Работа сотрудничества в 2005 г.

П. И. Зарубин

ОИЯИ

EPJ manuscript No.
(will be inserted by the editor)

Light nucleus clustering in fragmentation above 1 A GeV

N. P. Andreeva[1], D. A. Artemenkov[2], V. Bradnova[2], M. M. Chernyavsky[3], A. Sh. Gaitinov[1], N. A. Kachalova[2], S. P. Kharlamov[3], A. D. Kovalenko[2], M. Haiduc[4], S. G. Gerasimov[3], L. A. Goncharova[3], V. G. Larionova[3,†], A. I. Malakhov[2], A. A. Moiseenko[5], G. I. Orlova[3], N. G. Peresadko[3], N. G. Polukhina[3], P. A. Rukoyatkin[2], V. V. Rusakova[2], V. R. Sarkisyan[5], T. V. Shchedrina[2], E. Stan[2,4], R. Stanoeva[2,6], I. Tsakov[6], S. Vokál[2,7], A. Vokálová[2], P. I. Zarubin[2], and I. G. Zarubina[2]

[1] Institute for Physics and Technology, Almaty, Republic of Kazakhstan
[2] Joint Insitute for Nuclear Research, Dubna, Russia
[3] Lebedev Institute of Physics, Russian Academy of Sciences, Moscow, Russia
[4] Institute of Space Sciences, Bucharest-Mauguerele, Romania
[5] Yerevan Physics Institute, Yerevan, Armenia
[6] Institute for Nuclear Research and Nuclear Energy, Sofia, Bulgaria
[7] P. J. Šafárik University, Košice, Slovak Republic

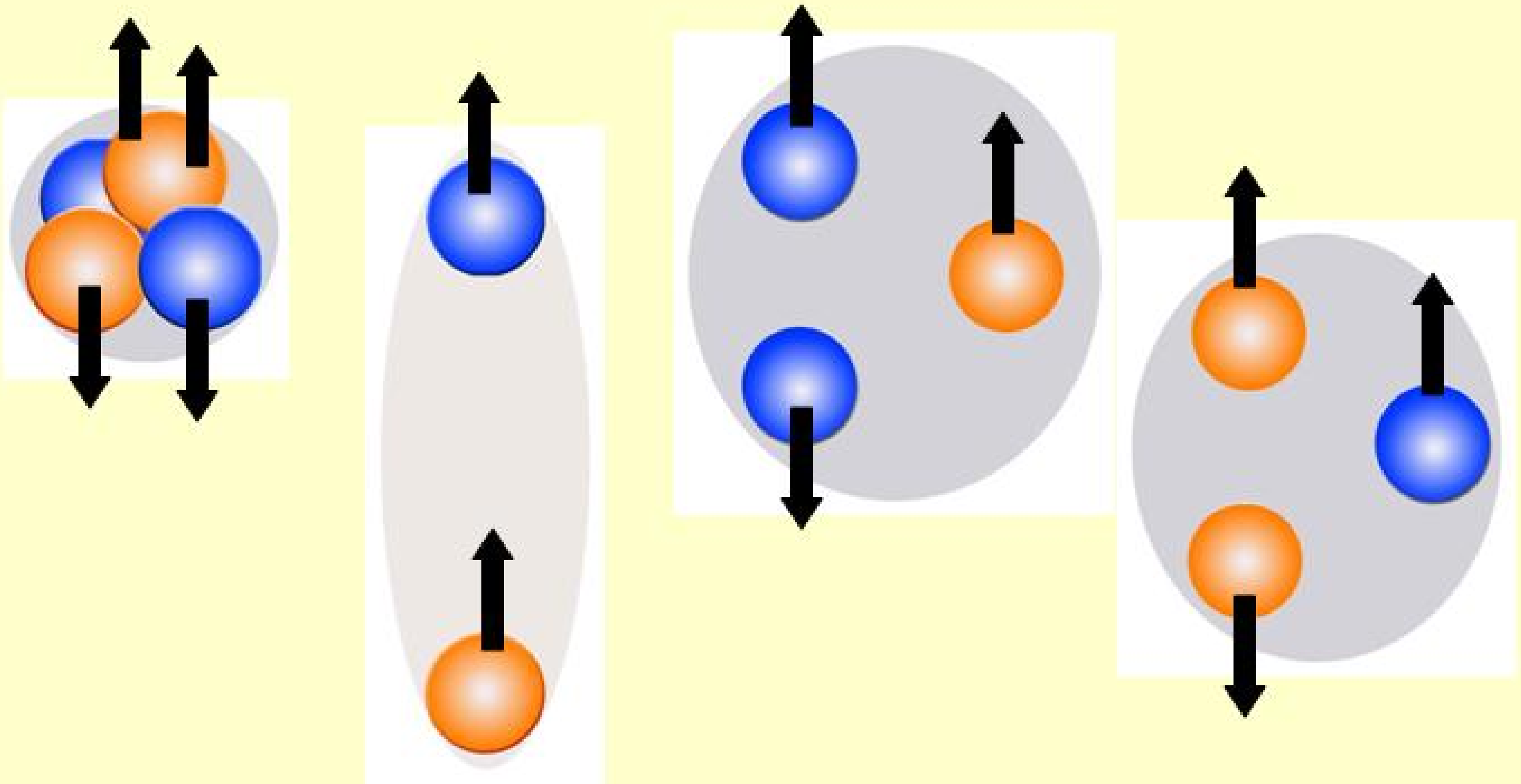
† deceased

Received: date / Revised version: date

Abstract. The relativistic invariant approach is applied to analyzing the 3.3 A GeV ^{22}Ne fragmentation in a nuclear track emulsion. New results on few body dissociations are obtained from the emulsion exposures to 2.1 A GeV ^{14}N and 1.2 A GeV ^{9}Be nuclei. The first observations of fragmentation of 1.2 A GeV ^{8}B and ^{9}C nuclei in emulsion are described. It can be asserted that the use of the invariant approach is an effective mean of obtaining conclusions about the behavior of systems involving a few He nuclei at a relative energy close to 1 MeV per nucleon. The observations allow one to justify the development of few body aspects of nuclear astrophysics.

Clustering building blocks:

more than one nucleon bound, stable & no exited states below particle decay thresholds – deuteron, triton, ^4He, and ^3He nuclei



