

NOT EVEN  
WRONG

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THE FAILURE OF STRING THEORY AND  
THE SEARCH FOR UNITY IN PHYSICAL LAW

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BASIC  
  
BOOKS

A Member of the Perseus Books Group  
New York

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## The Bogdanov Affair

While I was in the process of writing this book, one morning in October 2002 I came into the office and began the day as usual by reading my e-mail. A couple of physicist friends had forwarded to me reports of a rumor, one that they knew I would find interesting. The rumor was that two French brothers, Igor and Grichka Bogdanov, had concocted what some people were calling a "reverse-Sokal" hoax. In 1996, the physicist Alan Sokal had written a carefully constructed but utterly meaningless article with the title "Transgressing the Boundaries: Toward a Transformative Hermeneutics of Quantum Gravity." The article contained no rational argument and instead strung together unsupported claims, breathtaking leaps of logic, and a large collection of the sillier parts of the writings of both postmodern theorists and some scientists. It ended up making no sense at all, but was side-splittingly funny (if you were in on the joke). Sokal submitted the article to the well-known and rather prestigious academic journal *Social Text*, whose editors accepted it for publication in an issue on "Science Studies." The rumor in my e-mail was that the Bogdanov brothers had done something similar, constructing as a hoax utterly meaningless articles about quantum gravity, then getting them accepted by several journals and even using them to get a French university to award them PhDs.

After Sokal's hoax first appeared, I had thought fairly seriously about the idea of trying to write a superstring theory paper as a hoax, and seeing whether I could get it published in a physics journal. If I started with one of the more complicated and incoherent articles on superstring theory, reworked the argument to add a new layer of incoherence and implausibility and a few clever jokes, the result would be something that made no sense at all, but perhaps could pass many journal editors and referees. After thinking about this for a while, I finally gave up on the project because it was unclear to me

what I could claim to have proved if successful. Sokal's opponents had pointed out at the time that he had constructed what they would describe as a not very good argument of a kind that they endorsed, and whether he himself believed it was irrelevant. Similarly, any superstring theory hoax on my part could be characterized as a not very good piece of superstring theory research that I had managed to get by overworked and inattentive referees. The fact that I did not believe what I had written would prove nothing.

That morning I looked up the Bogdanov brothers' theses on the web and quickly skimmed through them. They didn't look like a hoax. In particular, very much unlike Sokal's paper, there was nothing at all funny about them. Later that afternoon I heard fresh rumors that a *New York Times* reporter had contacted one of the brothers, who had indignantly denied any hoax. It seemed that this was just one more example of incompetent work on quantum gravity, something not especially unusual.

The next day, many e-mails were being forwarded around about the Bogdanov "hoax." For example, someone who was visiting the Harvard string theory group sent a friend of his the following report:

So no one in the string group at Harvard can tell if these papers are real or fraudulent. This morning, told that they were frauds, everyone was laughing at how obvious it is. This afternoon, told they are real professors and that this is not a fraud, everyone here says, well, maybe it is real stuff.

This ultimately reached one of the Bogdanov brothers, who circulated it widely in an e-mail denying the existence of a hoax. Since I had some free time, I decided to look more closely at the two theses. One of them, Grichka's, was a pretty impenetrable piece of work mostly in the area of quantum algebra, something about which I am not particularly knowledgeable. The other, Igor's, was mostly about topological quantum field theory, a field I know much better. Igor's thesis was rather short, and a large part of it was an appendix consisting of four of his published papers. Looking carefully at these papers, I immediately noticed that two of them were nearly identical, including word for word identical abstracts, and both seemed to be

extracts from one of the others. Upon further investigation, it turned out there was a fifth paper the brothers had published in a different journal that was again more or less identical to the two others.

This certainly caught my attention, since while lots of people write incoherent papers, I had never heard of anyone ever engaging in this kind of extreme self-plagiarism by getting nearly identical papers published in three different journals. Looking more carefully at the longest of their papers, the one from which three others had been extracted, it became clear that it was a rather spectacular piece of nonsense, a great deal more so than anything I had previously seen in a physics journal. The introduction was an impressive array of invocations of various ideas, many of them about topological quantum field theory, but pretty much all of them either meaningless or simply wrong. The body of the article was no better, containing many completely ludicrous statements. The whole thing was funny, but it was looking more and more as if this was unintentional.

