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TI: **CHARM-F: An airborne Integrated Path Differential Absorption (IPDA) LIDAR for the simultaneous measurement of CO2 and CH4 Columns**

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AB: Currently, Deutsches Zentrum für Luft- und Raumfahrt (DLR) - in collaboration with Fraunhofer-Institut für Lasertechnik (ILT) and Kayser-Threde GmbH (KT) - is developing CHARM-F, an Integrated Path Differential Absorption (IPDA) LIDAR for simultaneous measurement of CO2 and CH4 columns. Design goal is a compact and rugged instrument optimized for airborne use on board of DLR's long range research aircraft HALO. The main scientific goal of the instrument is to provide precise column measurements of CO2 and CH4 to infer fluxes of these important greenhouse gases by means of inverse modeling. For this purpose, very stringent requirements concerning accuracy and precision have to be met since typical surface sources and sinks alter the total column only by a few percent. To achieve this, CHARM-F uses laser sources emitting pulse-pairs with nanosecond duration which allows for a precise

ranging and a proper separation of atmospheric influences (i.e. aerosol and clouds) from the ground return leading to an unambiguously defined column (no airmass factors involved). Two laser systems - one for each trace gas - are employed using highly efficient and robust Nd:YAG lasers to pump optical parametric oscillators (OPO) which convert the pump radiation to the desired measurement wavelengths in the near infrared. Each laser system emits a pulse pair having different wavelengths. One is tuned to an absorption line of the trace gas under consideration and the other one to a nearby wavelength with much less absorption. The close temporal pulse separation of 250 µs together with a relatively large spot size of 30 m on ground ensures that nearly the same area is illuminated by both pulses. To achieve single-mode operation, both the pump and the OPO are injection seeded. The seed lasers are locked to a gas cell filled with a mixture of CO2 and CH4 to ensure an absolute wavelength calibration. Furthermore, deviations of the wavelength between outgoing laser pulse and the seed lasers are measured to detect and to correct for possible mode pulling effects. A new pulse energy calibration concept using fiber-coupled integrating spheres is employed to allow for a proper normalization of the return signal strength. Assembly and laboratory tests of the instrument will start by end of 2011, the first flight test is planned for fall of 2012. CHARM-F is also intended to serve as an airborne demonstrator for the French-German climate satellite MERLIN that will be launched in 2016.