南極昭和基地の共鳴散乱ライダーシステム: Fe原子層の国内試験観測

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Resonance scattering lidar system at Syowa Station in Antarctica: Test observations of Fe atom layer in Japan

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We are developing a new resonance scattering lidar system to be installed at Syowa Station (69S, 39E) in Antarctica. For the new lidar system, we have employed a tunable alexandrite laser covering the resonance scattering lines of two neutral species, which are atomic potassium (K, 770 nm) and atomic iron (Fe, 386 nm), and two ion species, which are calcium ion (Ca^+, 393 nm) and aurorally excited nitrogen ion (N_2^+, 390 nm, 391 nm). Thus the new lidar system will provide information on the mesosphere and lower thermosphere as well as the ionosphere. Using the new resonance scattering lidar together with co-located other instruments, we will conduct a comprehensive ground-based observation of the low, middle, and upper atmosphere above Syowa Station. This unique observation is expected to make important contribution to studies on the atmospheric vertical coupling process and the neutral and charged particle interaction.

In this presentation, we will report current status on test observations of iron atom layer at National Institute of Polar Research at Tachikawa, Japan (36N, 139E). In order to obtain the iron resonance line at 386 nm, we operate the fundamental laser (i.e. the tuneable alexandrite laser) at 772 nm, which is shifted by 2 nm from the potassium resonance line at 770 nm, and then obtain the pulsed 386 nm laser using nonlinear crystal based on the second harmonic generation (SHG) technique. Currently a pulse energy of 48 mJ at 25 Hz (i.e. 1.2 W) at 386 nm is generated from the fundamental laser output of 160 mJ at 25 Hz (i.e. 4 W). According to previous observations, the pulse energy of 48 mJ is usually enough for detection of resonance scattering signals from iron layers. Thus, in addition to further improvement in the SHG unit, we are starting test observations of iron layer at Tachikawa.