

## Discussion on ground-based asteroseismology

led by

Christiaan Sterken

Vrije Universiteit Brussel, Pleinlaan 2, B-1050 Brussels, Belgium

*Dziembowski:* I would like to ask Eric Fosfat about the situation of human beings during the Antarctic night. How easily can be taken care of ill astronomers? How quickly can they be taken to hospital?

*Fosfat:* There is a doctor at the station with limited surgical equipment and capability, but if you are in real big trouble, there is absolutely no possible escape during 9 months and you have to be taken care at the station within these local possibility limits. During the daily routine, you have to take care that you get proper rest and you must be careful with breathing because you can freeze inside, which is very uncomfortable.

*Kaye:* There has been some discussion about the automation of telescopes. At Fairborn Observatory, there are at least two that are operated by Vienna and there is a large collection operated by Tennessee State University, but all those are photometric. As far as I know, they work extremely well. The Tennessee State group is still trying to build an automatic spectroscopic telescope that is still not off the ground and they've been trying that for about eight years. So when we're considering the possibility of automated telescopes for photometry we know how to do it, but it's still non-trivial and it still requires people to actually go there when there are technical problems. With spectroscopy, I am not sure the problem has been solved, and the other half of that is, where do you put this? It's likely that it is associated with a university which has students who would like to go to a telescope and use it. So, while in practice you can get a very high duty cycle on APTs, you could probably have something with a very high duty cycle and associated with a WET campaign, so that you get spectroscopy and photometry at the same time on the same object at a very dense collection. So when students actually go to the telescopes, they can take spectra of that object at a comparatively low duty cycle.

*Bedding:* I have a question and a comment. The question is if there is any possibility that the bandwidth for communications will improve at Dome C?

*Fosfat:* Right now, the bandwidth is a few kB. The prospect is to improve that to 150 kB in two or three years.

*Mosser:* In fact, it's very easy to transmit time series, it's just an email.

*Bedding:* My comment is directed towards Frank's talk, to point out the difference between photometry and spectroscopy for the detection of solar-like oscillations. In photometry, the background from granulation noise is higher than for spectroscopy. One can see  $\ell = 3$  modes in the velocities because of the lower background.

*Weiss:* I got the impression that the spectrograph for SONG does not use a fibre. What was the argument for that?

*Grundahl:* The configuration we chose is the safest (it is not the cheapest!). The reason for avoiding the fibre is that for the grating size we will use for the spectrograph you will get a lower efficiency. The use of a fibre has been tested with the iodine method, but I haven't seen a performance of half a meter per second, which is our goal, in the literature. I think it is likely but it would have to go into a prototype. One thing I probably didn't point out clearly is that by putting things into a Coude room, the only moving part that will experience weather is the telescope; everything else will be stationary. The only part that will move is the atmospheric dispersion corrector, and I think this is an important aspect for operations.

*Weiss:* But that will be the same with a fibre.

*Grundahl:* Yes. I am not saying this isn't possible, but I think it is better without a fibre.

*Kaye:* If you have a fibre-fed spectrograph and it will be automated, the potential for light loss in the fibre is much higher because of the way it's going to operate. We saw that at the Multiple Mirror Telescope at the Hard Labor Creek Observatory, where they put nine 33-cm mirrors together to form one 1-m-class telescope, and the outer eight mirrors each fed a fibre to the spectrograph. The path of the fibre was very short but you lost a lot of light just because of the nature of the beast. If you want to have it mechanically simple, Frank's layout is probably safe.

*Hatzes:* Two comments on your prototype design. There's a lot of reflections there, and if you want to make a 1-m telescope as efficient as possible you may not want to have a factor of  $0.85^4$  due to reflections in your light path. Another point about using the fibre: you may also want to estimate how much image stability will cost. Even if using the cell, if you have really really good seeing, you will get worse precision because the image will move around in the slit. There are a lot of trade-offs to consider.

*Grundahl:* We expect to use these coatings that give higher reflectivity. After the third mirror in the telescope you have an optical window which will essentially close the system from there on. You can get these windows which have, say, at least 98% over the wavelength range that we are interested in. With respect to the movements of the star, this is of concern to me as well. Because the telescope is so small, you will get a fairly large slit which will help with the efficiency, but for the image motion we would actually like to use tip/tilt stabilization. At Keck Marcy and Butler achieve 1 m/s with an 0.9 arcsec slit in  $\sim 0.6$  arcsecond seeing.

*Mosser:* With a Fourier tachometer, we avoid all these problems. We use a fibre, but under very different conditions. Think about Fourier tachometers, they are very efficient in these cases...

## Space-based asteroseismology



Jørgen Christensen-Dalsgaard and Gerald Handler.