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FLUX EMERGENCE AND THE EVOLUTION OF LARGE-SCALE PHOTOSPHERIC FIELD PATTERNS

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ABSTRACT Stackplot displays of the photospheric magnetic field show long-lived patterns that often rotate at rates differing from the intrinsic photospheric rate. These complex patterns are produced naturally by the flux-transport model, in which magnetic flux emerging in the form of active regions is dispersed over the solar surface by differential rotation, supergranular diffusion, and a poleward meridional flow. Numerical simulations show that long-lived patterns with slopes similar to the observed ones arise even when the longitudes of the erupting flux are randomized, suggesting that a deep-seated longitudinal organization is not required to explain the qualitative nature of the patterns. Both autocorrelation analysis and visual comparison between the slopes of the observed and simulated patterns indicate that the equatorial rotation period of the Sun is close to 26.75 days, significantly shorter than the traditional 26.9 day value of Snodgrass and Newton & Nunn but in agreement with the recent measurements of Komm, Howard, & Harvey. A complete discussion of these results may be found in Sheeley, Wang, & Nash, ApJ, 401, 378 (1992).