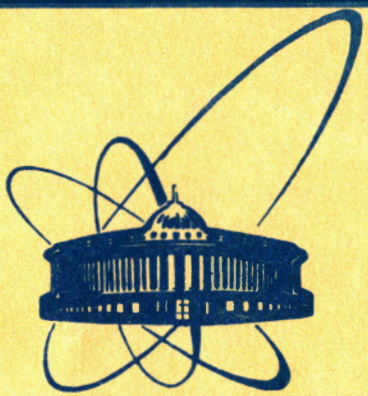

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ANALYSIS OF Λ AND ASSOCIATIVE PION PRODUCTION IN RELATIVISTIC NUCLEUS-NUCLEUS COLLISIONS

Dubna—Tbilisi—Warsaw Collaboration

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Experimental investigations of the nuclear stopping power /1/, density and temperature /2/ in relativistic nucleus-nucleus collisions are expected to shed light on the widely discussed problem of quark-gluon plasma formation. Data on nucleus-nucleus collisions show that nuclear matter is in general substantially transparent /3/, i.e., interaction products "remember" the primary collision direction. The first evidence for isotropic flow of the energy and the number of particles has been obtained from Nb-Nb high multiplicity collisions at 0.4 GeV per incident nucleon /4/.

Our data at 4.5 GeV/c per incident nucleon /5/ obtained using the streamer chamber spectrometer, SKM-200 show that $\cos\theta^*$ (θ^* - emission angle in the nucleon-nucleon, N-N, c.m. system) distributions for Λ's produced in central C-C, C-Ne and O-Ne collisions are flat (in contrast to those observed for both p-p /6/ and inelastic He-Li collisions), whereas $\cos\theta^*$ distributions of π^--mesons /7/ are similar and forward-backward peaked (Fig.1). Pions from central collisions with Λ's produced beyond the N-N kinematical limit were analyzed as a separate pion subsample (the cross section for such "Λ out" events is $\sigma \approx 10^{-3}\,\sigma^{inel}$). Angular distributions of the flows of the

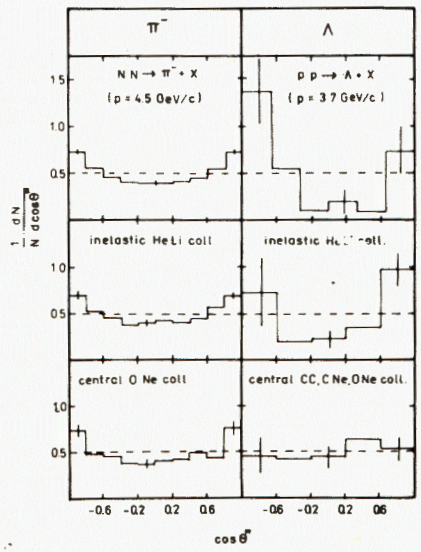

Fig. 1

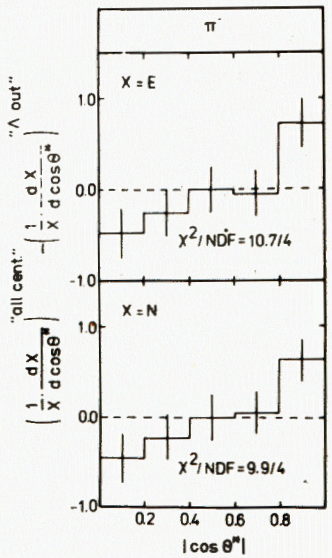

Fig. 2

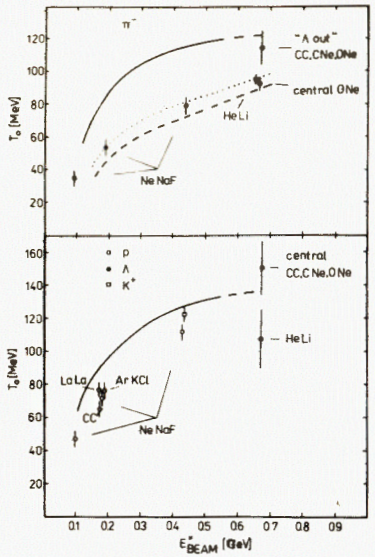

Fig. 3

energy and the number of pions turned out to be flat for "Λ out" events. The differences between the distributions for "Λ out" and "all central" O-Ne events are plotted in Fig.2.