Mg-Si Dissociation into charge state 2+2+2+2+2+1

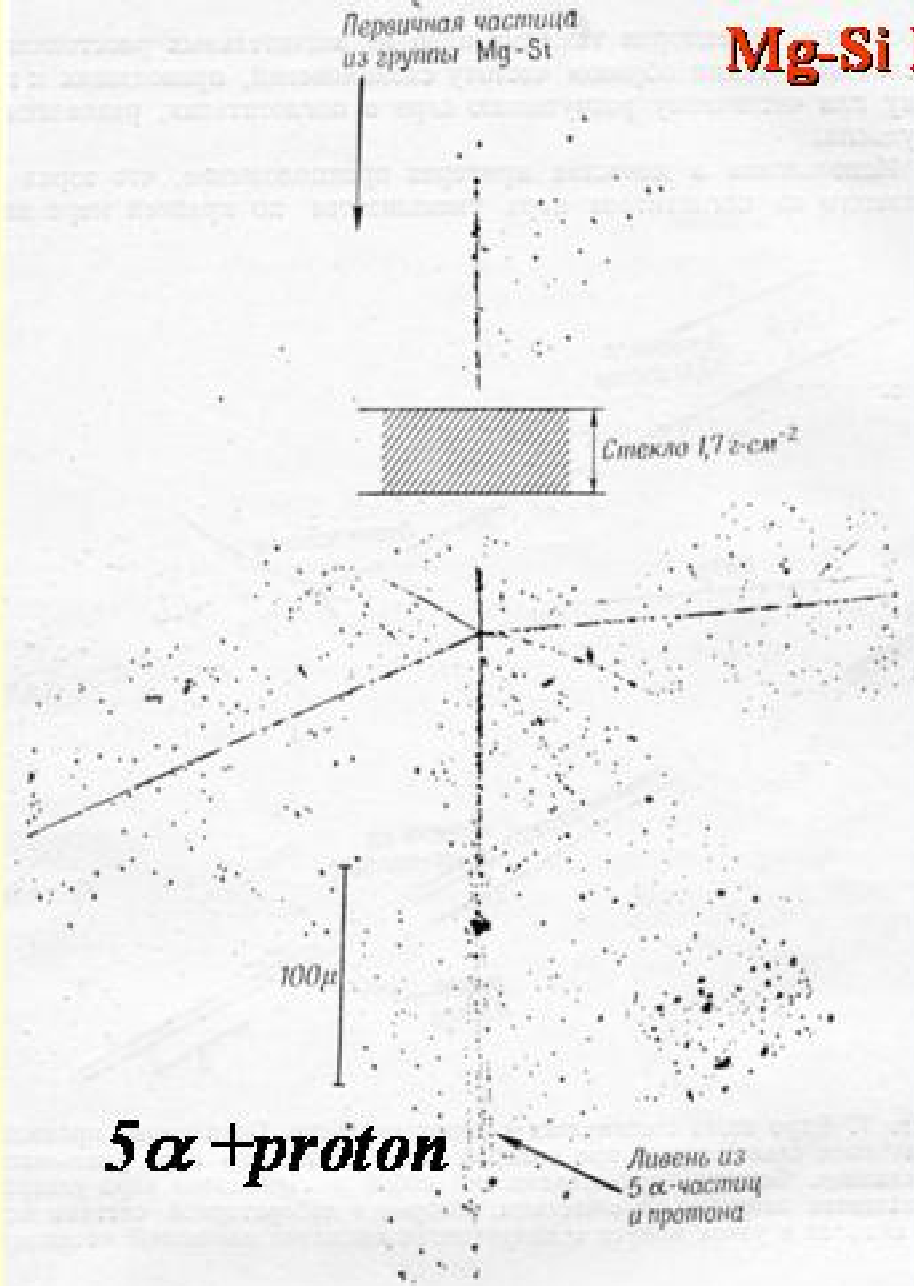
PROGRESS
in
COSMIC RAY PHYSICS

Edited by
J. G. WILSON

Contributors

U. Camerini	L. Michel	G. Puppi
W. O. Lock	B. Peters	N. Dallaporta
D. N. Perkins	H. V. Neher	E. P. George
C. C. Butler		H. Elliot

AMSTERDAM, 1952



Фиг. 6. Ядро из группы Mg — Si столкнулось с ядром эмульсии. Предполагают, что узкий ливень, состоящий из протона и 5 α-частиц, возник в результате испарения первичного ядра, возбужденного столкновением. Остальные частицы, испущенные в звезде, являются, повидимому, осколками ядра мишени.

