

## About cosmic ray sources

*Tuesday, 3 October 2017 17:30 (15)*

It is commonly accepted that the main sources of cosmic rays in the Galaxy are the supernovae explosions. Protons, nuclei and electrons are accelerated by shock waves produced by supernovae explosions. According to theory, maximum energy of accelerated protons can be as much as  $10^{16}$  eV. For nuclei it is  $Z$  times higher where  $Z$  is a nucleus electric charge. Other sources of cosmic rays could be active dwarf stars. In Galaxy there are about  $4 \cdot 10^{11}$  stars and more than 90% of these stars are in the bottom part the main sequence of Hertzsprung-Russell diagram. Many of dwarf stars are very active and produce powerful stellar flares. The Sun is yellow dwarf star of G2 class. The powerful solar flares occur one per year and they accelerate protons up to energy about (10-20) GeV. Maximum energy released in powerful solar flares is about  $10^{32}$  ergs. Stellar flares on active red dwarf stars are observed more often (several times per day) and the energy released during such events can have a value about  $10^{36}$  ergs. It is possible that the energy of accelerated protons could be as high as  $10^{14}$  eV. The evaluations show that the stellar flares could provide the energy density in Galaxy equals to  $\sim 1$  eV/cm<sup>3</sup>. Many of dwarf stars are not so far from the solar system (as the luminosities of these stars are very low they can be observed at the distances less than 50 kpc). New data on spectra of galactic protons and alpha-particles in the energy range from 50 GeV up to several hundreds GeV obtained in space experiments of PAMELA and AMS-02 show the complex energy dependence of spectral index. These data support the suggestion on the existence of nearby cosmic ray sources. Cosmic rays accelerated in supernovae explosions (the distances about 1 kpc and more) are in Galaxy about  $10^8$  years/ So, their spectra have to be smoothed.

**Primary author(s) :** Dr. KOPYSOV, Yuri (Institute of Nuclear Research, RAS)

**Co-author(s) :** Prof. STOZHKOV, Yuri (Lebedev Physical Institute, RAS)

**Presenter(s) :** Prof. STOZHKOV, Yuri (Lebedev Physical Institute, RAS)

**Session Classification :** Neutrino and astroparticle physics - 1

**Track Classification :** Neutrino and astroparticle physics