

ExSACT interviews on *Intellectual Property:*

h-cube* project

* *Micromechanical Bolometers arrays for THz hyperspectral imaging.*

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ATTRACT phase 2 project: [h-cube](#)



What is the h-cube project about and what is your role?

My home institution is **Consiglio Nazionale delle Ricerche (CNR)** in Italy, and I am the project coordinator of the [h-cube project](#) within the **ATTRACT phase 2**. Additionally, I am a fellow at the Paul-Drude Institute in Berlin, so I have been spending some time in Germany as well lately. The basic idea of h-cube is to build a new generation camera for the far infrared radiation, specifically, we would like to target a few terahertz (THz) frequency range. This is not something radically new, since one can already find THz cameras on the market, but they are usually not very practical or convenient. They have limited applications because they need to be cooled externally, are very expensive or difficult to scale up. Our approach will solve these issues by giving us a game-changing technology based on an uncool camera, which can operate at a room temperature with a large number of pixels that can be addressed independently.

What is the impact that you foresee for this project? It is a European project, so it is especially focused on the social, environmental, and economic impacts. Could you please tell me more about that?

Many people try working with THz radiation mostly because of possible applications. THz range lies in between photons, e. g. laser technology, and electron technology. And while we know photons and electrons very well, THz is something in between which makes it more challenging because you cannot use the standard techniques of electronics and photonics. However, there are precise and practical applications that work very well in the THz. The range of application is wide, from quality control to health monitoring, security, crop inspection, astrophysics and so on and so forth. With so many possibilities, you can imagine that having an apparatus that can efficiently detect THz radiation at room temperature can be useful in many different fields.

We do not foresee a direct impact on society as in a single specific task but more of a general impact. For example, from a practical point of view, if you had a THz camera working at room temperature at the border control at the airport, passengers would not need to go through the sometimes long and annoying security control. Instead, they could be monitored by an external camera when going through a corridor. Or for health monitoring. For example, sometimes people that have a tumour or something else that needs to be removed, are diagnosed many months before the surgery. Consequently, when the time of the surgery comes, the surgeons need to cut out larger portions of the diseased organs because they cannot be sure if the tumour has grown in the meantime.

Therefore, live monitoring as such can be extremely useful for precise surgical operations. Same story for the medicine. When you make a pill, it is very hard to see if it is homogeneous or if it works as well as you predicted. To do that, you need to crack them open and measure their components. But THz is non-destructive and will be able to increase the efficiency of producing and controlling drugs and food and so on and so forth. There are many fields in which THz can be useful for society.

With regards to the environment, I do not foresee any direct impact on the environment apart from the fact that the more efficient you are, the better you are at saving energy. So, our technology might, with its many, many applications, be able to fill some holes in this super wide field.

It will also have impact on the economy, especially if this technology will be commercialised...

Yes, we hope so, of course.

Do you maybe know how big is the market of sensing devices?

It is big, but I don't have the numbers with me right now. One of the partners in our project is a consulting agency (Asteria). Their main job in the project is to investigate the market and see where the most money is. Not because we want to get a lot of money, but because the chances of getting funding after ATTRACT are higher. The biggest markets are either quality control for food, the food industry and security.

I have noticed that one of the partners in your consortium is UAB TeraVil, a Lithuanian manufacturer of detectors and emitters. Are they expected to bring this technology to the market, or do they have some other role?

We discussed this possibility with them, but they are not interested in building a new technology at the moment. Their main task in the project is to compare the technology we get out of the lab with the one they are commercialising in their company. They also have a so-called 'open lab' where people can come and test THz devices using their technology. They are basically offering the same service, but of course, instead of paying a fee, they want to be part of the project because they want to be involved in the new technology. However, at the moment they are not really keen on taking it over and commercialising it.

We are currently in the 'in-between' stage. During **ATTRACT phase 1**, we were in the lab, and everything was fine: the technology, the proof of concept of the technology were working on. Now in **ATTRACT phase 2**, we are going out of the lab to the market. We hope to get something ready by the end of the project, but we cannot know for sure how well-performing it will be. At the moment, we are trying to submit a patent application and discussing about the patent negotiations and patent use after the project. But nothing is set in stone yet.

You have mentioned the possibility of a patent. Do you foresee any other forms of intellectual property or is a patent application the most suitable for you?

We think that the patent is the most suitable for us because the market is already full of players and the intellectual property (IP) landscape is huge. We think that just with patent applications, we cannot cover all the aspects of our technology. We partially knew about this issue in advance and some other patents came out few months after the project started. The field is rich with companies and research groups, so we aim to patent only some parts of our technology and, get the agreement of mutual use of patents with other companies involved in this field.

The European Commission has set rules about State Aid for research and development, and one of the aspects is the relationship between the research organisations and companies. It is foreseen that research services in contract research are offered at the market price. Additionally, the intellectual property transfer in collaboration projects must be suitably compensated so the company pays for it at a normal price. This question might be beyond the scope of your project but how familiar are you with these rules?

Not very familiar yet. I knew this was going on at the European level, but I have not looked at it yet.

What about the services? Do you offer any services to the companies, maybe your local ones, or not?

No, not at our institute.

The technology transfer is a big challenge and is rarely successful. Have you been personally involved in any success stories where you built a piece of technology that was later successfully transferred to the market?

