Interview with Professor Aleksander Wolszczan

We Are Part of the Universe

Robert Gardziński/Fotorzepa

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Academia: Fifteen years have passed since your discovery of the first extrasolar planetary system. How has that discovery altered your life?

Professor Aleksander Wolszczan: *Above all it essentially led me to change specialization: from a pulsar specialist I became a planetary astronomer. It also seriously affected my outlook - previously I had been so engrossed in my own field that the rest of the world did not seem very important. After discovering those planets, I realized that shouldn't be the case. I think it's quite natural: achieving something that has a broader impact and exceeds beyond your narrow field of focus comes as a kind of shock to the system, causing you to think differently about the world.*

What caused such a shock? The knowledge that planets exist around other stars?

Something significantly broader. I understood that our work is not some intellectual game, without any applications. Discovering planets and other cosmological discoveries makes us keenly aware that we are part of the Universe. Treating study of the wider Universe like a kind of curiosity is a huge mistake. Just as neglecting the environment we live in, i.e. our backyard, neighbors, and city, can cause huge inconveniences in our lives. The same sort of problem arises in science, albeit on a significantly grander scale. I am convinced that in the long run, the future of mankind hinges on to what extent we understand the Universe and our own origins in it.

Back then, in 1991, were you solely interested in pulsars or were you somewhat expecting to discover planets?

Two or three papers had been published in the years leading up to my discovery, speculating about the possibility of planet formation around neutron stars, but no one paid them *much heed. That was very definitely not what I wanted to research. Our project's objective was to look for old neutron stars. It was a very large project, requiring a lot of time on the Arecibo radiotelescope. Fortunately the telescope malfunctioned and couldn't be used normally - that put an end to the struggle with other astronomers over telescope time. We astronomers resident there in Arecibo gained two or three weeks essentially all to ourselves. And that made everything possible, giving us an incredible opportunity.*

And how did that project end?

Firstly, it confirmed our predictions that old neutron stars are isotropically distributed in the sky. Secondly, I then discovered a double pulsar which turned out to be the best known means of testing the theory of gravitation. The third finding was the unexpected discovery of a planetary system around a pulsar.

At that time it was not even clear whether planets occurred commonly in the Universe, or whether that was more of a unique discovery...

In the late 1980s it had already been realized that planets should frequently occur around normal stars. The surprise was more that none had yet been found. But it came as an even bigger surprise when the first planets outside our system were discovered orbiting a neutron star.

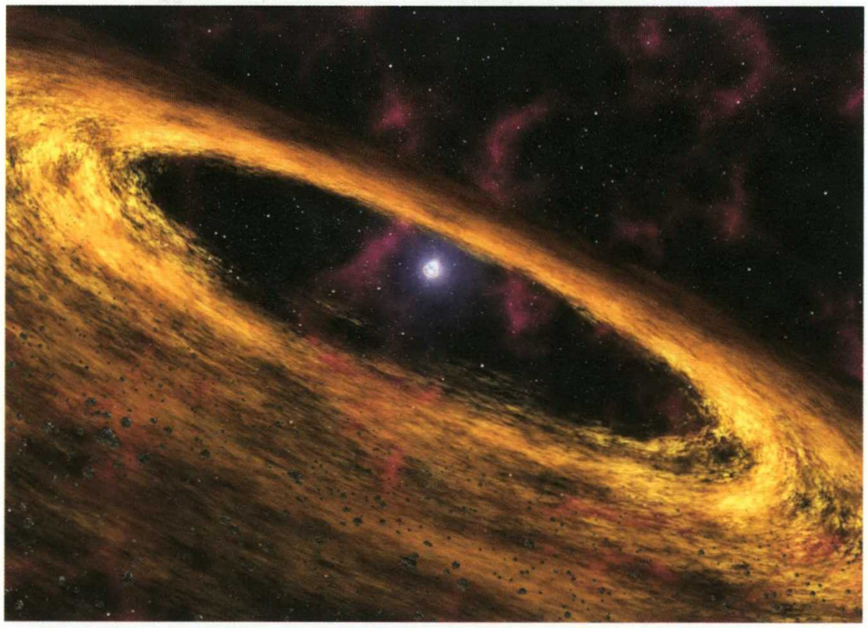
Do we already know whether those planets survived the supernova explosion that gave rise to the pulsar, or rather formed afterwards?

