Populations of High Energy Sources in Galaxies
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Collapsing Stars as Sources of High Energy Particles and Radiation

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The particle acceleration and the non-thermal radiation in the magnetospheres of collapsing stars are considered. The collapsing stars can be powerful sources of the high-energy charged particles and the non-thermal radiation bursts. These bursts can be observed by means of modern astronomical instruments.

Collapse begins when the mass of stellar core exceeds the Chandrasekhar bound and the star becomes dynamically unstable. The star compresses and its radius decreases. After that, the stars can evolve by several ways. The first is that the star explodes and loses mass. The massive stars will collapse to neutron stars or black holes. The star can loss its mass and we will observe this phenomenon as supernovae. The stars with the smaller mass will collapse to white dwarfs (Shapiro & Teukolsky (1985); Zeldovich & Novikov (1977)). The second possibility will realize when stars collapse without the loss of mass. In this case it is very difficult to observe the collapse, and we not have the astronomical date for the conformation of this stage.

The stars will emit electromagnetic radiation under the collapse (Kryvdyk (1999) and Kryvdyk (2001)). In this paper the non-thermal radiation from the collapsing stars with the initial dipole magnetic field on the non-relativistic stage is investigated, and the method for the search of collapsing stars is proposed. The magnetic field will increase during the collapse. The charged particles will be accelerated to relativistic energy in the magnetospheres of collapsing stars. These particles will emit electromagnetic waves from radio waves to gamma rays. The radiation flux increases during the collapse in the millions times and more compared with the initial flux. This radiation will be observed as the bursts in all frequency ranges. The intensity of these bursts is very high. The radiation flux from collapsing stars exceeds of the initial flux in millions on the final stage of collapse. Fig. 1 portrays the increase of the particles energy and the particles density during collapse. On the Fig. 2 is shown the polar jets arising by collapse. As follows from obtaining results, the collapsing stars can be the powerful sources of the non-thermal radiation. Where these impulses can be observed? First of all in middle of powerful gamma bursts and X-ray bursts which are not periodical and can be connected with the collapsing stars. These impulses can be observed also from the pre-supernovae. The stars go to this stage when the star begins to compress under the influence of the gravitational field. The powerful sources of the non-thermal radiation can be also the white dwarfs in double systems on the stage of the accretion-induced collapse. The periodical impulse non-thermal radiation can be generated also by the pulsating of the stars with magnetic field, since in this case the charged particles will accelerate and the non-thermal emission will generate. What difficulties can arise for the observation of collapsing stars? First, we can not point at the location of collapsing stars with enough accuracy. Above we indicated only at the types of stars that can be collapsed. But the theory not enables to make the detailed chronology of collapse, therefore we can not

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indicate where and when exactly the collapsing star can arise. This fact is a principal problem for the observational program of the search of collapsing stars. The next problem is how to choose the radiation bursts from collapsing stars from the great number of bursts with unknown origin.

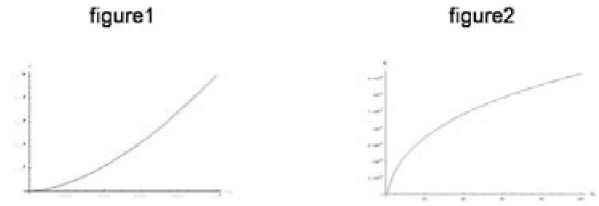

Figure 1. Figure Left: An increase of the particles energy during collapse; Figure right: An increase of the particles density during collapse.

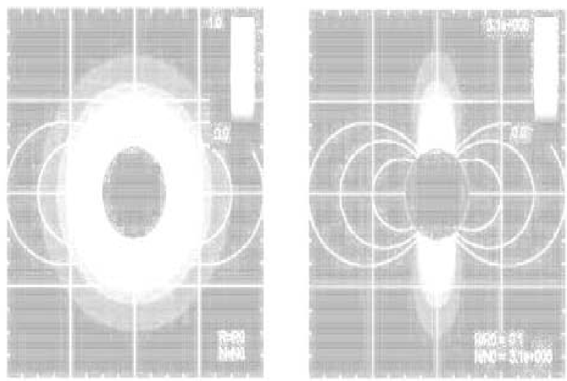

Figure 2. Polar jets in the magnetosphere of collapsing stars.

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