THE STABILITY OF A MAGNETIC FLUX ROPE AND ITS RELATION TO SUNSPOTS, FACULAE AND FLARES

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Abstract. The stability of a magnetic flux rope is investigated in the presence of an Alfvén wave flux. It is shown that instabilities will arise when the transverse perturbation velocity exceeds the Alfvén velocity for the flux rope. With this restriction the maximum permitted Alfvén energy fluxes have been calculated under a variety of conditions typical of faculae, flares and sunspots. It is shown that the power requirements for faculae are very close to the theoretical limit and that flares may or may not exhibit a flash phase depending on whether the stability criterion is exceeded or not. The Alfvén fluxes which have been suggested for sunspots are, however, generally less than the limit based on this criterion.

DISCUSSION

Schmidt: If I am not mistaken, I think that dissipation of an Alfvén wave effectively sets in at the limit which you describe as an instability, so would you object to an interpretation where this is an onset of dissipation of a wave rather than the onset of an instability, or do you really mean that it is the same thing?

Wilson: Much the same thing. I think that Piddington suggested this morning a mechanism whereby an Alfvén wave may dissipate through pushing the neighboring material around, but this would be a fairly steady dissipation, and you could imagine such a process continuing for quite a long while and providing the heating for fairly stable structures. Once you exceed this limit the dissipation will be sudden and rapid. You may call it either dissipation or instability, I am quite happy either way.

R. Grant Athay (ed.), Chromospheric Fine Structure, 301.