MIXING SYNCHROTRON RADIATION AND LASER SOURCES: DUAL-COMB SPECTROSCOPY IN THE SUBMILLIMETER-WAVE REGION

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On the AILES beamline of the SOLEIL synchrotron the HEROES consortium is currently developing new spectrometers based on heterodyne mixing of the THz synchrotron radiation with dedicated laser sources. We report here the first results on one of these spectrometers that aims at exploiting the discrete nature of coherent synchrotron radiation (CSR) in the 100–1000 GHz region, revealed a few years ago by our team[a], to perform dual-comb THz spectroscopy. CSR generated by the so called low-α mode of the SOLEIL machine produces a relatively intense, offset-free, high density frequency-comb in the THz range (THz-FC). We will present the details of our preliminary experimental set-up mixing the THz-FC from SOLEIL with an optical comb from Menlo C-fiber femtosecond laser. Pure rotation absorption transitions of acetonitrile in the frequency domain (covering the 100–500 GHz range) as well as time-domain free induction decays (FIDs) were observed allowing to establish the performances of this new instrument.

[a]Tammaro, S., Pirali, O., Roy, P., Lampin, J.F., Ducournau, G., Cuisset, A., Hindle, F., Mouret, G. "High density terahertz frequency comb produced by coherent synchrotron radiation" Nature Communications., 6: art. 7733. (2015)