GARY CHAPMAN: What are Faculae?

CHAPMAN: There are some observational characteristics of faculae that we should keep in mind. In the upper photosphere, between $T = 1$ in the quiet sun and the temperature minimum, these are bright structures that are magnetically associated. This is above the level where the hot wall effect is seen. This is evidence that there is dissipation of energy in that location. The energy is then radiated to space. There is energy transport of some form in the photosphere and chromosphere in and above faculae. One wonders where that energy comes from.

Recent observations by Bonnet and Acton show there is not a clear division between pores and faculae. There are beautiful cases of pores in the continuum that disappear in the ultraviolet bands. This has been known for some time. Frazier and Stenflo worked on it. In a couple papers they showed there is a relation between the magnetic flux in a feature and its behavior as a pore or facular. So there is a distribution of properties. There is a flux $= 10^{18}$ Mx above which the feature will be recognized generally as a pore, and below which it will be seen as a facula.

We do not know whether these objects are a single flux tube or a collection of even smaller tubes.

DISCUSSION

FOUKAL: Is there a sharp cutoff between what you call faculae and the network?

CHAPMAN: Not very sharp, but in magnetic flux a factor of $5 \pm 2$.

FOUKAL: Is there a qualitative cutoff in the physics?

CHAPMAN: There is a change in the physics. As you go to smaller flux tubes, you get heating at lower heights. Parker's idea was wrong about Alfvén wave heating upward. The energy missing from the spot does not go up. But at certain wavelengths, the sunspot is the brightest thing in the transition zone. As you decrease the flux, the heat being deposited in the atmosphere drops to lower levels.

FOUKAL: If you go to the observational evidence I do not see any discontinuity either in the continuum or in the UV.

CHAPMAN: Yes, there is no discontinuity.

FOUKAL: They are just smaller versions of the same thing.

CHAPMAN: They are not the same thing.

FOUKAL: Can you give an observational reason why they are different?

CHAPMAN: From Stenflo's articles, there is a clear distinction between spots and pores on the one hand and faculae on the other.
POUKAL: But I am asking about the difference of faculae from even smaller faculae and network. What this leads to is, if there is no distinction, then all the energy coming out of the network is the relic of missing sunspots. I do not see any observational distinction besides size, which is not a qualitative distinction.

CHAPMAN: I think that is possible. There is not a distinction between network or faculae. The magnetic field is still 1.5 KG. The size of the flux tubes is the only difference.

HARVEY: Just remember that flux does come up in forms other than sunspots. That flux does produce faculae. There are lots of faculae that cannot be traced back to a spot.

CHAPMAN: That's a good point; it's not quite as clear cut.

POUKAL: That would seem even more fatal to the argument of detailed balance. There are self-contained flux tubes that never contained sunspots.

SCHATTEN: When we talk about detailed balance we mean roughly equal, within 10 or 20%.

CHAPMAN: I am not interested with the doctrinaire view of detailed balance. It's a tool to get at how energy might be stored or transported. If you come close, you already have a problem - how do you transport heat from sunspots to faculae? If there is 10 or 20% leak it is interesting but not pivotal.

POUKAL: If you believe the network at high latitudes is being fueled by missing energy from sunspots, you have to have a good mechanism.

ZIRIN: The observations show big irradiance dips that match the sunspots. Is the idea that the loss is made up in between over some long period of time?

NEWKIRK: That is the irradiance, not the luminosity. The question is, does the luminosity change with the appearance and disappearance of sunspots, or is it compensated either locally or globally?