WEDNESDAY, MARCH 4, 2015

INTEGRATED PHOTONICS & SENSING

08:30 – 09:00 **5.1** Invited Paper: **Silicon-based Photonic Integrated Circuits for the Mid-infrared**
G. Roelkens
Photonics Research Group, Ghent University - imec, Sint-Pietersnieuwstraat 41, 9000 Gent, Belgium

09:00 – 09:15 **5.2** **Widely Tuneable External Cavity QCL with MOEMS Diffraction Grating for Spectral Scan Rates in the kHz Range**
R. Ostendorf[1], A. Merten[2], J. Grahmann[2], S. Hugger[1], F. Fuchs[1], J. Wagner[1]
[1] Fraunhofer Institute for Applied Solid State Physics IAF, Tullastrasse 72, 79108 Freiburg, Germany
[2] Fraunhofer Institute for Photonic Microsystems, Maria-Reiche-Strasse 2, 01109 Dresden, Germany

09:15 – 09:30 **5.3** **Applications of Hyper-Spectral-Imaging with QCLs in Microscopy**
M. Godejohann[1], B. Bird[2], M. Barre[2]
[1] MG Optical Solutions GmbH, Hauptstraße 35c, 86922 Eresing, Germany
[2] Daylight Solutions, 15378 Avenue of Science, Suite 200, CA-92128 –San Diego, USA

09:30 – 09:45 **5.4** **Mid-infrared Sensor Systems For Monitoring Dissolved Greenhouse Gases**
T. Schädle[1,2], B. Pejcic[2], B.Mizaikoff[1],
[1] Institute of Analytical and Bioanalytical Chemistry, University of Ulm, Ulm, Germany
[2] CSIRO, Earth Science and Resource Engineering, Wealth from Oceans Flagship, Perth, Australia

09:45 – 10:00 **5.5** **Mid-infrared Sensors for Determining Dissolved VOCs and PAHs in Seawater**
R. Stach[1,2], B. Pejcic[1], E. Crooke[1], X. Qi[1], A. Ross[1], M. Myers[1], B. Mizaikoff[2]
[1] CSIRO, Wealth from Oceans Flagship, Kensington, WA, Australia
[2] Institute of Analytical and Bioanalytical Chemistry, University of Ulm, Ulm, Germany

10:00 – 10:15 **5.6** **Miniaturized Enhanced Sensing Systems for Molecular Detection**
L. A. Dunbar, L. Duchêne, R. Eckert, R. P. Stanley
CSEM Centre Suisse d'Electronique et de Microtechnique SA, Jaquet-Droz 1, Case postal, 2002 Neuchâtel, Switzerland

10:15 – 10:45 **Coffee Break**

Silicon-based photonic integrated circuits for the mid-infrared

Gunther Roelkens[*,1]

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In this paper I review our work on silicon photonic integrated circuits for spectroscopic sensing applications. Silicon photonics is an emerging technology for the realization of high-speed transceivers. However, the application range is not limited to optical communication. The wide transparence range of group IV materials such as silicon and germanium enable photonic integrated circuits operating in the mid-infrared. Passive waveguide circuits containing spectrometers have been realzed both in the short-wave infrared (on silicon-on-insulator) and in the mid-infrared (on silicon-on-insulator and germanium-on-silicon). In order to realize chip-size spectroscopic sensors the integration of light sources (lasers, LEDs) and photodetectors are required as well. For this purpose GaSb-based layer stacks are bonded on the silicon waveguide circuits, which are then processed into opto-electronic components. This way, a InGaAsSb on silicon spectrometer with 46 channels was demonstrated, operating in the 1.5-2.5um wavelength range. Laser integration has been demonstrated as well in this wavelength range. An alternative approach for photodetection in this wavelength range is the integration of PbS and HgTe colloidal nanocrystal films on silicon waveguide circuits. Short-wave infrared photoconductors integrated on silicon were demonstrated. An alternative approach to mid-infrared light generation is the use of the large Kerr nonlinearity of silicon together with the broad dispersion engineering feasible in high index contrast silicon photonic waveguide circuits. This way, the efficient generation of mid-infrared radiation is possible using 'standard' optical pump sources. We demonstrated the generation of 3.6um radiation using a pump around 2um wavelength and a signal in the telecommunication wavelength band. Also, an octave spanning frequency comb in the 1.5-3um wavelength range using spectral broadening in a silicon photonic wire was demonstrated. Using silicon photonic technology we demonstrate the on-chip spectroscopic detection of glucose at physiologically relevant concentrations.