The average transverse momenta and their dispersions for pions from "Λ out" and "all central" O-Ne events are: $\langle p_T \rangle$ = = 279±21, D_{p_T} = 191±22 and $\langle p_T \rangle$ =234±6, D_{p_T} = 164±8 (in MeV/c), respectively.

Average temperatures, T_0, of particle sources can be obtained using a $\langle p_T \rangle$ fit [8]. Fig.3 shows T_0 versus the kinetic c.m. energy of the incident beam per nucleon for protons, K^+, and π^- -mesons at lower energies [2], together with out data. Solid lines correspond to calculations performed assuming the full thermalization of nuclear matter (100% stopping power) [8]. N-N data, shown as dotted and dashed lines, correspond to T_0 calculated using the $\langle p_T \rangle$ and $(\frac{d^3\sigma}{dp^3}(\theta^* = 90°) \sim \exp(-T^*/T_0))$ fits [2], respectively. The highest values of T_0 close to the full thermalization are obtained for Λ's from central nuclear collisions (T_0 = (150±19) MeV) and for π's from "Λ out" events (T_0 = (114±11) MeV). Temperatures derived from the pion data are expected to be underestimated due to a possible significant contribution of pions from decays of Δ and possibly to other effects discussed in ref. [8].

Our data presented in this paper seem to indicate that in the above discussed "Λ out" events Λ's and pions are emitted from a single hot source being at rest in the N-N c.m. system.

REFERENCES

1. Busza W., Goldhaber A.S. Phys.Lett., 1984, 139B, p.235.
2. Nagamaiya S. Nucl.Phys., 1984, A418, p. 239;
   to calculate T_0 values from the data presented in the above paper and references therein, we used the $(\frac{d^3\sigma}{dp^3}(\theta^* = 90°) \sim \exp(-T^*/T_0))$ fit.
3. Das Gupta S. Phys.Rev.Lett., 1978, 41, p. 1450;
   Gaździcki M., Mrówczyński St. JINR, E2-83-548, Dubna, 1983 (to be published in Phys.Rev.C.).
4. Gutbrod H.H. et al. Proc. of the 6th Balaton Conference on Nuclear Physics, Hungary, 1983, p. 269.
5. Anikina M. et al. Phys.Rev.Lett., 1983, 50, p. 1971.
6. Louttit R. et al. Phys.Rev., 1961, 123, p. 1465.
7. We defined the NN collision as: $NN = \frac{1}{2}np + \frac{1}{2}pn$; the np data were taken from: A.Abdivaliev et al. JINR, P1-82-507, Dubna, 1982.
8. Hagedorn R., Rafelski J. Phys.Lett., 1980, 97B, p. 136.

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Анализ взаимодействия Λ-гиперонов и ассоциативного рождения пионов во взаимодействиях релятивистских ядер

Дается анализ процессов образования пионов, Λ-гиперонов и ассоциативного рождения пионов в центральных ядро-ядерных взаимодействиях при 4,5 ГэВ/с на нуклон, зарегистрированных в стримерном спектрометре СКМ-200. Полученные результаты указывают на то,что в событиях,в которых рождаются кумулятивные Λ-гипероны, частицы испускаются из одного "горячего" источника, покоящегося в системе центра масс для нуклон-нуклонного взаимодействия.

Работа выполнена в Лаборатории высоких энергий ОИЯИ.

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Analysis of Λ and Associative Ion Production in Relativistic Nucleus-Nucleus Collisions

Data on pion, Λ and associative pion production in central nucleus-nucleus collisions at a momentum of 4.5 GeV/c per incident nucleon obtained using the streamer spectrometer, SKM-200, are analyzed. The results indicate that a single hot source of particles being at rest in the c.m. system in created in events with Λ's produced beyond the nucleon-nucleon kinematical limit.

The investigation has been performed at the Laboratory of High Energies, JINR.

Communication of the Joint Institute for Nuclear Research. Dubna 1984