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A joint scientific session of the Division of General Physics and Astronomy and the Division of Nuclear Physics of the Academy of Sciences of the USSR was held on February 28 and March 1, 1979 at the P. N. Lebedev Physics Institute. The following papers were delivered:

1. *D. V. Shirkov, V. P. Gerdt, and O. V. Tarasov*, Existing possibilities for computerization of analytic calculations for physical problems.
2. *V. G. Kadyshevskiĭ*, Electromagnetic-interaction gauge theory containing an elementary length.
3. *G. A. Askar'yan*, Mesons and neutrinos in ultracompression of matter and beams.
4. *A. B. Severnyĭ, V. A. Kotov, and T. T. Tsap*, Investigation of the sun's pulsations and the problem of its internal structure.
5. *V. A. Kotov and S. Kuchmi*, Investigation of the sun's brightness variations.
6. *S. V. Vorontsov and V. N. Zharkov*, The theoretical spectrum of the sun's oscillations.

We publish below abbreviated contents of four of the papers.

G. A. Askar'yan. *Mesons and neutrinos in ultracompression of matter and beams.*[1] Known neutrino[2] and meson sources are of low intensity: for example, pulsed nuclear reactors produce only antineutrinos of low average energy (≤10 MeV) as a result of slow (>1 sec) β decay. Meson factories use beams of accelerated particles carrying comparatively small currents. At the same time, it would be most desirable to have pulsed meson and neutrino sources of very high intensity for a number of scientific and applied purposes.

Our paper of Ref. 1 proposed a powerful pulsed source of meson plasma and neutrinos, which are emitted on decay of the mesons.

1. *Mesons and neutrinos in compression of particle beams.* Much progress has been made in the production of ion beams: currents of the order of mega-amperes have been produced[3,4] with energies of the order of MeV and durations in the tens of nanoseconds[3,4], and such beams have been injected into magnetic fields with $H \sim 10^3$–10^4 Oe. The energies of such beams must be hundreds of times larger to produce mesons. This increase can be brought about by increasing the magnetic field sharply in time, for example, by compressing the magnetic flux with a liner to field strengths of 10^5–10^6 Oe. Then the energies of the ions will rise under nonrelativistic adiabatic compression $W_1 \approx W_0(H_1/H_0)$ to hundreds of MeV (the energy increase may be much larger with quasibetatron acceleration). Apart from strengthening the field by explosive liner compression,[5] there are other electrical ways to produce high fields. Ejection of a beam onto a target produces a bunch of meson plasma and neutrino emission in the decays $\pi \to \mu+\nu$ and $\mu \to e+\nu+\bar{\nu}$. The mesons that are formed can be further accelerated in a vortex field or injected into an accelerator. Apart from ejecting a beam onto a target generation, it is also possible in collisions with gas nuclei or in colliding beams. The ejection and generation process can also be brought about in portions. The total number of particles may range up to 10^{16}–10^{17}, which with ejection times of $\sim 10^{-7}$ sec will produce 10^{23}–10^{24} neutrinos per second with energies in the tens and hundreds of MeV.

This source may be attainable in view of the fact that mega-ampere accelerators cost no more than $100,000.

2. *Generation of mesons and neutrinos in ultracompression of matter.* The use of ultracompression of matter by ablation pressure[6] to produce thermonuclear[7] or nuclear chain reaction[8] bursts is not limited to power-engineering applications. It has recently been proposed that such bursts could be used to produce ultrahigh-intensity neutron fluxes[8,9], to accelerate heavy ions on dispersal of plasma away from or into the interior of a hollow shell,[10] to produce transuranium elements[10,11], to produce high magnetic fields,[8] etc. However, the temperatures in the bursts (~MeV) are too low for production of mesons. The explosion of a hollow ultracompressed shell[10] is of greatest interest, since in this case it is possible to use implosion[12] to increase the concentration of the effect. A hollow ultracompressed shell can be obtained by compressing a hollow shell, using the inertial pressure or counterpressure of frozen-in[1] or spontaneous[13] magnetic fields (a magnetic cushion). Let us assume that a plasma with concentrations of $\sim 10^{25}$ particles/cm^3, which is two orders lower than the concentration in the ultracompressed layer ($\sim 10^{27}$ particles/cm^3) is situated within such a layer in a magnetic field. When the ultracompressed layer is imploded, the temperature rise may be by no more than factors of ten because of poor centering, but the inductive acceleration of the ions by the compressed magnetic field may provide energies ≳100 MeV. Here, head-on collisions of particles rotating on contacting opposed orbits increase the probability of meson production (the cross section ≳30/Mb[14]). This inductive acceleration involves nearly the entire assemblage of ions, and because of the high initial temperatures, particle collisions do not affect the acceleration regime. A burst that forms a bunch of π-mesons and

0038-5670/79/080666-05$01.10

neutrino emission can deliver $\sim10^{18}-10^{19}$ particles in a time $\sim10^{-8}$ sec and additional neutrinos for $\sim10^{-6}$ sec by decay of μ-mesons, i.e., we may expect $10^{26}-10^{27}$ neutrinos/sec with energies in the tens and hundreds of MeV.

The same use of implosion might be made in collapsing a medium with a cavity[15] in the strong neutrino flux from a burst[7,8] due to energy release in the medium in reactions of the types (nf), $(n\alpha)$,[15] etc.

Generation of dense meson bunches and powerful neutrino bursts can be used not only in nuclear physics, but also for applied purposes—in medicine, biology, communications, cold fusion, etc.

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