^{14}N Dissociation with ^{8}Be like fragmentation

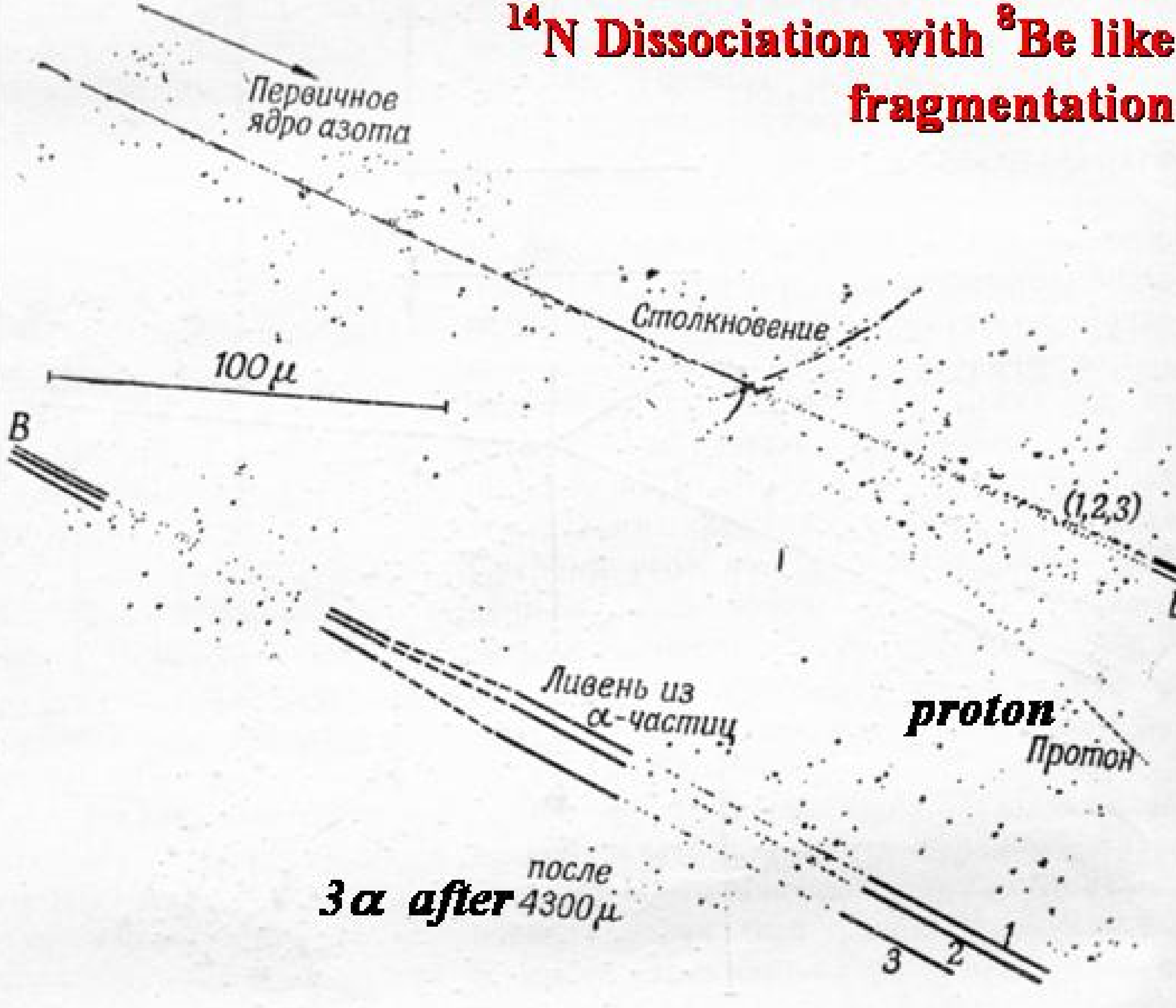
PROGRESS
in
COSMIC RAY PHYSICS

Edited by
J. G. WILSON

Contributors

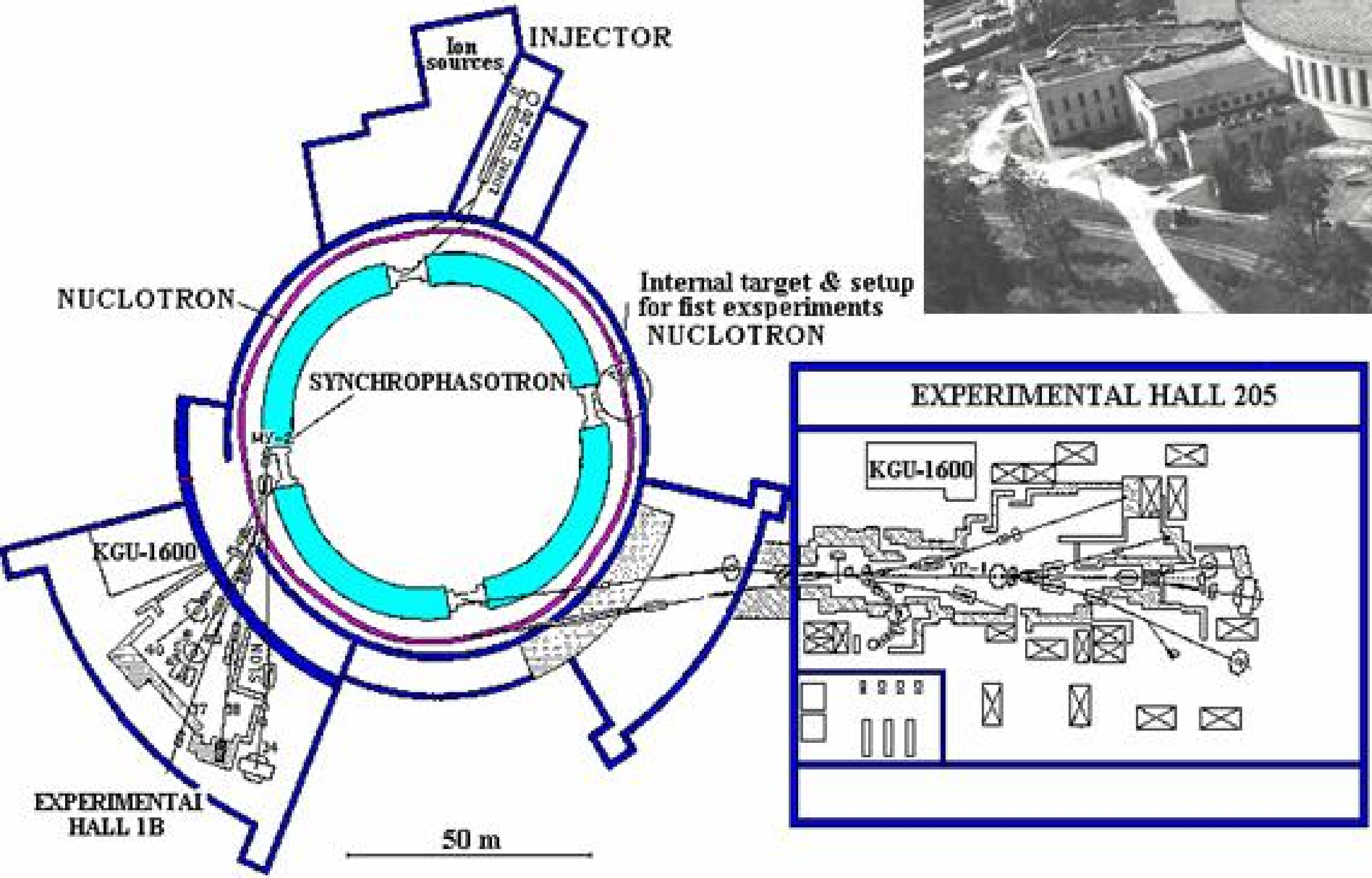
U. Camerini — L. Michel — G. Puppi
W. O. Lock — B. Peters — N. Dallaporta
D. N. Perkins — H. V. Neher — E. P. George
C. C. Butler — H. Elliot

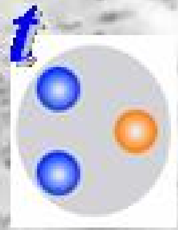
AMSTERDAM, 1952

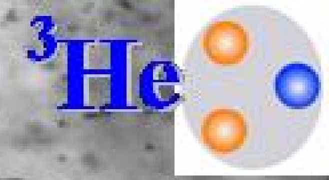


Фиг. 7. Ядро азота столкнулось с ядром эмульсии. Повидимому, произошло скользящее столкновение, при котором заряд первичного ядра уменьшается на единицу. Остаток, представляющий собой возбужденное ядро углерода, распадается затем на 3 α-частицы, которые в лабораторной системе испускаются в узком конусе в направлении движения первичной частицы

