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## Determination of European Honey Bees Permittivity and Conductivity in THz Regime

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High frequencies technologies in vast ranges from communication to bioimaging are developing rapidly and various devices radiating in both GHz as well as THz ranges, namely from 20GHz up to 2THz, are being developed. Such rapid growth, raise the safety issues of such radiation exposures both for humans and other species. This concern is particularly important for insects, as their sizes are both smaller than humans and also are in the same order of magnitude as THz wavelengths. Hence, insect exposed to such radiations can both absorb more energy, which is higher than the safe limit and also show resonances due to their small body size which can act as a dielectric cavity. In this regards, studying the effect of GHz and THz exposure on insects seems vital and requires a detail knowledge of the insects anatomy, as well as the permittivity and conductivity of insects in these ranges. As honey bees are of great importance for environment, and are in-danger, the first case study of insect exposure is on European honey bees.

Correspondingly, and under the project of THz environmental monitoring, we intend to study the European honey bees exposure under GHz and THz radiations, which requires a detailed knowledge on permittivity and conductivity of the insect at the mentioned frequencies. Measuring permittivity and conductivity of the honey bee will be carried out by utilizing a SWISSto 12 transmission measurement setup at 26-40GHz, and 110GHz-170GHz frequency ranges. As the measurement can only be carried out on died honey bees, preserving techniques should be adapted, to correctly take into account the effect of insect's water content. The measurements have to be separately carried out on main body parts of the insect e.g. wings, head, legs, and body, as different part of insect's body have various constituents and hence varying refractive indices.

The current master project will deal with the measurements of dielectric properties of European honey bees using the SWISSto 12 transmission measurement setup. The preserved bees should be separated into their different body parts and then be blended to get a fixed powder with minimum amount of air. The dielectric properties of each part should be then measured and compared to an average permittivity and conductivity of a given bee.

Got curious? simply contact us for an informal meeting discussing the topic or send a thesis request per email to us.

- Requirements:** Knowledge of electromagnetic field theory, interest in THz technology and material characterization
- Character of the project:** 30% Theory / 70% Experiment
- We offer:** An interesting master project at the edge of science in a friendly research environment.
- Contact:** Dr. Mandana Jalali (mandana.jalali@uni-due.de)