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On the magnetospheres of close-in terrestrial exoplanets under extreme stellar wind conditions

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Close-in extrasolar planets are known to be subject to strong tidal interaction with their host star. One of the effects caused by this interaction is the despin of the planet (tidal locking). For tidally locked planets the rotation rate is determined by the orbital period, leading to rotation rates which are much lower than those expected for planets not subject to tidal locking. Commonly employed scaling-laws for the planetary magnetic moment indicate that planets with such low rotation rates are likely to have a strongly reduced magnetic moment, and thus a much smaller magnetosphere. For young stars (i.e. of ages $\approx$ 1 Gyr), the size of such a magnetosphere is even further reduced (a) by the dense and fast stellar wind and (b) by the frequent collision with stellar coronal mass ejections.These results apply in particular to planets located within the habitable zone around M stars (i. e. within the region where liquid water is expected to be stable on the planetary surface). For such planets, we discuss implications of the weak magnetospheric protection for nonthermal atmospheric loss and for the cosmic ray flux to the planetary atmosphere.