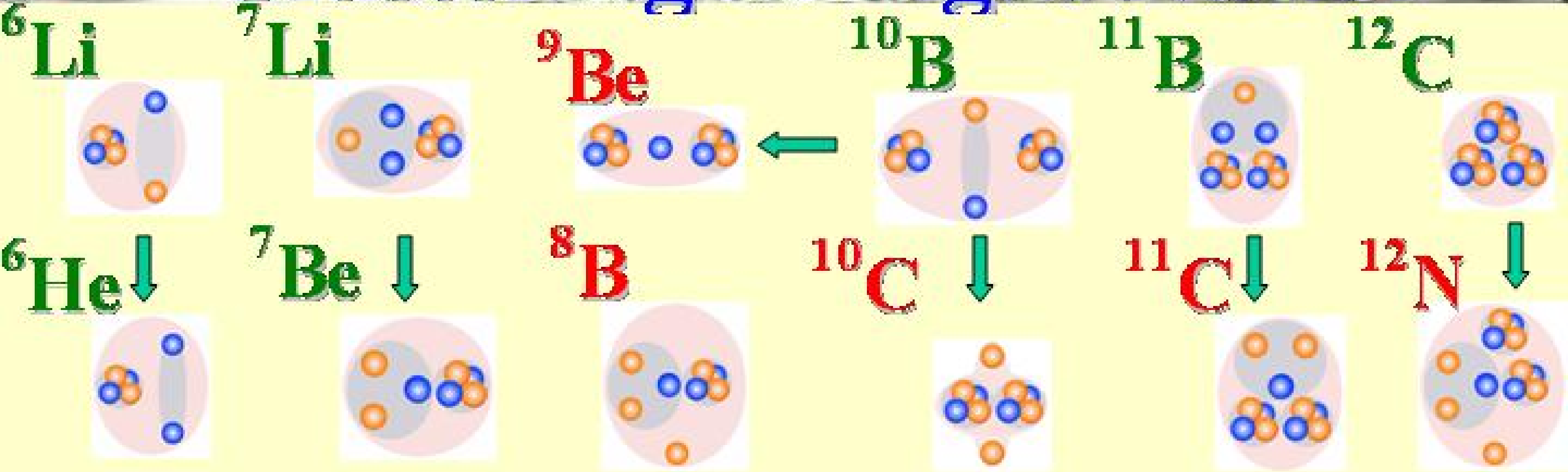
Dubna: Relativistic Nuclei





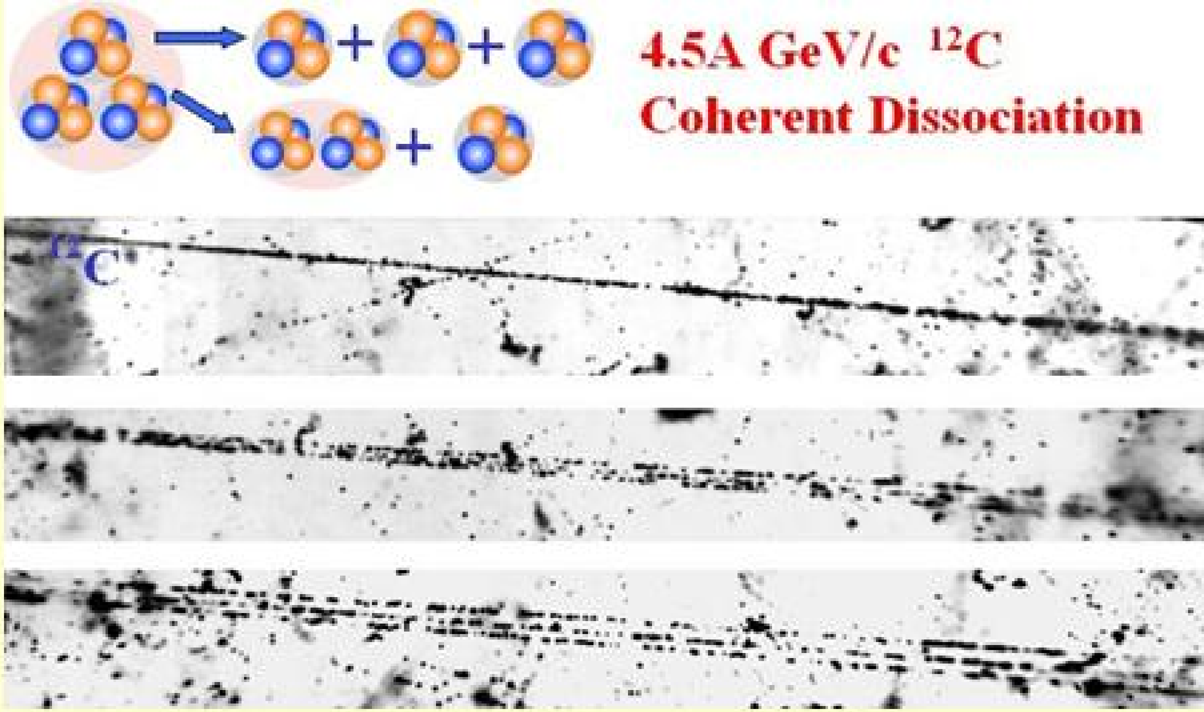


Clustering in Light Nuclei



Secondary beams of light radioactive nuclei will be produced mostly via charge exchange reactions. ^{8}B and ^{9}Be beams has been formed via fragmentation of ^{10}B.

Advantages of relativistic fragmentation



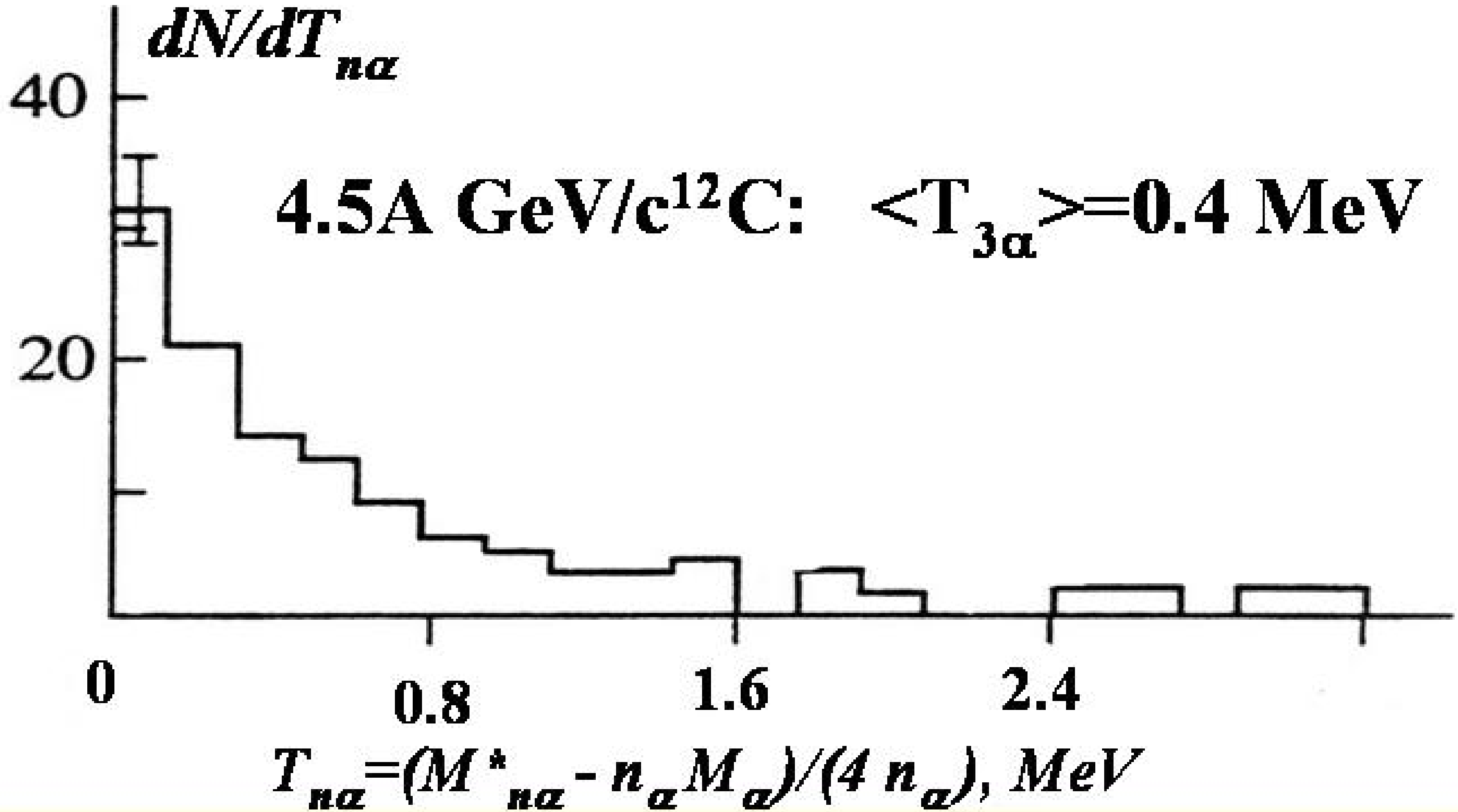
1. a limiting fragmentation regime is set in,
2. the reaction takes shortest time,
3. fragmentation collimated in a narrow cone – 3D images,
4. ionization losses of the reaction products are minimum,
5. detection threshold is close to zero.

Physics of Atomic Nuclei, Vol. 58, No. 11, 1995, pp. 1905 - 1910. Translated from Yadernaya Fizika, Vol. 58, No. 11, 1995, pp. 2014 - 2020.

ELEMENTARY PARTICLES AND FIELDS
Experiment

Coherent Dissociation $^{12}C \to 3\alpha$ in Lead-Enriched Emulsion at 4.5 GeV/*c* per Nucleon

V. V. Belaga, A. A. Benjaza[1], V. V. Rusakova, J. A. Salamov[2], and G. M. Chernov
Joint Institute for Nuclear Research, Dubna, Moscow oblast', 141980 Russia
Received May 16, 1994; in final form, March 6, 1995

