変革を駆動する先端物理・数学プログラム (FoPM)

国外連携機関長期研修 報告書

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I worked at NASA/ Jet Propulsion Laboratory as an intern for 3 months. I'm a student representative at IEEE UFFC-S. My supervisor at JPL is a member of IEEE headquarters, and we met at a conference then he invited me to the internship. During the internship, I stayed in Pasadena, Los Angeles. Pasadena is about 30 minutes away from LA downtown and the weather is perfect to live. The group I joined was in a section of Deep Space Network; that have responsibility for all communications between Earth and satellites in deep space, such as James Webb Space Telescope and even Voyager. Especially, I worked on developing a new mission concept of passive optical communication with quantum-well modulating retroreflectors and an optical frequency comb. There are several works that utilize multiple modes of light as independent communication channels in terms of fiber-based communication. But in space applications, we have to use free-space ways to communicate. In the group I belonged is interested in passive optical communication with MRR, since there no longer be need of laser systems at remote sites, such as CubeSats or UAVs, and its low power consumption. With MRR, we can reduce the complexity and requirements at remote sites. My work was exploring the way to combine their advantages for future space missions. I have done simulations with optical ray tracing software and developed a real optical system. I checked that the experimental results were consistent with my simulation. Now we are preparing for a conference paper about my work. What I was surprised at was that the approach of research was quite different from what I do in Japan. In Japan, we are trying to develop the state of the art clocks without any other limitations, so we can develop our plans and systems from scratch. But at JPL, since the system has to be for space missions, we have to think about many limitations and conflicts from other sources, such as overall power consumption and size. I had to understand many factors involved in a mission and their trade-off, in addition to just my system. This catching up took me about one month and was one of the most difficult things at JPL. My work at JPL was different from what I do in Japan and it is difficult to try different research area in one laboratory, so such internship experience was valuable and fruitful.

My purposes for this internship were: how difficult tacking different and unfamiliar research areas was, thinking about the way of research I do in Japan from a different aspect, what my best career should be, how the top level international laboratory was, and how my research ability was compared to other international researchers. Working at JPL with a topic of optical communication was perfect for me to check such things and I want to utilize this great experience during and after Ph.D.