Contribution ID : **301** Type : **Poster**

Modelling graph dynamics of flaring active regions using SDO/HMI data

Thursday, 13 October 2016 15:15 (30)

Evolution of flaring active regions (AR) shows high spatial complexity and nontrivial changes of observed patterns over time. It is practically impossible to give detailed description of magnetogram morphology. This is why signatures are quite often used: critical points, neutral lines, unsigned and signed areas of magnetic textures. However, when comparing two magnetograms adjacent in time, it is difficult to find or evaluate significant signature changes because of high patterns variability. This is why it is more convenient to use approximating simplicial structures like graphs, namely set of vertices connected by edges.

We compute so-called critical nets, which consist of stable minima and maxima points connected by ascending paths in terms of Morse theory. Critical net approximates singular manifold of AR with graph which is rebuilt during evolution. Dynamics regimes can be conveniently tracked using methods of spectral geometry. For that we use discrete laplacian and its spectrum. We present examples of critical nets for flaring AR and estimations of their spectra.

This work was supported by the Russian Foundation for Basic Research (grant 15-01-09156 A)

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Session Classification : Poster session - IV

Track Classification : Methods of experimental physics