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Concluding Remarks I

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Abstract Some interesting topics presented in the Workshop are discussesd.

The following topics discussed at the workshop seems to me as the most interesting.

I. Puzzles in X-ray astronomy.

1. **Broad Fe lines in the spectra of AGN.** If confirmed, they open an outstanding possibility for investigation of the processes in the close vicinity of black holes, for learning the properties of the gravitational fields of rotating black holes.
2. **Magnetic fields of X-ray pulsars, obtained from cyclotron lines, and by other measurements.** The contradiction exist between magnetic field measurements from the cyclotron line model, and many other observational properties in the X-ray pulsar Her X-1. The "cyclotron line" interpretation leads to very high magnetic fields $\sim 5 \times 10^{12}$ Gs, while interpretation of observations of the beam properties at different observational phases leads to about 100 times smaller field. All recycled radio pulsars, originated from the X-ray pulsars have even smaller fields, as well as X-ray pulsars in some LMXB X-ray burst sources. The model based on the relativistic dipole radiation of the strongly anisotropic electrons may solve this contradiction, because the estimation of the magnetic field in this interpretation decreases $2\gamma_{||}$ times, with $\gamma_{||} \sim 20 - 50$ (Baushev and Bisnovatyi-Kogan, 1999). The observations of the cyclotron harmonics (Santangelo et al., 1999) may be an important test for the choice of the radiation model, and nonequidistance of the observed harmonics fits better to the relativistic magneto-dipole model (Baushev, 2002).
3. **Microquasars.** The number of the objects with this name is increasing. They include galactic X-ray sources with jets. First these objects were connected with galactic black hole sources, but now some types of X-ray binaries containing neutron stars have been found as radio-emitters (LMXB Z-sources), and jets have been observed in Sco X-1. The investigation of jets and outbursts in galactic X-ray sources is important for understanding

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of the accretion picture and choice between different accretion models (advective discs, optically thick/thin discs, ADAF, ADIAS etc.).

II. Nature of cosmic gamma ray bursts.

This problem is the most puzzling in the modern astrophysics, and number of questions strongly exceeds the number of answers. Some evidences about the connection of GRB with supernovae explosions make a "Hypernova" model as most attractive, and based on the collapse of massive stellar core with formation of black hole surrounded by a heavy accretion disc. Still many observational features remain unclear in the model of cosmological GRB.

1. **Redshifts** are measured only in long-duration bursts, are short bursts have different nature?
2. **Origin** of hard gamma ray (20–20 000 MeV) afterglow, lasting up to 1.5 hours.
3. **Hard X-ray** absorption features.
4. **Influence** of strong GRB explosion on host galaxies, which is not found.
5. **Absence** of the expected correlations connected with properties of GRB at large and small redshifts.
6. **Relation** between GRB and Fast X - Transients

III. SGR, AXP and Magnetars.

The very probable relation between these 3 types of objects is still not well understood. The following questions remain.

1. **Some AXP** show bursts, similar to SGR: are they of the same origin, are they all magnetars?
2. **Giant bursts in SGR** are not seen in AXP, and are not seen in nearby galaxies, while their expected number from galaxies in the local group exceeds 10.
3. **Connection** of giant SGR bursts with short GRB is expected, because SGR in other galaxies would have the same observational properties as short GRB.

IV. Search of dark matter.

The problem of a dark matter in the most puzzling in cosmology, and it is even older than GRB problem in high-energy astrophysics. This problem is related also to the most fundamental properties of matter and particle physics. While theoretical study of dark matter is very indefinite, the observational investigations seems to be the only real source of the information. These studies include

1. **Investigation** of dynamical and kinematical properties of galaxies in clusters, X-ray observations of gas in clusters for estimations of the dark matter density distribution.
2. **Investigation** of the spectrum of fluctuations of CMB, the most expectations come from the future PLANCK mission, scheduled for 2007.
3. **Direct search** of dark matter in the EGRET data and in observations of future hard gamma ray experiments pose important restrictions of the stability properties of dark matter particles.

V. Space missions.

We live in the exclusive time when the largest number of big space missions investigate the universe. These missions cover all the regions: radio (WMAP), optics and UV (HST), X-rays (RXTE, Chandra, Newton-XMM), gamma-rays (Integral).

In future we may expect smaller space missions, designed for more restricted number of problems. The interesting missions described in the talks have been the hard gamma ray missions AGILE and GLAST, where new materials and technology for the detection of gamma rays are used; the mission SWIFT, which is designed for investigating the nature of GRB; and the ambitious missions for a more distant future: JWST for infrared, and XEUS for soft X-ray observations.

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