Some Properties of the Solar Granulation and Mesogranulation

Mühlmann Werner, Inst. für Astronomie, Graz, Austria
Hanslmeier Arnold, Inst. für Astronomie, Graz, Austria
Brandt Peter N., KIS, Freiburg, Germany

Based on a 8.7 hour time series of solar granulation images (Simon et al. 1994), of a spatial resolution mostly better than 400 km, we calculated lifetimes of granules, vorticity and divergence of the velocity fields and we tried to determine the mesogranular pattern by corks.

The granules have been selected by the filter of Roudier and Muller (1986) with a FWHM of 1.25 arcsec. Then several conditions have to be fullfilled for the granules to decide whether they are still alive or they have dissolved. For this purpose the size, the center of intensity and the correlations have to be considered. First results show a peak between 5 and 10 minutes lifetime.

The velocity fields have been calculated with the LCT – method (November and Simon, 1988). With the velocity fields obtained by this method the divergence and the vorticity can be computed. The vorticity is higher in the regions of negative divergence, i. e. in the regions of downflow. There are almost no high vorticity values in upflow regions.

In order to make the mesogranular pattern visible we made use of corks being moved by the velocity field. When the corks are distributed uniformly all over the images, they show a pattern of cells of 5 to 10 arcsec in diameter after about 2 hours. If the calculation runs till the end of the sequence also the supergranular pattern becomes visible. A very interesting fact is that the corks seem to move in small channels towards the limb of the supergranules.

References

Determining Fractal Dimensions of Solar Radio Bursts

Astrid VERONIG
Mauro MESSEROTTI
Arnold HANSLMEIER

1 Institut für Astronomie Graz, Graz, Austria
2 Trieste Astronomical Observatory, Trieste, Italy

We analysed a set of time series related to different types of solar radio events (30 type I noise storms and 27 type IV bursts) through the methods of non-linear analysis to determine the nature of the underlying physical processes.

On first sight solar radio events seem to be of stochastic behaviour, linear mode-theory does not lead to satisfying results. So we applied non-linear analysis tools in order to find out whether there is some determinism in the physical processes responsible for solar radio bursts. In a first step we applied the Grassberger-Procaccia method [1,2] to stationary subsets [3,4] of the time series to determine the correlation dimension of a tentative attractor. In a second step we used a method which does not need a stationarity condition being applied. We calculated the local pointwise dimension of the data sets. If there are more attractors operating at the same time, the correlation dimension averages over all these attractors and does not lead to positive results. The local pointwise dimension allows to discriminate different attractors operating at the same time to some extent [5].

The results of the conventional correlation dimension method and the local pointwise dimension show consistency. There exists no low dimensionality in the analysed time series, meaning that solar radio bursts are stochastically driven systems or too complex (high-dimensional) phenomena to be detected with our analysis tools.