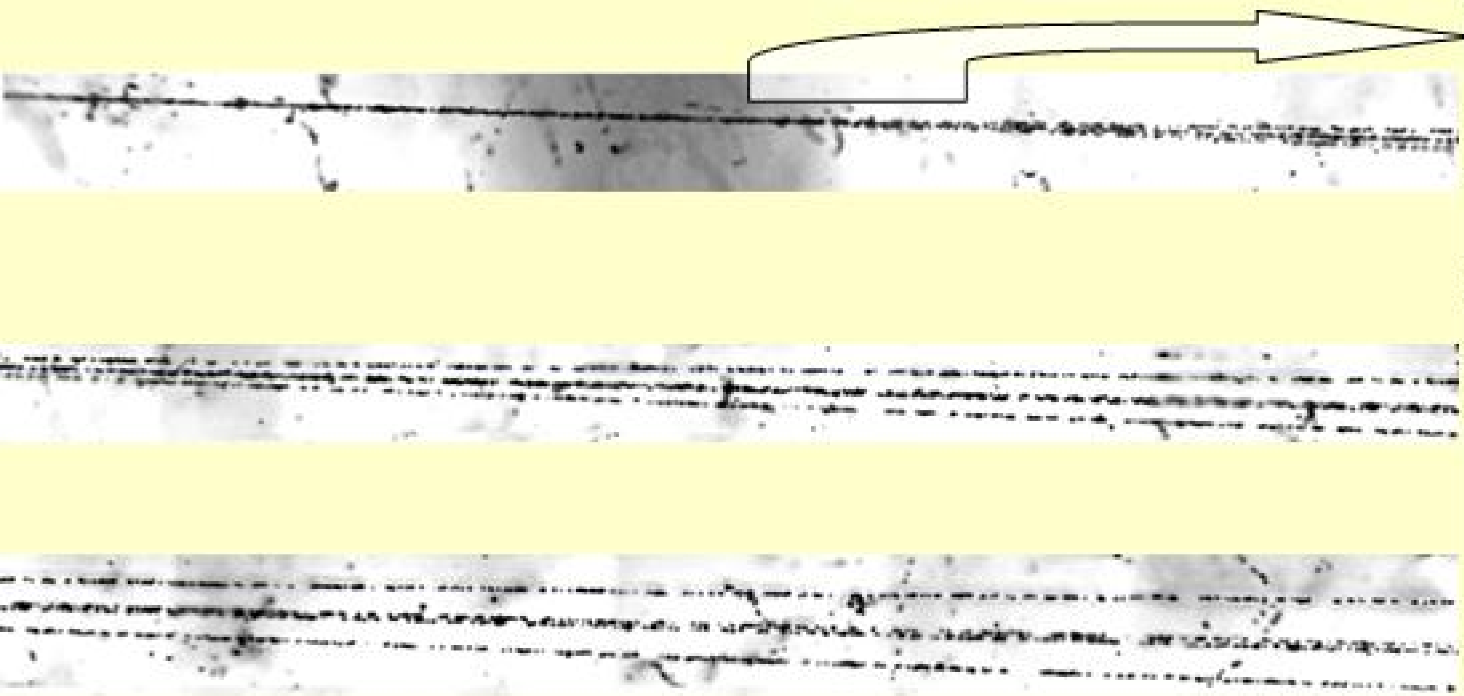


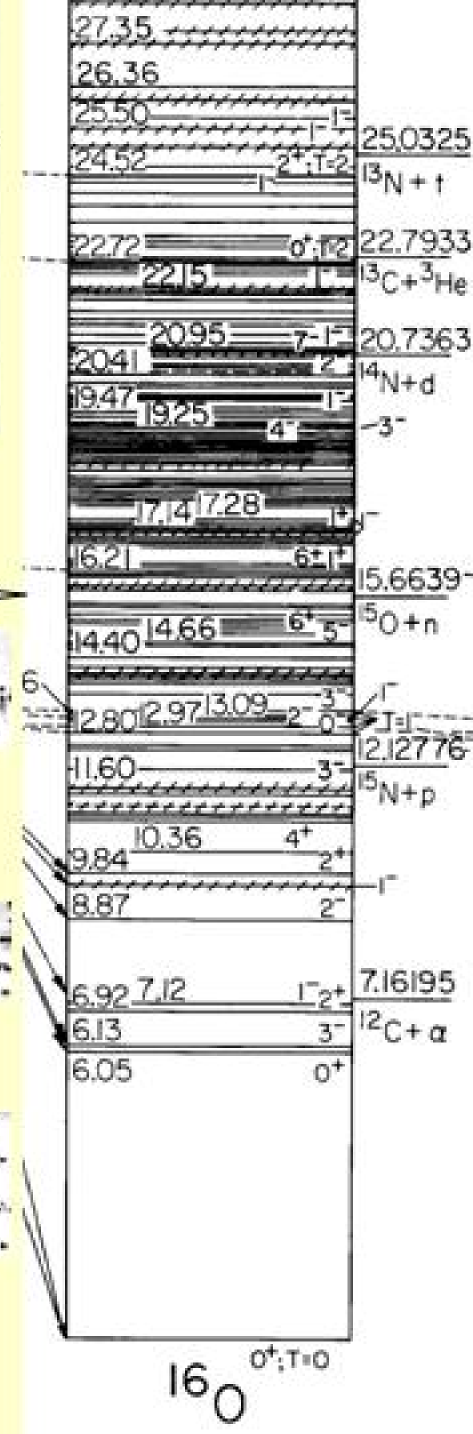
Physics of Atomic Nuclei, Vol. 59, No. 1, 1996, pp. 102 - 108. Translated from Yadernaya Fizika, Vol. 59, No. 1, 1996, pp. 110 - 116.

ELEMENTARY PARTICLES AND FIELDS
Experiment

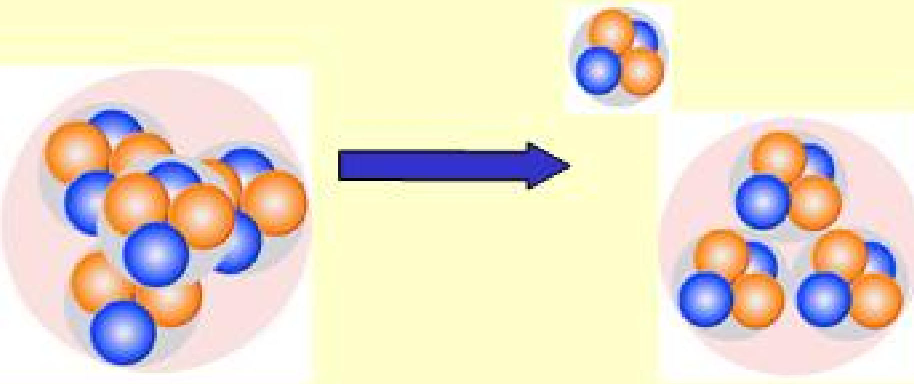
Coherent Dissociation $^{16}O \to 4\alpha$ in Photoemulsion at an Incident Momentum of 4.5 GeV/*c* per Nucleon

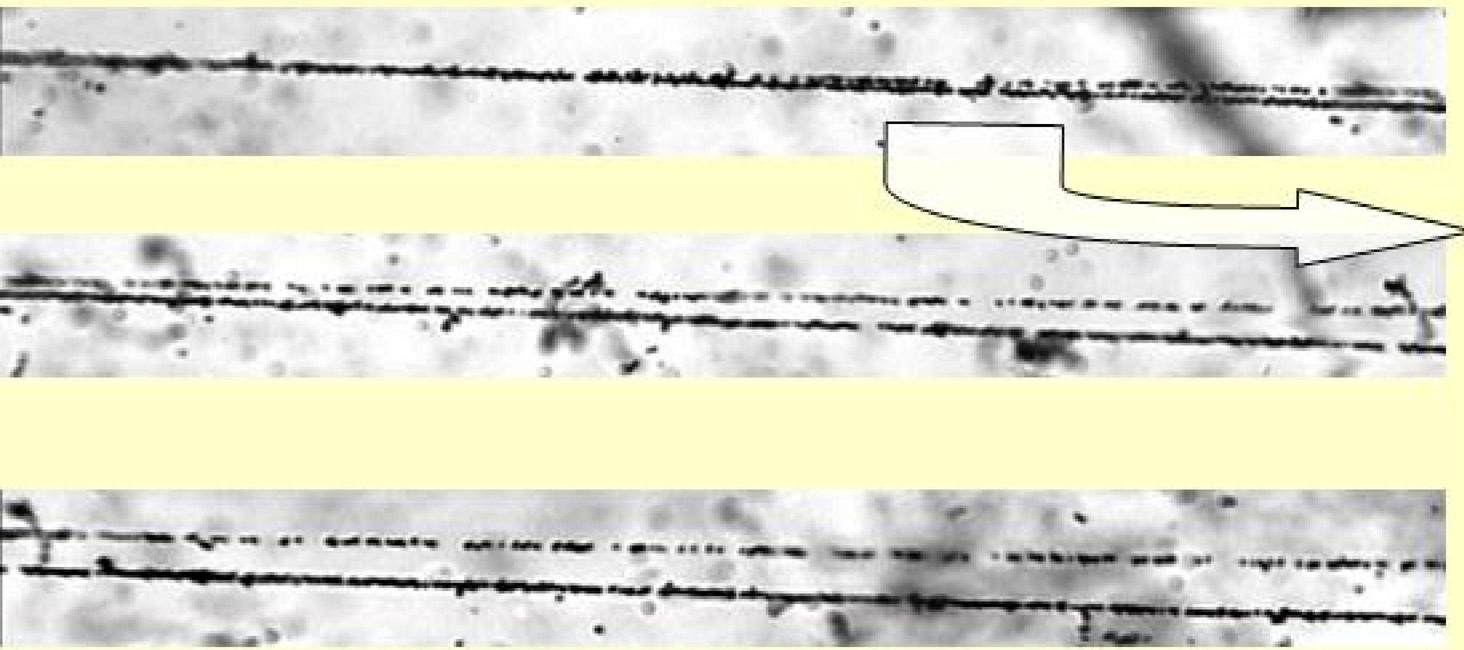
Almaty–Bucharest–Dubna–Dushanbe–Yerevan–Košice–Moscow–
St. Petersburg–Tashkent–Tbilisi Collaboration[1)]