Considered as a whole, what the Bogdanov brothers had managed to do (besides getting their theses accepted) was to publish five articles, three of which were nearly identical, in peer-reviewed journals. Two of the journals were quite well known and respected (*Classical and Quantum Gravity* and *Annals of Physics*), while a third was one with an illustrious history, but where standards were known to have slipped in recent years (*Nuovo Cimento*), and the final two were more obscure (*Czechoslovak Journal of Physics* and *Chinese Journal of Physics*). Evidently, five sets of editors and referees had gone over these papers and accepted them for publication, without noticing that they were egregious nonsense. Later on, several of the referees' reports surfaced, two of which were quite perfunctory, but one of which was much more detailed, making seven recommendations about changes that needed to be made to the paper before it would be suitable for publication. Ultimately, one of the journals involved (*Classical and Quantum Gravity*) released a statement saying that its editorial board had agreed that publication of the paper was a mistake and (undisclosed) steps would be taken to keep this from happening again. The editor of one of the other journals (*Annals of Physics*), Frank Wilczek, also said that publication had been a mistake, one made

before he had become editor, and he hoped to improve the standards of the journal.

Various journalists looked into the story, and articles about the Bogdanovs were published in several places, including the *Chronicle of Higher Education*, *Nature*, and the *New York Times*. Many details emerged about the brothers and how they got their PhDs. They are in their fifties, had a TV show in France during the 1980s involving science fiction, and now have a new show of short segments in which they answer questions about science. Moshe Flato, a mathematical physicist at the Université de Bourgogne in Dijon, had agreed to take them on as students in the early 1990s, but had died unexpectedly in 1998. After his death the brothers presented their theses, and one of them (Grichka) was passed and awarded a mathematics PhD in 1999. The second (Igor) was failed, but told he could try again if he could get three articles accepted by peer-reviewed journals, something he went ahead and did, as we have seen. He was finally also passed and given a physics PhD in 2002.

It is hard to give anything like a summary of the Bogdanov papers, since they make so little sense, but roughly they claim to be saying something about the beginning of space and time using topological quantum field theory, and all this is somehow related to quantum field theory at high temperature. The discussion section at the end of their three identical papers is all about relations of their work to superstring theory and the problem of supersymmetry breaking. To get an idea of what the referees thought of the papers, here is the only substantive paragraph in one of the referees' reports:

Motivated by string theory results, in this paper the author discussed the space-time below Planck scale as a thermodynamic system subject to KMS condition. Since the physics of the Planck scale has been largely unexplored, the viewpoint presented in this paper can be interesting as a possible approach of the Planck scale physics.

The significance of the Bogdanov affair was hotly debated among physicists for the next few months, with most superstring theorists taking the position that this was just a case of a few referees being lazy, and that these weren't papers about superstring theory anyway.

While very few in the particle theory community have tried to defend the Bogdanovs' work or to claim that it makes much sense, some very weird e-mails did make the rounds. One superstring theorist circulated to his colleagues an attack on a mathematical physicist who had pointed out evidence that the Bogdanovs did not understand what a topological quantum field theory is, making clear in the process that he himself shared the brothers' misconception.

The Bogdanovs wrote to me politely in February 2003, defending their work and asking me what I thought was wrong with it. I made the mistake of thinking that they could perhaps use some helpful advice and wrote back a friendly response. In it I mainly tried to make the point that what they had written was too vague and incoherent to make much sense, and that they needed to make their ideas much clearer and more precise before anyone could tell whether they had any value.

Late in 2003 I received an e-mail from a Professor Liu Yang, supposedly at the International Institute of Theoretical Physics in Hong Kong, defending in detail the work of the Bogdanovs in the field of Riemannian Cosmology. Upon investigation, it became clear that there is no such institute; nor is there such a Professor Yang. Looking closely at the e-mail header showed that it had come from a computer attached to a dial-up connection in Paris, but configured to claim a Hong Kong Internet address. I did not pay much attention to this, but it convinced me the Bogdanovs were not the innocent, guiltless sorts that I had previously thought.

