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现代应用光学

小视场绝对辐射计视场测量及修正项计算

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摘要：风云三号A星和B星上搭载的太阳辐射监测仪由于视场较大而引入较多不确定因素，因此风云三号C星太阳辐射监测仪采用小视场绝对辐射计来跟踪太阳测量。本文研究了小视场绝对辐射计视场带来的修正因素。计算了C星太阳辐射监测仪由视场光阑和主光阑确定的视场大小；基于此视场计算值，给出了仪器辐照度测量值随光源入射角变化的理论曲线；并且利用实验室搭建的视场测量装置，对此变化曲线进行了实际测量。结果表明，测量曲线与理论曲线的相对偏差平均为1%~2%，接近测量装置的极限精度，从而验证了视场计算值的准确性。利用计算视场评价了在轨测量时辐射计与冷空间背景的辐射交换修正项，结果显示，小视场会对太阳辐射测量产生 2.023 W/m^2 的冷空间背景修正，相对太阳辐照度测量精度要求，修正项计算标准差可以忽略。

关键词：太阳辐射监测仪 绝对辐射计 视场测量 辐射交换

Field of View Measurement and Correction Term Calculation for Small-Field Radiometer

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Abstract: Solar Irradiance Monitor (SIM) on the FY-3C satellite was designed to be a Small-field-of-view Radiometer (SFoV-R) with a precise solar pointing system to decrease the measurement uncertainty derived from the wide field-of-view of SIM on FY-3A and FY-3B satellites. To obtain the measurement uncertainty derived from the SFoV-R, the field-of-view of SFoV-R on FY-3C satellite determined by a view-limiting aperture and a precision aperture was calculated. Based on this field-of-view, a theoretical change curve of the measured irradiance incidence angle was achieved. Then, an actual measurement of the change curves was performed. The result indicates that the relative deviation on an average between the theoretical and measured change curves is 1%-2%, which is close to the limit accuracy of the measuring installation and proves the veracity of the calculated values for field-of-view. The correction term of radiation exchange between space and the radiometer is estimated to be 2.023 W/m^2 based on the calculated field-of-view. Experiments show that the standard deviation of this correction term can be neglected compared to the requirement of solar irradiance measurement accuracy.

Keywords: Solar Irradiance Monitor Absolute Radiometer field-of-view measurement Radiation Exchange

收稿日期 2012-11-12 修回日期 2013-01-22 网络版发布日期 2013-04-20

基金项目:

航天光谱仪新理念高精度在轨绝对辐射定标方法研究

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