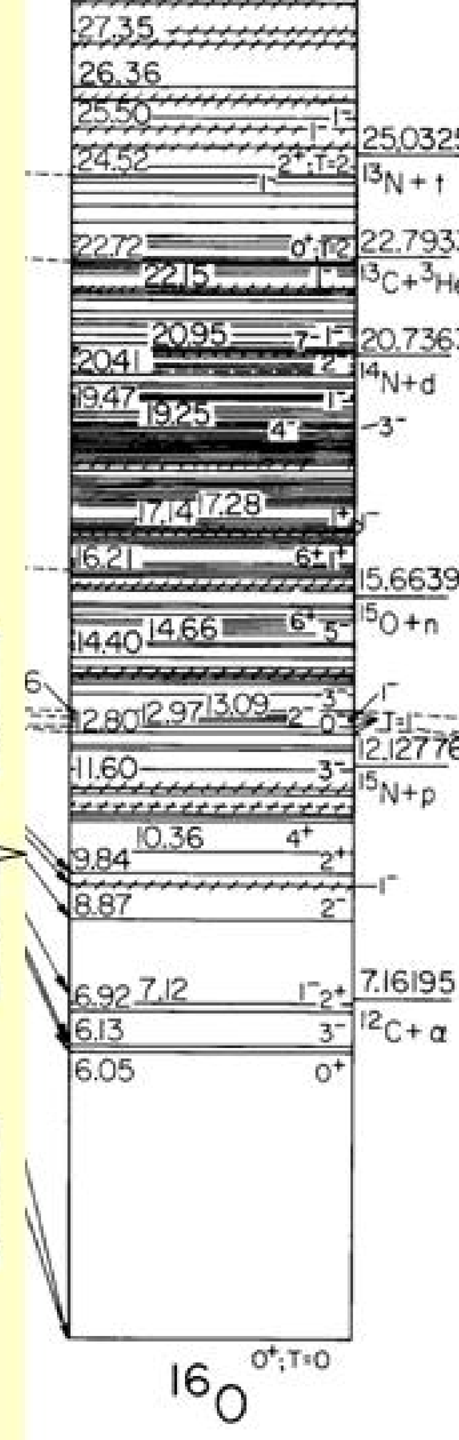




4.5 A GeV/c ^{16}O







27.35
26.36
25.50
24.52
25.0325
$^{13}N + t$
22.72
22.15
22.7933
$^{13}C + ^{3}He$
20.95
20.41
20.7363
$^{14}N + d$
19.47
19.25
17.14
17.28
16.21
15.6639
14.40
14.66
$^{15}O + n$
12.80
12.97
13.09
12.12776
11.60
$^{15}N + p$
9.84
10.36
8.87
6.92
7.12
7.16195
6.13
$^{12}C + \alpha$
6.05
^{16}O
$0^+; T=0$

СООБЩЕНИЯ
ОБЪЕДИНЕННОГО
ИНСТИТУТА
ЯДЕРНЫХ
ИССЛЕДОВАНИЙ
ДУБНА

Р1-85-692

ТОПОЛОГИЧЕСКИЕ ХАРАКТЕРИСТИКИ
ПРОЦЕССА ФРАГМЕНТАЦИИ ЯДЕР НЕОНА-22
С ИМПУЛЬСОМ 4,1 А ГэВ/с
НА ЯДРАХ ФОТОЭМУЛЬСИИ

Сотрудничество: Алма-Ата - Бухарест - Гатчина - Дубна - Душанбе - Ереван - Кошице - Краков - Ленинград - Москва

1985

Fragmentation of ^{22}Ne in emulsion at 4.1A GeV/c

A. El-Naghy ... and V R Sarkisyan

Nuclear Physics A516 (1990) 673–714
North Holland

ELECTROMAGNETIC DISSOCIATION OF 200 GeV/NUCLEON ^{16}O AND ^{32}S IONS IN NUCLEAR EMULSIONS

G. BARONI[8], V. BISI[10], A.C. BRESLIN[3], D.H. DAVIS[6], S. DELL'UOMO[8], S. DI LIBERTO[8], P. GIUBELLINO[10], G. GRELLA[9], K. HOSHINO[7], M. KAZUNO[4], M. KOBAYASHI[4], K. KODAMA[7], A. MARZARI-CHIESA[10], M.A. MAZZONI[2], F. MEDDI[8], M.T. MUCIACCIA[1], K. NIU[7], L. RAMELLO[10], G. ROMANO[9], G. ROSA[8], C. SGARBI[8], H. SHIBUYA[4], S. SIMONE[1], D.N. TOVEE[6], N. USHIDA[5], C. WILKIN[6] and S.K.C. YUEN[6]

СООБЩЕНИЯ
ОБЪЕДИНЕННОГО
ИНСТИТУТА
ЯДЕРНЫХ
ИССЛЕДОВАНИЙ
ДУБНА

Р1-88-252

ТОПОЛОГИЧЕСКИЕ ХАРАКТЕРИСТИКИ
ФРАГМЕНТАЦИИ ЯДЕР ^{28}Si
С ИМПУЛЬСОМ 4,5 А ГэВ/с
НА ЯДРАХ ФОТОЭМУЛЬСИИ

Сотрудничество: Алма-Ата – Бухарест – Дубна – Душанбе – Ереван – Ленинград

1988

Physics of Atomic Nuclei, Vol. 68, No. 3, 2005, pp. 455–465. Translated from Yadernaya Fizika, Vol. 68, No. 3, 2005, pp. 484–494.