The likelihood that a planetary system orbiting an original star that turned into a pulsar might survive the explosion is minimal. It seems more likely that some of the matter ejected during the supernova explosion did not reach escape velocity, fell back, and formed a disk around the newly-created neutron star; the planets could have formed from it. Discovering planets orbiting a pulsar made us realize that planetary systems orbiting other stars must be quite commonplace, if they could form even under such difficult conditions. Perhaps we were just not searching the right way. Two years later that suspicion was dramatically confirmed when the first planet orbiting a star similar to the Sun proved to be what is called a hot Jupiter, a planet circling its star every four days instead of every 10 or 15 years as expected for Jupiter-like planets. Since that time we have been discovering a whole zoo of planets and planetary systems, but so far none of them has been similar to our Solar System - with the exception of that pulsar system, strangely enough.

The discovery of the first planet orbiting a star similar to the Sun, 51 Pegasi, is frequently portrayed as the first discovery of an extrasolar planet - especially in non-Polish literature. Do you feel somehow neglected that those planets around the pulsar are not always recognized as having been the first?

I don't lose any sleep over it. Besides, it seems to me that science is slowly gaining the upper hand over emotionality and a lack of objectivity. We also have to remember what I clearly understood from the outset: that my discovery did not fit the mold. It was interesting that very few attempts were made to challenge it. The observational facts were strong enough that questioning them did not make sense. But one could also sense a lack of acceptance, stemming from the fact that everyone had been prepared for the first discovered planet to be a Jupiter circling a star similar to the Sun, once every 10 or 15 years like in our Solar System. Yet things turned out completely differently. For many astronomers that proved hard to accept, a psychological shock that still lingers to a certain extent.

The team that discovered the planet circling 51 Pegasi are now in the lead among big planet-hunting projects and consortia. Have you ever dreamed about pulling together such a large group of planet-hunters?



NASA/JPL-Caltech

How did the planets orbiting the pulsar PSR B1257+12 come into being? One new discovery - a disk of gas, dust, and debris circling a different pulsar, which exploded as a supernova only 100,000 years ago - could help us explain how new planets arise around such "dead" stars

I am deeply convinced that such consortia are very necessary, especially for research that entails huge costs and cannot be carried out by small teams, without the kind of financial backing provided by university consortia and various foundations. On the other hand, however, work in large groups has to be subject to some sort of routine. That means a risk of overlooking something completely new, which could have taken research down a different avenue. Both methods are necessary: both large teams that capitalize on existing discoveries and expand newly-discovered fields, and small, more flexible groups that can do things that might seem like madness at first glance but might yield great discoveries from time to time.

At present I have a small Polish-US group that has already achieved its first successes. In a certain sense it represents the culmination of my efforts to establish a planetary study group in Toruń doing top-caliber research. In May we managed to attract a bit of media attention when we discovered the first giant planet orbiting a giant star - one similar to the Sun but further along in its evolution and already greatly distended. Our ambition is to monopolize a somewhat neglected, but vastly interesting field of research: discovering planets orbiting old, evolved stars. What happens to such planetary systems as stars go through the long process of dying? Could life arise there? One day this field will be nearly just as popular as hunting for planets similar to the Earth.

Robert Gardziński/Fotorzepa

Professor Wolszczan's current ambition is to create a research group monopolizing an unrightfully neglected, but vastly interesting field of research: discovering planets orbiting old, evolved stars

You divide your research time up between Poland and the United States. What are the advantages and shortcomings of the different research systems in these countries? Where is it better to work?

I am definitely not an objective critic here as I spend relatively little time in Poland. But it does seem to me that the US system is obviously better, more effective, more flexible, and significantly healthier financially. It ensures the basic conditions necessary for rapid development, especially for young scientists. It simply invests in talent. It doesn't drag talented young researchers downwards, doesn't put obstacles in their way. On the contrary, it rewards talented people and gives them truly excellent chances to develop themselves. Now of course there is a crisis everywhere and things are no longer that easy, but they are still not bad.

