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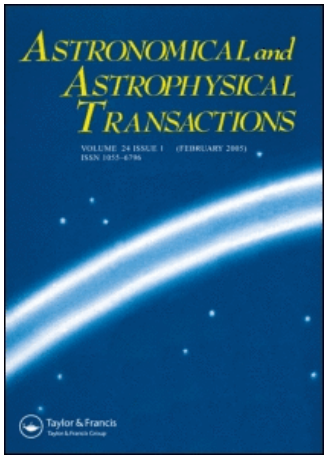

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Theory of the sunspot dissipation

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THEORY OF THE SUNSPOT DISSIPATION

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A new dissipative model of the sunspot is proposed. The model includes all basic relevant ideas: (1) a thin boundary layer between the magnetic flux tube of the sunspot and the photosphere; (2) the turbulent diffusivity ($D_t = \bar{v} \cdot \bar{l}/3 \gg D = c^2/4\pi \cdot \sigma$); (3) the large-scale plasma streaming around the sunspot.

The basic idea of the new approach is to prescribe some reasonable spatial distribution of magnetic field both in the sunspot and in the nearby photosphere. This distribution contains some unknown functions of time which are to be determined after integration of the magnetic diffusion equation. The latter procedure gives a solution for the radial velocity. Then, using the boundary conditions and some natural physical hypothesis one can find all the time-functions, in particular, the time dependencies of the sunspot area and magnetic field, i.e. the law of a slow decay of the typical sunspot. The law obtained includes both the "linear phase" and the slow-down of the decay in small sunspots, i.e. the effect predicted by the author in 1976 and revealed later in high-quality observational data.

The radial velocity field derived from the model fairly agrees with the "moat" streaming pattern around the spot.