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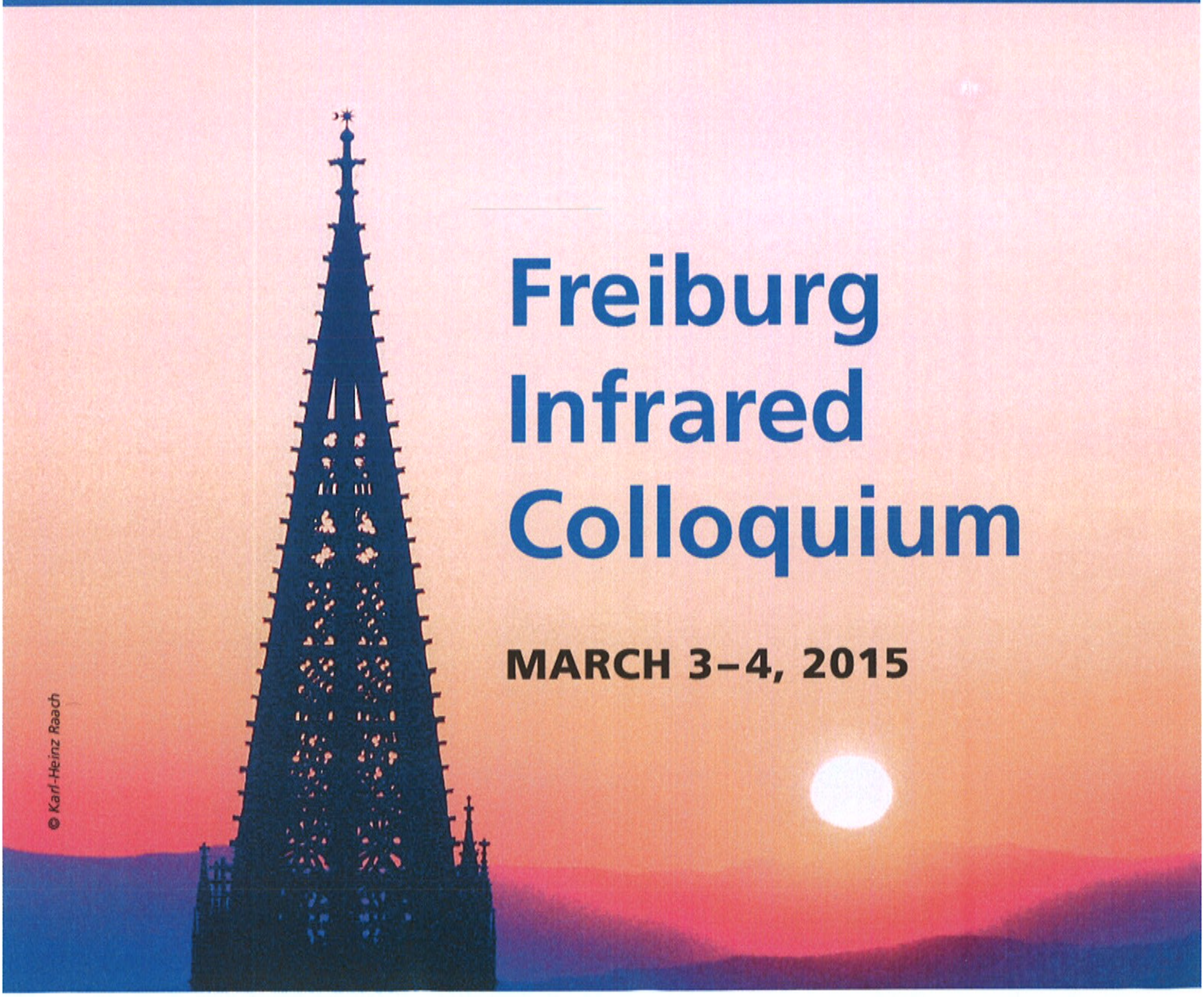
ABSTRACT BOOKLET



Freiburg Infrared Colloquium

MARCH 3–4, 2015