报告题目

Solar System Study: from Solar Magnetic Field Reversal to Ionospheric Magnetic Flux Rope, to Interstellar Electron Turbulence and beyond

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摘要:

1. Solar open flux migration from pole to pole: magnetic field reversal

Coronal holes are solar regions with low soft X-ray or low extreme ultraviolet intensities. In this work, we identify coronal holes with outward and inward open magnetic fluxes being in the opposite poles during solar quiet period. We find that during the sunspot rising phase, the outward and inward open fluxes perform pole-to-pole trans-equatorial migrations in opposite directions. The migration of the open fluxes consists of three parts: open flux areas migrating across the equator, new open flux areas generated in the low latitude and migrating poleward, and new open flux areas locally generated in the polar region. All three components contribute to the reversal of magnetic polarity. The percentage of contribution from each component is different for different solar cycle. Our results also show that the sunspot number is positively correlated with the lower-latitude open magnetic flux area, but negatively correlated with the total open flux area.

1. A mechanism for the field line twisting in the ionospheric magnetic flux rope

Magnetic flux ropes (MFRs) with twisted magnetic field lines are common in the solar system, most of which can be caused by magnetic reconnection or velocity shear. However, these two mechanisms have difficulties in explaining the formation of MFRs observed in the planetary ionosphere. Here we find that a dynamo process can be caused by the differential compression at different parts of a flux tube when it is sinking into the partially ionized ionosphere, leading to an increase in the magnetic energy. The differential compression also produces an azimuthal component of ▽×**E**, which generates azimuthal magnetic fields with twisted magnetic field lines and gives rise to an ionospheric MFR.

1. In situ observations of interstellar electron turbulence spectrum by Voyager 1

Interstellar scintillation of radio waves from pulsars reveals that the interstellar turbulence spectrum of electron density approximates the Kolmogorov power law. Here we obtain the interstellar turbulence spectrum of electron density from in situ observations of Voyager 1. The observed spectrum extends from *λ*=15au to 50 m, close to the Debye length. The measured spectrum covers part of the Kolmogorov inertial range, as well as ion and electron kinetic scales. The observed Kolmogorov inertial range shows good agreement with earlier studies by Lee and Jokipii. Around the kinetic scales, a bulge of spectral intensity higher than the Kolmogorov spectrum is found.

报告人简历：

李罗权1969年获台湾大学物理系学士学位，1975年获美国加州理工学院物理系博士学位，主要研究方向为空间科学与等离子体物理学。曾先后在美国太空总署哥达太空研究中心、美国马里兰大学、美国阿拉斯加大学、台湾成功大学、台湾“中央大学”、台湾“国家实验研究院”等研究单位做学术研究并担任行政要职。曾获得多项荣誉，包括傅尔布莱特杰出学者奖等奖励，并当选为台湾中央研究院和美国国家工程院等多家著名学术机构的院士。1990年，他被聘为中科院空间中心的客座教授，对空间中心的学术研究发挥过重要的指导作用。近年来，其取得了多项研究成果，主要包括：星际介质的湍流谱、极光区千米波辐射的回旋脉塞理论、磁通量传输事件的多X线重联模型、日珥形成机理、无碰撞激波加热机制以及地球高层大气中巨大喷流的等具有国际高影响力的发现。