



DeMaMech Exchange Program

Aug. 2005 – Jan. 2006



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Summary

- Host institute were **Technical University Delft** (Aug. 2005 – Dec. 2005) and **Denmark Technical University** (Jan. 2006)
- Research topic was **Noise properties of wavefront sensor in Adaptive Optics**
- Took 2 courses in Delft (**Lower intermediate course** and **Advanced optical microscopy**)
- The life in Delft was quite comfortable (moderate climate and good location of my accommodation).
- In Denmark, I lived in the Student Village, where a lot of people from various countries had lived.

Everything I had experienced was all fresh and unforgettable !!



TU Delft



DTU

Research

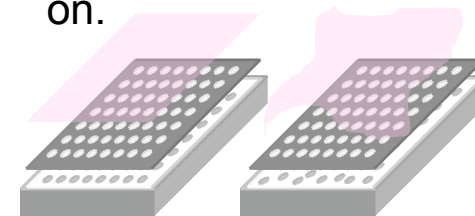
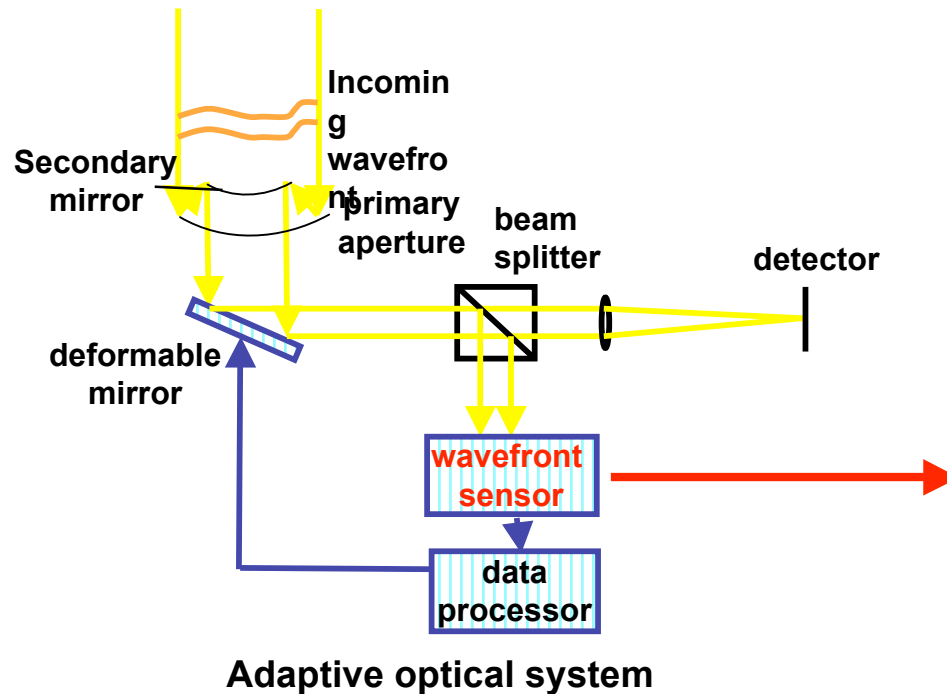
Noise properties of wavefront sensor in Adaptive Optics

Aim: Find the noise sources which influence on the output of the Hartmann-Shack wavefront sensor in the measurement of wavefront.

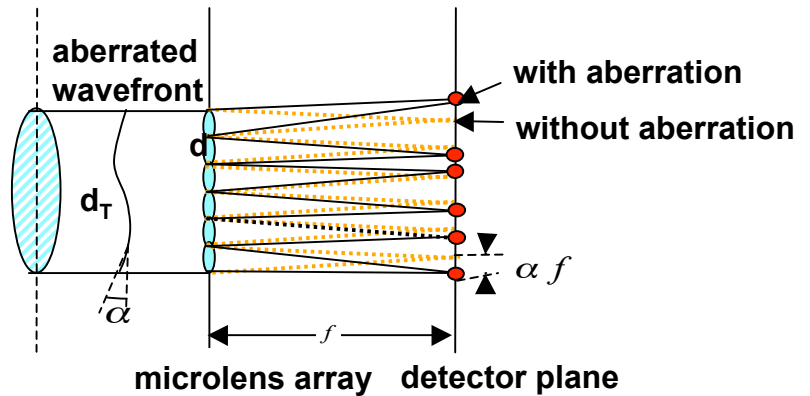
Noise sources

detector noise (photon noise, dark current noise ...)
truncation noise

Those noise sources are influenced on the number of pixels and photons, temperature, and so on.



Hartmann method



Hartmann-Shack wavefront sensor

Course

English Courses

- 3 English courses per a week
- In the last class, I took an exam and also made a presentation about Hokkaido.

What is Hokkaido?

- Area: 83,454km²(>Holland: 41,526km²)
- Population: 5.65million(<Holland: 16.32million)

Tourism in Hokkaido

- Hokkaido has a lot of attractive place s!
- 6million people visit there from the rest of Japan per a year.

Siretoko

- Siretoko has been designated UNESCO World Heritage Site since this year.
- There are a wide variety of animals and plants.

I ♥ Hokkaido.

I hope all of you would like to go to Hokkaido!
If you want more information, feel free to ask me!!

Advanced optical microscopy

- Clarifying the physical background of novel optical microscopy methods and studying the most important methods, its importance and limitations.
- I made a 40-minute presentation about CCD camera.

What is CCD?

- CCD (Charge Coupled Device) are **silicon based** integrated circuits consisting of **matrix of photodiode** which convert light energy in the form of photons into an electronic charge
- CCDs have many advantages, such **high-quality, low-noise, high uniformity**, and so on.
- They are used for **scientific, astronomical, biological**, and the other commercial imaging areas.

Architecture of CCD

- **Interline Transfer (IL)**
 - IL is composed of a hybrid structure incorporating **gate photodiode** and an associated **parallel readout CCD storage** into each pixel element.
 - During readout, the next frame is being integrated, thus achieving a **continuous operation and higher frame rate**
 - The major disadvantages of IL CCD architectures arise from the **complexity** of the devices, which leads to **higher unit cost and lower sensitivity**

The Two Phase Clocking

- **Four gates** for each pixel, with adjacent gates connected together in pairs.
- Each gate pair is connected to a **clock line** and one of the gates in each pair is designed with a **raised-type doping level** under the gate

CCD Enhancing Technologies

- **Pixel Binning**
 - Pixel binning is a clocking scheme used to **combine the charge** collected by several adjacent CCD pixels
 - It is designed to reduce noise and improve the **signal-to-noise ratio and frame rate** at the expense of **resolution**

Exchange Student Life

Various meetings and partings...



Long beer glass!



In Praha



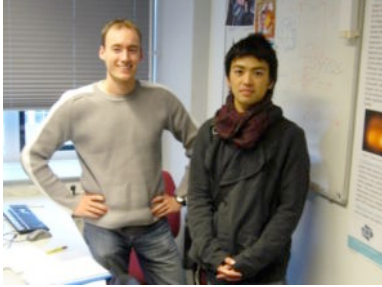
Party in Denmark



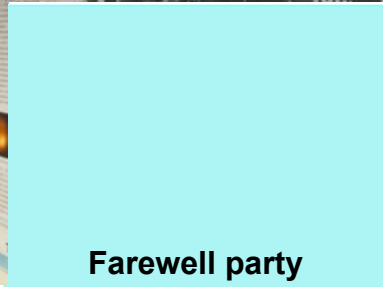
My birthday party



With Spanish friend



With my supervisor



Farewell party



With Shinji Ono!



English course



With container mates

