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Of Tilt and Twist

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Abstract. Using Mees Solar Observatory active-region vector magnetograms and Mt. Wilson Observatory full-disk longitudinal magnetograms, we measure both the twist and tilt of the magnetic fields of 368 active regions. This dataset clearly shows two well-known phenomena, Joy's law and the hemispheric helicity rule, as well as a lesser-known twist-tilt relationship, which is the point of this work. Those regions that closely follow Joy's law show no twist-tilt relationship, which is a predicted consequence of convective buffeting of initially untwisted and unwrithed flux tubes through the Σ effect. Those regions that strongly depart from Joy's law show significantly larger than average twist and a very strong twist-tilt relationship. These properties suggest that the twist-tilt relationship in these regions is due to kinking of flux tubes that are highly twisted but not strongly writhed.