# iSPEX: Measure aerosols with your smartphone!

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An increasing number of people carry a smartphone with internet connection, a camera and considerable computing power in their pocket almost all the time, wherever they go. iSPEX, a spectropolarimetric add-on with complementary App makes use of this opportunity, and instantly turns a smartphone into a scientific instrument to measure dust and other aerosols in our atmosphere (Figure 1). A measurement involves scanning the blue sky, which yields the angular behavior of the degree of linear polarization as a function of wavelength, which can unambiguously be interpreted in terms of size, shape and chemical composition of the aerosols in the sky. The measurements are automatically tagged with location and pointing information, and submitted to a central database where they will be interpreted. Together with observations from other users at random locations, the data is compiled into an aerosol map. Through crowd sourcing, the general public will thus be able to contribute to a better assessment of the presence of different types of aerosols in the atmosphere. It may also improve the understanding of the relationship between atmospheric aerosols and health issues or climate change.

iSPEX is based on our new ground-based SPEX instrument which will also be presented at the conference [see contribution of J. de Boer et al.]. With SPEX (Spectropolarimeter for Planetary Exploration) we perform multi-angle, multi-wavelength measurements of the intensity and polarization of sunlight scattered by aerosols in the atmosphere (Snik et al. 2009). It will be deployed at CESAR, the Cabauw Experimental Site for Atmospheric Research, which is also host to complementary aerosol measurement equipment, including $PM_{10}$ and $PM_{2.5}$ monitors, sunphotometers and lidar instruments. Both for the ground-based SPEX and iSPEX, we interpret the data using a modified version of the POLDER algorithm (Hasekamp, 2010). The data from the SPEX instrument add significantly to the current suite of aerosol measurement equipment, but they are restricted to the Cabauw site. By distributing many iSPEX units, an air quality measurement network can be created that has both large coverage and the potential for detecting localized effects. Such a smartphone spectropolarimeter is less accurate than its official counterpart at a meteorological site, but we show how many measurements allow for suppression of errors through averaging.

We will give a live demonstration of the first iSPEX prototype. We hope to convince you that iSPEX is not only a great outreach tool to engage the public in issues pertaining to atmospheric aerosols, but that it may also contribute to the solution of several urgent social and scientific problems.

Hasekamp, O. P., (2010): Capability of multi-viewing-angle photo-polarimetric measurements for the simultaneous retrieval of aerosol and cloud properties. *Atmos. Meas. Tech.* **3**, 839–851.

Snik, F., Karalidi, T., and Keller, C. U. (2009) Spectral modulation for full linear polarimetry, *Appl. Opt.* **48**, 1337-1346.

Figure 1. Observing with a smartphone

The iSPEX team consists of the following people:

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