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Title:	**Dr. Marvin Münzberg: What is actually happening?**
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Marvin Münzberg: For me personally, transfer means that we don't just sit in our own lab and do research and maybe write a paper now and then, but that we get in touch with people, that we talk to industry partners, that we also respond to the needs of users, so that we can make progress together.

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Speaker Announcement (under Music): Listen UP. The Podcast oft he University of Potsdam

Speaker 1: Today: What's actually happening? With Dr. Marvin Münzberg.

Speaker 2: Marvin Münzberg from Berlin studied chemistry at the University of Potsdam, was employed as a research assistant in the field of physical chemistry during his studies, and also completed his doctorate there following his diploma:

Marvin Münzberg: That is to say, I haven't really had anything to do with hardcore chemistry for years, with tipping two things into each other, but actually a lot on the computer, but also just building things together overall, which is a lot of fun for me. And building techniques, investigating stuff. Making samples secondarily, so to speak, but rather investigating the sample and finding out something about the sample.
As part of my PhD, I was looking at process analysis, and that is, we actually specialized in looking at things that happen during a reaction. That is, when you have a chemical reaction, there is a certain sequence of events from start to finish. And what you often do is: You look at what you put in at the beginning? And then you look at what you get out at the end. But very little attention is paid to what actually happens during the process.

Speaker 1: Turbid liquids in particular are the subject of Marvin Münzberg's research. Among other things, they play a role in the production of coatings and paints, in cosmetics and in the food industry.

Marvin Münzberg: For example, you have a dispersion, as it's called, and it looks like milk or like white wall paint. And most other techniques have the problem that they can't measure in there because no light gets through; it's just white, so it's very cloudy. And our technology can do that. Using certain tricks, we can still measure in there and determine the particle size. In other words, we see how the particles slowly grow and become larger and larger, and this is measured over time.

Speaker 2: The measurement technique Marvin Münzberg uses in his very practical research work is called photon density wave spectroscopy.

Marvin Münzberg: It's optical spectroscopy with lasers, where we go with laser beams into a sample or into a reactor and then measure the properties of that sample, so in real time on the spot, in the

original concentrations, without now taking a sample, diluting it and sending it to some laboratory and so on.

Speaker 1: This method for analytical characterization of chemical, physical or biotechnological processes in liquid dispersions was developed at the University of Potsdam.

Marvin Münzberg: I think it was almost 20 years ago that Dr. Oliver Reich developed it. He initiated it in his doctoral thesis, but the technology is still being further developed at the university and, as far as I know, we are pretty much the only working group that has this technology and is also developing it further.

Speaker 2: Marvin Münzberg now heads the "Applied Analytical Photonics" working group. The group of around ten young junior scientists conducts research at InnoFSPEC Potsdam.

Speaker 1: InnoFSPEC - the name stands for Innovative Fiber Optic Spectroscopy and Sensor Technology - was founded in 2008 as a joint project of the University and the Leibniz Institute for Astrophysics in Potsdam.

Speaker 2: Under the motto "from molecules to galaxies", the Innovation Center conducts interdisciplinary photonics research in astrophysics and physical chemistry.

Speaker 1: There, the innovative method of photon density wave spectroscopy, PDW for short, with which Marvin Münzberg and his colleagues work, is being further developed. In order to be able to transfer the research results into practice, the company PDW-Analytics was founded as a spin-off in 2013.

Speaker 2: For the young scientists, this opens up the possibility of a dual-career system: on the one hand, they can continue their research and, on the other hand, they have the opportunity to apply their results in collaborations and projects with the processing industry and to further develop the technology in practice as well. For Marvin Münzberg, this was a decisive criterion for staying in Potsdam after completing his doctorate.

Marvin Münzberg: Basic research is very important, but I have always lacked a connection to reality. So what do I do with it in the end? It's very nice that this works and that I see this effect. But what does it help? And that's why it was always important to me that I work on technology that can actually go somewhere and be used. And that's why it's called Applied Analytical Photonics, because we want to get into applications. We also have a lot of industrial partners through the university, where we use our technology on site and cooperate with industry to make progress.

Speaker 2: Of course, as a scientist, Marvin Münzberg is fundamentally interested in what is actually going on during a process he is studying.

Speaker 1: Above all, however, it is his concern to find out where the potential for optimization lies.

Marvin Münzberg: Exactly, by seeing how the process runs and what is happening, we can of course also intervene at certain points. That means we can see if something is going wrong during a reaction and can then stop the process or add something to change the product. Or we can see that nothing is

happening now, and actually we still let it run for three hours, even though that doesn't help at all. You can really do process optimization, so to speak.

Speaker 2: The fields of application for process optimization are manifold. Whether in the production of plastics, algae or beer, there are actually steps in every industrial manufacturing process in which the intermediate products are present in a very turbid form and could be analyzed using photon density wave spectroscopy.

Speaker 1: Unfortunately, the young scientist regrets, it is still standard in the chemical industry today to work according to established empirical values.

Marvin Münzberg: That means you always do the same thing and hope that the same thing will come out. And if it doesn't come out, then you have to think about what went wrong. Quite often, you throw it away and just do it again, which is of course quite questionable from an environmental point of view. A good example, where you can perhaps also see that it is otherwise always empirical values, is in cheese production. An enzyme is added so that the cheese becomes cheese. And there is a cheese master who checks exactly when do I have to pierce the cheese now? That is, he stands there, goes in with his finger and sees "Ah, now is the right time. And with our technology, we can see exactly this point, because the cheese changes visually, even though you might not notice it with your eye. There is then a point where you can see exactly "Okay, now would be the perfect time to just pierce this cheese". And that means you can automate it and, of course, also achieve a reproducibility that you wouldn't otherwise be able to achieve as a human being.

Speaker 1: Marvin Münzberg is particularly interested in projects that have a very concrete environmental relevance:

Marvin Münzberg: For example, we have a project that is just starting. The aim is to cultivate algae and measure them in a photon bio reactor. And we want to look at the microbial load. When can we see, so to speak, that the algae are not doing well while they are growing, so that we can get higher yields? And for me, it's about simply making progress, so to speak, because I think that this is a technology or a process that should be promoted.

Speaker 2: In order to obtain as comprehensive an overall picture as possible of the processes under investigation, Marvin Münzberg's research group does not limit itself to photon density wave spectroscopy, but uses various analytical methods and technologies depending on the requirements. As required, their own techniques are also developed to complement the already existing possibilities.

Speaker 1: For the future, Marvin Münzberg wishes that this form of process analytics would be used as a matter of course in every industrial manufacturing process.

Marvin Münzberg: So, at the moment, with the topic of Industry 4.0, it's been on the rise, of course, that more and more industries and techniques are somehow using process analysis. But it is not yet where it should be, in my opinion. In fact, at least every newly built reactor should be fully equipped with process analysis so that we know what is actually happening and where we can intervene. I come from the technology side, and I enjoy solving problems. Where the problems come from exactly, whether it's algae or beer brewing or polymers or crystallization, is not so important. For me, it's more

about whether it's an interesting topic. Something interesting is happening, so to speak, and we want to try to find out together what. What is actually happening?

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Speaker Announcement: Listen-UP: The Podcast of the University of Potsdam.

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