

EARTH OBSERVATION SYMPOSIUM (B1)
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MULTI-COMPONENT ATMOSPHERE DETECTION TECHNOLOGY BASED ON SPACE-BASED
FILAMENT LASER

Abstract

With the increasing severity of environmental problem, many countries are studying the technology of space-based atmospheric pollutants detection and developing the related equipments. Especially, the multi-component atmosphere detection has become the research focus, due to the scientific significance and application prospect. According to the above exigent requirements, the multi-component atmosphere detection technology based on space-based filament laser has been developed, which can achieve the remote instantaneous detection. When femtosecond laser pulse propagates in air, the natural diffraction can be restrained, and the filament laser will be generated due to the nonlinear self-focus effect. The diameter of filament laser is about $100\mu\text{m}$, so the laser intensity is about $10^{14}\text{W}/\text{cm}^2$ inside the filaments laser. When the filament laser interacts with the air, the pollutants are dissociated into small fragments, and the molecules and atoms are ionized. The fluorescent fingerprint spectrum will be emitted according to the special chemical composition, which can be applied in detecting the atmospheric components and identifying the pollutants. The analysis of the pollutant concentration can be performed through direct measurements of the characteristic spectral lines. Relying on the possible generation of filaments at dozens of kilometric distances, this technology can help people find future applications in remote analysis of hazardous or unreachable spots, especially in space-based detection system. Besides the simple gaseous pollutant, for example SO_2 , NO_2 and CO , the complicated atmospheric pollutants also own the characteristic fingerprint spectrum, including the large biological molecules, dust, aerosol, etc. Multi-component atmosphere detection technology based on filament laser shows the features of LIDAR, which can carry out the real-time vertical dimensional detection in large scale continuously. In the meantime, this technology can resolve the problems in the detection of unknown complicated pollutants faced by current technologies. The space detection system based on this technology can be used in daily environmental detection, early warning for atmospheric pollution, and sudden pollution survey, etc.