How similar are starspots to sunspots?

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Abstract. Despite a lack of deductive magnetohydrodynamic explanation for the formation and the equilibrium of a sunspot, extensive observations in combination with magnetohydrostatic models have provided reasonable understanding of the thermal-magnetic structure of sunspots in the observable layers. A key property of a sunspot is the Wilson depression – geometrical depression of the observable optical depth unity level within a sunspot – that results from the cooler temperature and reduced gas pressure. Here we examine how such a thermal-magnetic relationship scales with the stellar parameters, viz. the effective temperature $T_{\text{eff}}$ and surface gravity $g$ as well as the associated changes in the opacity of the stellar photospheric gas. Combining some recent helioseismic results concerning the sub-surface structure of sunspots, we then discuss the implications for activity related photospheric brightness variations and their correlation with other activity measures for stars across the cool-half of the H-R diagram.

Complex variations in line-intensity ratio of coronal emission lines with height above the limb

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Abstract. We obtained spectroscopic observations simultaneously in two coronal emission lines, one $\text{[Fe x]}$ 6374 Å and the other line being $\text{[Fe xi]}$ 7892 Å or $\text{[Fe xiii]}$ 10747 Å or $\text{[Fe xiv]}$ 5303 Å, and studied the variations in intensity and FWHM ratios of these lines with respect to those of 6374 Å as a function height above the limb. We find that the intensity ratio of 7892 Å and 10747 Å lines with respect to 6374 Å line increase with height and that of 5303 Å to 6374 Å decreases with height above the limb. This implies that the temperature in coronal loops will appear to increase with height if we consider intensity ratio of 7892 Å and 6374 Å, and 10747 Å and 6374 Å while the temperature will appear to decrease with height if we consider intensity ratio of 5303 Å to 6374 Å line. The normalized FWHM (with respect to wavelength) ratio of 6374 Å to all the other coronal lines observed increases with height. The FWHM ratio at the limb depends on the pair of emission lines chosen; it is about one in the case 6374 Å and 7892 Å emission lines, indicating a common temperature and nonthermal velocity in the coronal loops near the limb; it is about 0.7 at the limb in the case 6374 Å and 5303 Å lines and becomes about one at a height of 120°. The varying FWHM ratios with height indicate that hotter and colder plasmas in coronal loops interact with each other. Therefore, the observed increase in FWHM of coronal emission lines, which are associated with plasma at about 1