Magnetospheric Activity of Young Stars with Accretion Disks

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The discussion of observational data shows that the activity of young stars is connected with two types of electromagnetic processes. First is to be similar to solar dynamo and takes part in the formation of solar-like spots seen in the radiation flux in visible and UV bands. The observed radio emission, X-ray flux, stellar wind, disks, jets, power of activity and its decay in time cannot be explained by the dynamo theory.

In order to understand the support of young stars' activity it is needed to consider the fossil magnetic field theory. This theory shows that newborn stars can have internal magnetic fields greater than 1 mil Gauss and the surface field $B_s \approx 1kG$. The convection inside young stars tangle the large scale magnetic field and strengthens the chaotic magnetic field in a form of slender magnetic flux tubes (MFT). The MFT rise up to the surface and define the activity of young stars decaying in time. At first, the large MFT must arise on the surface . The smaller MFT are involved in the rising process gradually.

There exist two types of magnetic flux tubes: "soft" and "stiff" MFT. Soft MFT are rings, tangles and balls. These elements weakly interact with the regular magnetic field. Soft MFT can freely rise through convective shell of the star's atmosphere. The interaction of these tubes with a magnetospheric field can lead to non-solar types of young stars' activity. The "stiff" tubes are strongly coupled with the internal regular magnetic field. Their dynamics is defined by their buoyancy and rigid boundary conditions. If some part of the "stiff" tube rise up to the atmosphere of the star then it has the form of a loop or an arch.

Solar-like atmospheric activity of young stars is caused by "stiff" MFT. It is characterized by flashes, dark spots and other irregular phenomena. Although this type of activity of TTS is similar to solar one but it has a more powerful energetics and has no cycles.

In order to explain the active processes such as accretion disks, radio and X-ray emission, excesses in emission lines, it is needed to consider the magnetospheric model of activity. It includes the interaction between the fossil magnetic field and the magnetosphere of the star, the disk magnetic field and also accretion-ejection MHD plasma interaction. The fossil magnetic field theory can give new possibilities to investigate the active phenomena. The time evolution of fossil magnetic field can explain the attenuation of young star activity with their age.

The geometry of the fossil field depends on the conditions of star formation and may have three type forms: open, dipolar or quadrupolar ones. The formation of magnetospheres of young stars is described. The model of magnetic stars with magnetic accretion disks is developed in which both types of magnetic fields have the fossil nature. The three type of magnetic activities are possible in the frame of this model: atmospheric, magnetospheric and disks ones. In frame of our model we can investigate the rotational history of star with disk, ionizational and thermal properties of disks. We show in particular that in the magnetopause region the current sheet can form that can generate the X-Ray's radiation.