Early in June 2004 the Bogdanovs published a book in France with the title *Avant le Big-bang* (Before the Big Bang), which sold quite well. In their book they used part of the e-mail I had sent them the year before to claim that I was now a supporter of theirs. They mis-translated one line of my e-mail (where I was being too polite), "It's certainly possible that you have some new worthwhile results on quantum groups," as "Il est tout à fait certain que vous avez obtenu des résultats nouveaux et utiles dans les groupes quantiques" (It is completely certain that you have obtained new worthwhile results on quantum groups).

Around this same time a message defending the Bogdanovs appeared from a "Roland Schwartz," whose computer was using exactly

the same Paris Internet service provider as Professor Yang. Later that month, the brothers started sending e-mails using an Internet domain name purporting to be an International Institute of Mathematical Physics in Riga. This address hosts a website for a Mathematical Center of Riemannian Cosmology, devoted to the work of the Bogdanovs. In a posting on a French Internet newsgroup, the brothers helpfully explain that the University of Riga set up the site for them, and that's why it has a Lithuanian domain name. One problem with this is that Riga is in Latvia, not Lithuania. I take this rather personally, since my father was born in Riga (the Latvian version of my name is Voits). He and his parents became exiles at the time of the Soviet occupation during World War II. I have visited Riga several times (including a visit to the university); the first time was soon after independence, on a trip with my father while he was still alive. Riga is a beautiful city, with the downtown not much changed since before the war. In recent years, the old city and much of the downtown have been elegantly renovated, and Riga is now once again a large, vibrant city with great restaurants, hotels, and shops. I am sure, however, that it does not have an International Institute of Mathematical Physics.

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Leaving aside the issue of whether the Bogdanovs are hoaxers or really believe in their own work, this episode definitively showed that in the field of quantum gravity one can easily publish complete gibberish in many journals, some of them rather prominent. Whereas Sokal put a lot of effort into fooling the *Social Text* editors, the nonsensical papers of the Bogdanovs may have been guilelessly produced, and then made it into five journals, not just one. This brings into question the entire recent peer-reviewed literature in this part of physics, since the refereeing process is apparently badly broken.

One unusual thing about the Bogdanov papers is that they were never submitted to the online preprint database used by virtually all particle theorists and most mathematicians. Fewer and fewer physicists ever look at print journals these days, since essentially all recent papers of interest are available conveniently on the Web from the database. The continuing survival of the journals is somewhat mysterious, especially since many of them are very expensive. A typical large university spends over \$100,000 a year buying physics journals,

the content of which is almost all more easily available online for free. The one thing the journals do provide that the preprint database does not is the peer-review process. The main thing the journals are selling is the fact that what they publish has supposedly been carefully vetted by experts. The Bogdanov story suggests that, at least for papers in quantum gravity in some journals, this vetting is no longer worth much. Another reason for the survival of the journals is that they fulfill an important role in academia, where too often the main standard used to evaluate researchers' work is the number of their publications in peer-reviewed journals, something that was at work in the decision to pass Igor Bogdanov's thesis. The breakdown in refereeing is thus a serious threat to the whole academic research enterprise.

Why did the referees in this case accept for publication such obviously incoherent nonsense? One reason is undoubtedly that many physicists do not willingly admit that they don't understand things. Faced with a stew of references to physics and mathematics in which they were not expert, instead of sending it back to the editor or taking the time to look closely into what the authors were saying, the referees decided to assume that there must be something of interest there, and accepted the articles with minimal comment. The referee's report reproduced earlier shows clearly the line of thinking at work: "Well, this somehow has to do with string theory, quantum gravity, and the beginning of the universe, and it uses something called the 'KMS condition,' which is supposed to be important. Nothing published in this whole area really makes complete sense, so maybe this is no worse than lots of other stuff and maybe there's even an intelligible idea in here somewhere. Why not just accept it?"

The Bogdanov affair convincingly shows that something is seriously broken in that part of the scientific community that pursues speculative research in quantum gravity. A sizable number of referees and editors were not able to recognize complete nonsense for what it was, or if they were capable of doing so, felt that it was just not worth the trouble. The theoretical physics community seems so far to have reacted to this episode by trying to deny or minimize its significance, thus ensuring that the problems it highlights will continue for the foreseeable future.