

His children, believing they were much more sophisticated than their father, tried in vain to convince Dinesh that the Minnesota catfish was in fact a fish. They were not successful then, and I hope, have not been successful now. A photo of a Minnesota catfish is indeed very rare, but to convince the skeptical reader that it is not a fish, I have downloaded a photo from the web:

Figure 7: A Minnesota catfish.

4.1 A Poem for a Man No Longer Young

At solemn occasions such as this one, (what could be more solemn than a man turning 60), I like to quote from some authority on the aging process. Today, I quote from the poem of Roger McGough, as it seems particularly apt for Dinesh:

Let Me Die A Young Man's Death

Let me die a young man's death
not a clean and in between
the sheets holy-water death.
Not a famous-last-words
peaceful out of breath death.

When I'm 73 and in constant good tumour,
may I be mown down at dawn
by a bright red sports car
on my way home
from an all night party.

Or when I'm 91
with silver hair
and sitting in a barber's chair,
may rival gangsters
with ham-fisted tommy-guns burst in
and give me a short back and insides

Or when I'm 104
and banned from the Cavern
may my mistress
catching me in bed with her daughter
and fearing for her son
cut me up into little pieces
and throw away every piece but one

Let me die a young man's death
Not a free from sin tiptoe in
candle wax and waning death
Not a curtains drawn by angels borne
'what a nice way to go' death

Figure 8: **Happy Birthday Dinesh.**

5 Conclusion

I unfortunately did not have access to a photo of Dinesh driving around in his new car as the newly appointed Director of the Variable Energy Cyclotron Center. So I took the liberty of photo shopping a photo I have. If you like, Dinesh is metaphorically taking his younger colleagues out for "spin" in his new car, and they are enjoying the ride. I hope they all enjoy have fun.

6 Acknowledgements

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References

[1] D. K. Srivastava and B. Sinha, Phys. Lett. B **261**, 1 (1991).

[2] S. Chakrabarty, J. Alam, D. K. Srivastava, B. Sinha and S. Raha, In *Calcutta 1991, Medium and high energy nuclear physics* 229-230

[3] J. Alam, D. K. Srivastava, B. Sinha, S. Chakrabarty and S. Raha, Nucl. Phys. A **544**, 493C (1992).

[4] D. K. Srivastava and B. Sinha, J. Phys. G G **18**, 1467 (1992).

[5] S. Chakrabarty, J. Alam, D. K. Srivastava, B. Sinha and S. Raha, Phys. Rev. D **46**, 3802 (1992).

[6] J. I. Kapusta, L. D. McLerran and D. Kumar Srivastava, Phys. Lett. B **283** (1992) 145.

[7] J. -eAlam, D. K. Srivastava, B. Sinha and D. N. Basu, Phys. Rev. D **48** (1993) 1117.

[8] D. K. Srivastava and B. Sinha, Phys. Rev. Lett. **73** (1994) 2421.

[9] D. K. Srivastava, M. G. Mustafa and B. Muller, Phys. Rev. C **56** (1997) 1064 [nucl-th/9611041].

[10] J. Cleymans, K. Redlich and D. K. Srivastava, Phys. Rev. C **55** (1997) 1431 [nucl-th/9611047].