

M22a The Sources of Magnetic Field Twist in Solar Active Regions

Shudong Bao (NAOC, NAOJ), Takashi Sakurai and Yoshinori Suematsu (NAOJ)

Recent observations have revealed that a hemispheric preference of magnetic chirality exists throughout the solar atmosphere, such as the net sign of current helicity in active regions, dextral/sinistral filaments, S- or inverse S-shaped coronal loops, and interplanetary magnetic clouds; namely a preponderance of left-handed helical fields in the northern hemisphere and right-handed ones in the southern. The explanation of this hemispheric tendency is still open to question.

In this paper we review several possible mechanisms for the origin of twist of the photospheric fields in active regions and correct some misinterpretations. The weakness of the hemispheric chirality rule indicates that the Coriolis force, differential rotation, and α -effect play their own roles at different levels below the photosphere. The Coriolis force acting on the rising flux tube within the convection zone generates twist of the same sense inferred from observation. The effect of differential rotation acting on already emerged magnetic fields leads to negative current helicity in the northern hemisphere and positive in the southern, but the corresponding effect caused by the Coriolis force is opposite. In addition, the current helicity of the fluctuating fields generated by the α -effect can produce the observed magnetic twist. Finally, we suggest that some surface flows (*e.g.*, converging flows that can give rise to cancellation of opposite polarity flux at the photosphere) are also important to the generation of twist.