Topology of "White Stars" in the Relativistic Fragmentation of Light Nuclei

N. P. Andreeva[1)], V. Bradnova[2)], S. Vokal[2),3)], A. Vokalova[2)], A. Sh. Gaitinov[1)], S. G. Gerasimov[4)], L. A. Goncharova[4)], V. A. Dronov[4)], P. I. Zarubin[2)*], I. G. Zarubina[2)], A. D. Kovalenko[2)], A. Kravchakova[3)], V. G. Larionova[4)], O. V. Levitskaya[5)], F. G. Lepekhin[5)], A. I. Malakhov[2)], A. A. Moiseenko[6)], G. I. Orlova[4)], N. G. Peresadko[4)], N. G. Polukhina[4)], P. A. Rukoyatkin[2)], V. V. Rusakova[2)], N. A. Salmanova[4)], V. R. Sarkisyan[6)], B. B. Simonov[5)], E. Stan[2),7)], R. Stanoeva[2),8)], M. M. Chernyavsky[4)], M. Haiduc[7)], S. P. Kharlamov[4)], I. Tsakov[8)], and T. V. Schedrina[2)]
The BECQUEREL Collaboration

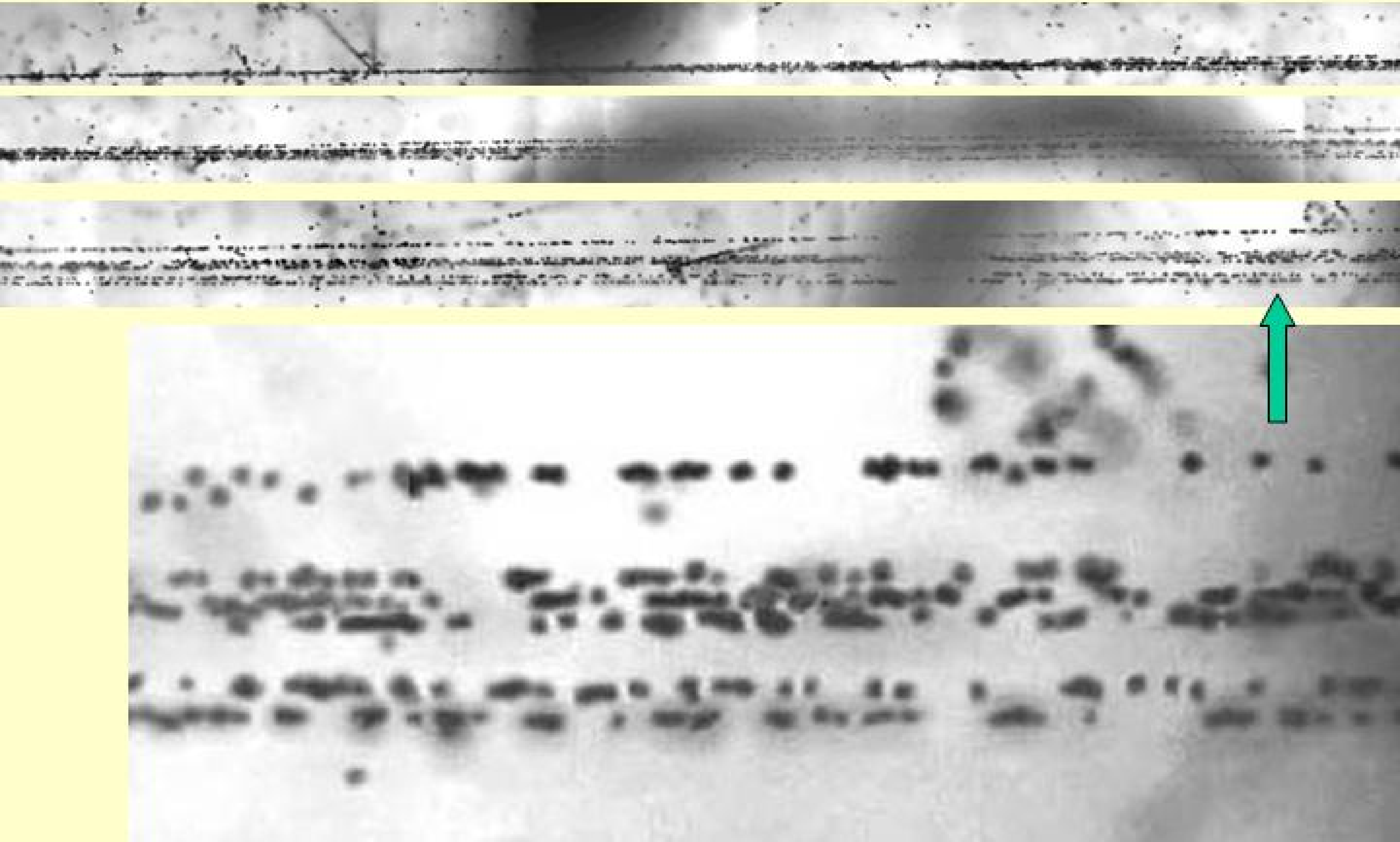
Received May 24, 2004; in final form, August 27, 2004

PHYSICAL REVIEW C 70, 014901 (2004)

Nuclear fragmentation in interactions of 3.7A GeV ^{24}Mg projectiles with emulsion targets

M. A. Jilany
Physics Department, Faculty of Science (Sohag), South Valley University, Sohag, Egypt
(Received 10 September 2003; revised manuscript received 29 April 2004; published 9 July 2004)

4.5A GeV/c ^{24}Mg Peripheral Dissociation into charge state 2+2+2+2+2+2 with ^{8}Be and ^{12}C* like fragments



Nuclear Physics A516 (1990) 673–714
North Holland

ELECTROMAGNETIC DISSOCIATION OF 200 GeV/NUCLEON ^{16}O AND ^{32}S IONS IN NUCLEAR EMULSIONS

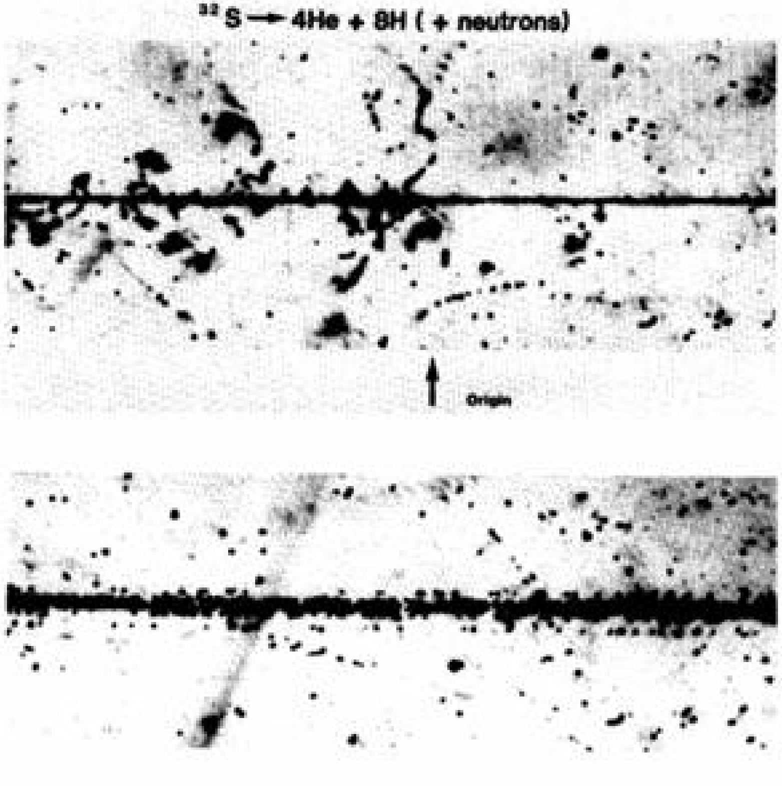


Fig. 3. Microphotograph of a complex projectile EMD (200 GeV/nucleon ^{32}S).

