SUB-DOPPLER RESOLUTION DIFFERENCE-FREQUENCY-GENERATION INFRARED SPECTROMETER WITH HIGH SENSITIVITY AND WIDE TUNABILITY

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We made a 3.4-μm spectrometer that consists of a 1.06-μm Nd:YAG laser as a pump source, a 1.55-μm extended-cavity laser diode (ECLD) as a signal source, and a waveguide-type periodically-poled lithium niobate (PPLN) with a difference-frequency-generation efficiency of 10 %/W. The linewidth of the ECLD is reduced less than 50 kHz by stabilizing the 3.4-μm frequency to one of the modes of a Fabry-Perot cavity, which is also employed as an absorption cell to increase the effective absorption length and to enhance the optical field strength at the antinodes. The spectrometer conjunction with wavelength modulation spectroscopy allows us to record 300 kHz wide Lamb dips of the ν_3 band of $^{12}CH_4$ and $^{13}CH_4$ from 88.2 to 90.5 THz. The tunable range currently limited by the phase matching condition of the PPLN can be extended from 83 to 94 THz.