The US system is quite well known for thriving and being more productive scientifically. But it has also been said that a system in which one's promotion or opportunities depend strictly upon the number of one's publications makes it very difficult to work in fields where relatively long periods of time must elapse between successive publications. Is it really true that one needs to wait until retirement to try to create a bigger picture?

That is a simplified view. It is true that the frenzy of publication-counting and checking which journals are on the Philadelphia List or not really does get in the way. It is also true that

Stanisław Krawczyk/Toruń Center for Astronomy, Nicolaus Copernicus University

The 32-meter radiotelescope owned by the Toruń Center for Astronomy, Nicolaus Copernicus University, participates in the worldwide VLBI network and permits observation of a whole range of objects: from pulsars and planetary systems to quasars and radiogalaxies

under the US funding system, 40% of one's time is spent writing applications to various foundations. But on the other hand various agencies, such as NASA, do try (although quite ineptly) to create some sort of window for unusual research projects. They do realize the limitations of the system. In Poland, on the other hand, I really am appalled when I see the tons of paperwork involved and the restrictions later imposed on projects that get accepted. Compared with that, the US system is very simple.

Does your work occupy most of your life at this point, or does science leave you time for other pastimes and passions?

I do not have much free time, but when traveling around the world I try to find moments to see something new. I have always been very curious about the world. Being in different places, meeting different people, seeing different things - that has always been my passion. At home I spend a lot of time working in my garden. I love cooking. My wife and I are aficionados of Mediterranean cuisine. We love to spend time in the kitchen inventing new dishes together.

The hard sciences, specifically physics and astronomy, were in a certain sense still considered to be the most important disciplines in the 20th century, but now interest has shifted towards the biological sciences. If you were just starting out on your scientific career right now, might you choose a different field?

Frankly speaking, I can't say what I would do if I were to step back so many years. But physics and astrophysics are definitely the most fundamental sciences one can imagine. At this point applied sciences have gained the upper hand and the fundamentals are starting to be forgotten somewhat. That is not good, because fundamental sciences and their applications together form a closed cycle. Neglecting one of these elements has an impact on the development of the other. And for studying our place in the Universe, astrophysics is absolutely crucial. Despite our vast efforts to understand the phenomenon of life and explain how it arose, we stand no chance of getting to the essence of the problem without discovering life elsewhere.

I once had a cosmologist friend who in the 1990s used to say: "Just let me figure out how much that Ω_0 equals, and then I can retire as a researcher." Is there any one thing that you would really like to find out?

There is an old Polish saying about how chasing a rabbit is much more intriguing than actually catching it. Cosmology is a very good example of that. Of course, Ω_0 is no longer such a mysterious issue, but we do face the question why the Big Bang model, which otherwise functions well, completely fails to account for dark matter and dark energy, which constitute 90% of everything that exists in the Universe. That is something hugely problematic, while Ω_0 or any other particular value is relatively unimportant, simply part of the model.

In other words, even answers to the questions which seem most important to us simply lead to more questions?

They lead to more questions which far surpass the original ones. Hence my approach, which can be likened to chasing that proverbial rabbit. For now, there is no ultimate answer and there will not be one.

Thank you ever so much for the interview, Professor Wolszczan.

Interviewed by:
Weronika Śliwa
Warsaw, 15 July 2007

Prof. Aleksander Wolszczan became world-renowned for discovering the first extrasolar planetary system. He graduated in 1969 with a degree in astronomy from Nicholaus Copernicus University in Toruń, where he also defended his doctorate in 1975 (on scintillation in pulsar spectra). Since 1992 he has worked at Penn State University as professor of astronomy and astrophysics. In 1991 he discovered the three first extrasolar planets, orbiting the pulsar PSR 1257+12. (The paper about this discovery in *Nature* was recognized as one of the 15 most fundamental discoveries in the field of physics ever to have been published in the prestigious journal.) He won the Polish Astronomical Society Award for Young Astronomers in 1976, the award of the Foundation for Polish Science in 1992, and the Beatrice M. Tinsley prize from the American Astronomical Society in 1996. In 1997 he was decorated with the Commander's Cross of the *Polonia Restituta* Order for his contributions to Polish science.