Development of a narrow-band optical filter for daytime/thermospheric observations with a Na lidar at Tromsoe (2)

*川原 琢也[1]、小林 啓悟[1]、野村 俊介[1]、野澤 悟徳[2]、斎藤 徳人[3]、津田 卓雄[4]、和田 智之[3]、高橋 透[5]
*Takuya Kawahara[1], Keigo Kobayashi[1], Shunsuke Nomura[1], Satonori Nozawa[2], Norihito Saito[3], Takuo T. Tsuda[4], Satoshi Wada[3], Toru Takahashi[5]

1. 信州大学工学部 学術研究院工学系、2. 名古屋大学 宇宙地球環境研究所、3. 理化学研究所 光量子工学研究センター、4. 電気通信大学、5. 電子航法研究所
1. Faculty of Engineering, Shinshu University, 2. ISEE, Nagoya University, 3. Center for Advanced Photonics, RIKEN, 4. University of Electro-Communications, 5. Electronic Navigation Research Institute

An ultra-narrowband magneto-optical filter is being developed for the Na lidar receiver in Tromsoe to aim daytime observations under sunlit conditions. The filter consists of a heated Na cell (> 150 C) placed in a strong magnetic field (> 120 mT) between two crossed polarizers. A combination of magnetic field and cell temperature provides one transmission profile. A Current stage is described below.
(1) High-temperature Na atoms in the cell are chemically active. Thus, a commercially available glass-type Na cell is unstable at a high temperature of more than 150 C. An original sapphire cell is especially under development for the lidar daytime measurement.
(2) The filter was constructed using a glass-type cell for the transmission measurement. The continuous light source at 589 nm was built by the sum frequency generation technique from narrowband 1064/1319 nm DFB lasers. The magnetic field at the cell place is 245 mT. The measured transmission profiles were compared with theoretical ones at several cell temperature conditions between 160 C and 190 C.
(3) The transmission profiles vary between a magnetic field and cell temperature combinations. The Na lidar observation needs absolute and precise laser frequency control and a precise transmission profile (resolution ~1MHz) of the optical filter of the receiver. The best profile for the lidar observation is discussed using theoretical calculations.

Discussions about these topics are presented.

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