Yes! Currently, I am involved with another project in which we got a patent accepted just a couple of months ago. And as you were saying, it is very challenging for several reasons. First of all, the way we work as scientists, we usually do not look directly for applications. Most of the time, the most important thing for us is to get a good paper out. But when you get a good paper out, it is already too late. Because you are spreading the knowledge you cannot patent your technology anymore. On the other hand, I feel that the timeline for the patent acquisition is too long for us. If I have a good idea and have many competitors working in the field, it is very hard for me to wait a couple of years for the patent to come out and only after that proceed with the publication.

My career is balanced, of course, I'm interested in technology, and it would be nice to be involved with some company producing the technology, but in order to improve my career I need to improve my curriculum vitae. Therefore, not publishing a good paper on time can have big consequences for us. For example, several colleagues got some patents out but they were not able to do anything with them. The patent was out, it expired a few years later and that was the end of the story. And they did not get a nice paper out of it. Personally, I think this is the biggest limitation. A faster way of getting some protection for your intellectual property would be needed. I understand why it is such a huge challenge considering there are so many patents

around, looking for state-of-the-art can be very time-consuming. But sometimes we need to think about whether something is worth patenting or not.

Does your institute have an internal technology transfer office that offers support, or do you use external support? What is your experience?

Our institute Consiglio Nazionale delle Ricerche has a technology transfer office at the national level. Our institute is gigantic and spread all around the country. The technology transfer office is located in Rome, the capital. We interact with them quite a lot and they helped us find the external attorneys to file the patent. They are very useful. But what we would really like to have is somebody to help us with more practical tasks.

As I mentioned before, I did the prior art research myself. And that was extremely time-consuming because there is no clear united database. We had to read all the patent claims by ourselves, which was difficult, so having an office that could at least help with the prior art analysis would have been a huge benefit, at least for my institute. After we realised we had something that could be patented, the office was very good. They put us in contact with the right attorneys and the process went smoothly from there. But in the beginning, it was really slow.

Could you describe the role of the consulting company which is one of the h-cube partners?

Asteria, the consulting company, is working on the market analysis. When we started the project and the proposal, we verified that more or less the IP landscape was good at the time. We knew that there was room for our product, but we did not have a clear vision of the market sectors which could suit us best. Asteria is talking directly to the companies and investigating which sector would benefit from our product. This is helping us a lot because we receive feedback on what to focus on.

As researchers, we can spend time proving a concept or we can focus on practical issues, such as the development of fast detectors instead of highly sensitive detectors because one is more useful for application than the other. Working with them has been useful so far because they show us the right way to go to achieve the right product for the market. Working with a consulting company is very useful and I will consider doing that in my next project as well. Having somebody that is an expert on the topic and also able and capable of talking to the scientists, is a huge asset.

Have you ever heard about anyone breaking the rules? Maybe a company that stole someone's intellectual property at the university or institute? Are you aware of such cases?

No, not in my field. I read about it in the news, but I don't know anybody or any of my colleagues involved in this kind of situation.

Have you ever considered the possibility of creating a spin-out company of the institute?

Yes, we have considered it as a consortium. However, before deciding on it, we need to see how the project goes, and if we can get a nice working technology and maybe some patents just to protect our technology. One potential issue that we could face is that for a spin-off company, we would need people who will work 100% just on that because it would not be easy if we do it. I have a good position in academia. I like my job and I would find challenging to switch. It would be amazing to be involved in a spin-off through a scientific board, but we need

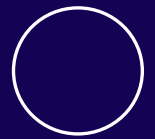
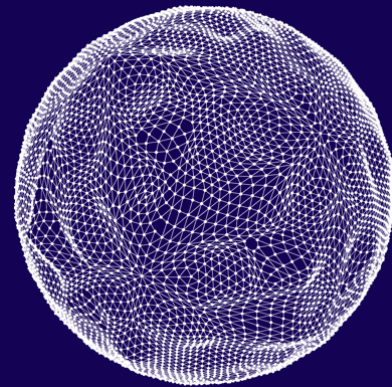
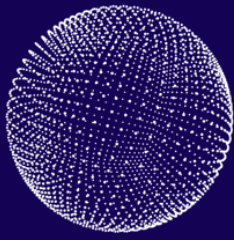
major players for that, and it is not easy to convince young postdocs or PhD students to make the jump. They are either scared or they want to stay in academia. So, even if we decide that it is worth establishing a spin-off and we try to commercialise the technology the way we hope, it could be difficult to find the right people for that.

Have you considered looking for people from other areas who don't have technical backgrounds?

I would like to have both. We need people who are experts in economy, market strategies, and so on, but we also need scientists because they know best what is doable and what is not doable, even if they are not involved in every detail of the project. In my experience, this kind of mixed figure is very hard to find, and that is a big limitation in all the technology transfers to the market.

What about the management of intellectual property in terms of creating spin out or spin-off in relation to the university or institute? Is it difficult to negotiate? Are there any other problems? Does it take too long?

As far as my experience goes, the process could be a bit long in my opinion. So again, not all of the gears run smoothly. You need to interact with many people and read and discuss a lot of other people's work, which can sometimes quickly drain your enthusiasm.



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