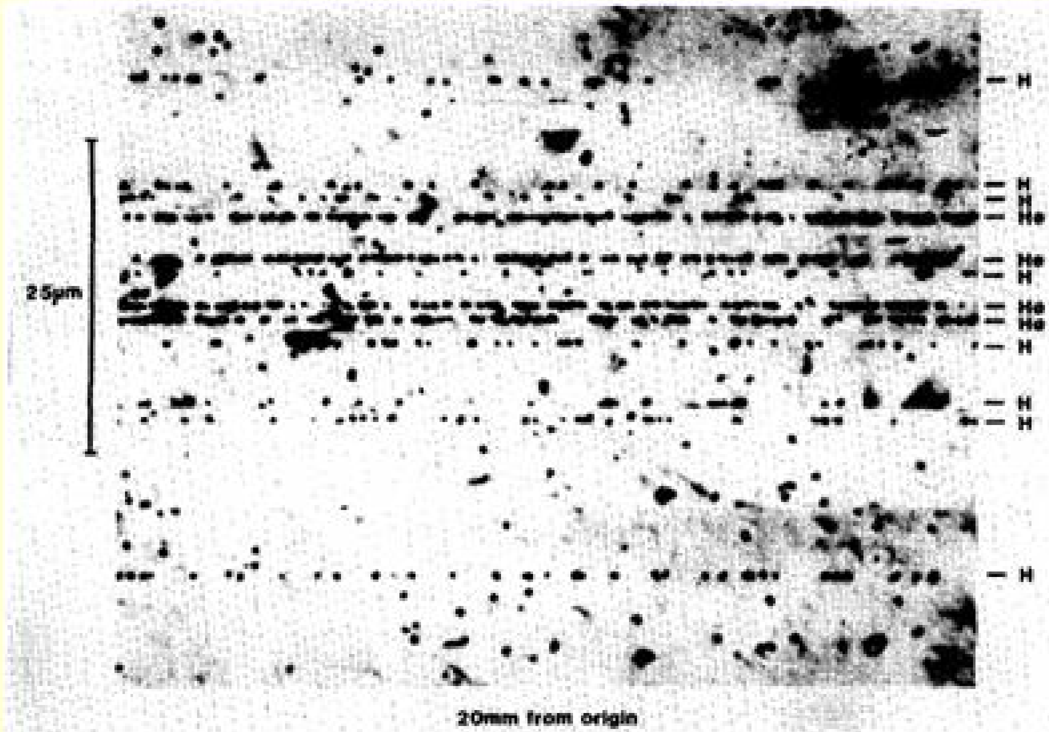


Fig. 3—continued

The common topological feature for fragmentation of the Ne, Mg, Si, and S nuclei consists in a suppression of binary splittings to fragments with charges larger than 2.

The growth of the fragmentation degree is revealed in an increase of the multiplicity of singly and doubly charged fragments up to complete dissociation with increasing of excitation.

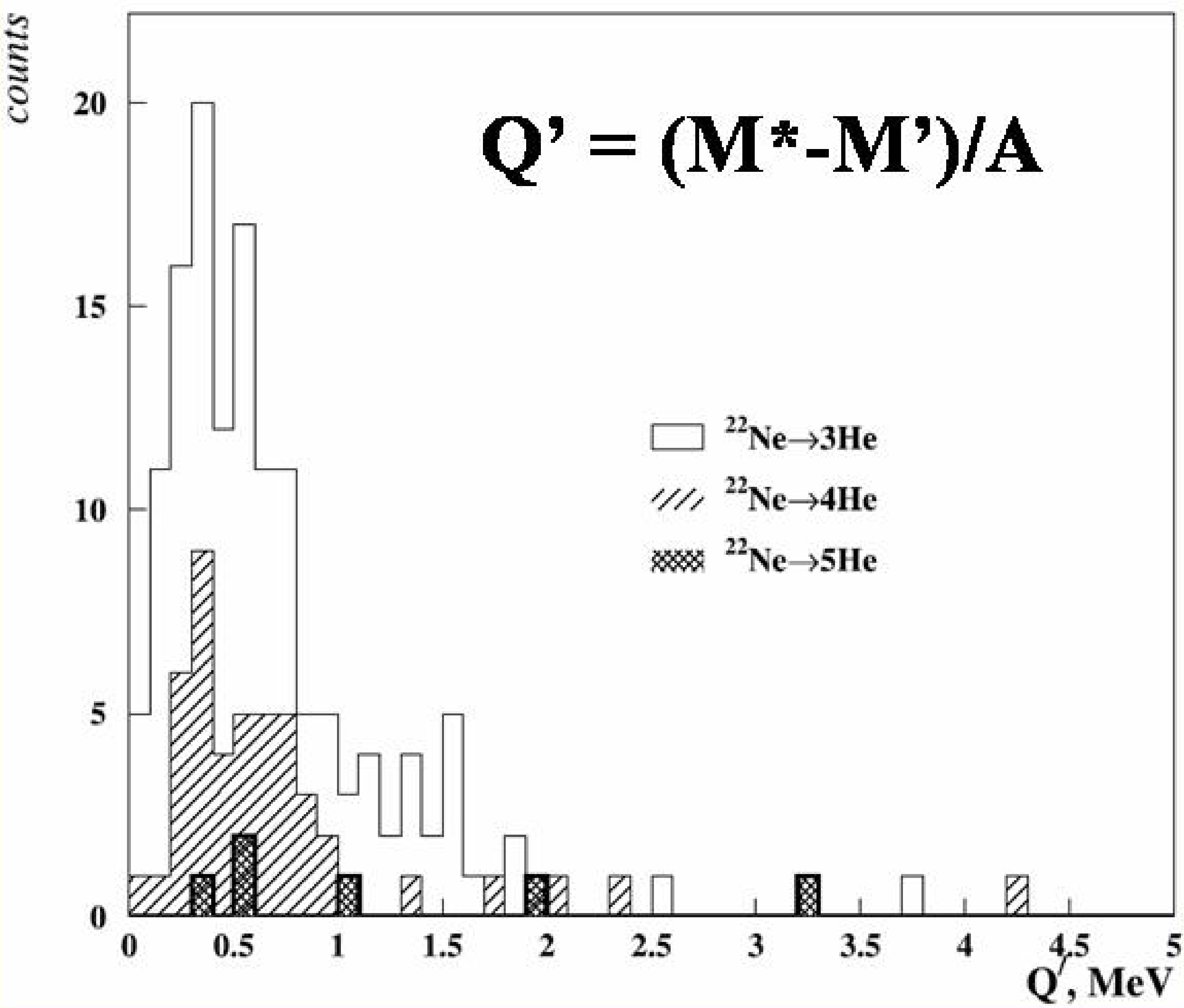
This circumstance shows in an obvious way on a domination of the multiple cluster states having high density over the binary states having lower energy thresholds.

Alpha-particle condensation in nuclei *P. Schuck, H. Horiuchi, G. Ropke, A. Tohsaki, C. R. Physique 4 (2003) 537-540*

At least light $n\alpha$-nuclei may show around the threshold for $n\alpha$ disintegration, bound or resonant which are of the α-particle gas type, i. e., they can be characterized by a self-bound dilute gas of almost unperturbed α-particles, all in relative *s*-states with respect to their respective center of mass coordinates and thus forming a Bose condensed state. Such state is quite analogous to the recently discovered Bose condensates of bosonic atoms formed in magnetic traps.

The only nucleus, which shows a well-developed α-particle structure in its ground state is ^{8}Be. Other $n\alpha$-nuclei collapse in their ground states to much denser system where the α-particles strongly overlap and probably loose almost totally their identity. When these $n\alpha$-nuclei are expanded, at some low densities α-particles reappear forming a Bose condensate. If energy is just right, the decompression may stall around the α-condensate density and the whole system may decay into α-particles via the coherent state.

$$^{12}C \rightarrow 3\,\alpha,\ \ldots,\ ^{40}Ca \rightarrow 10\,\alpha,\ ^{48}Cr \rightarrow 3\ ^{16}O,\ ^{32}S \rightarrow ^{16}O + 4\,\alpha$$



The Q' distribution for the fragmentation channels $^{22}Ne \rightarrow n\alpha$.

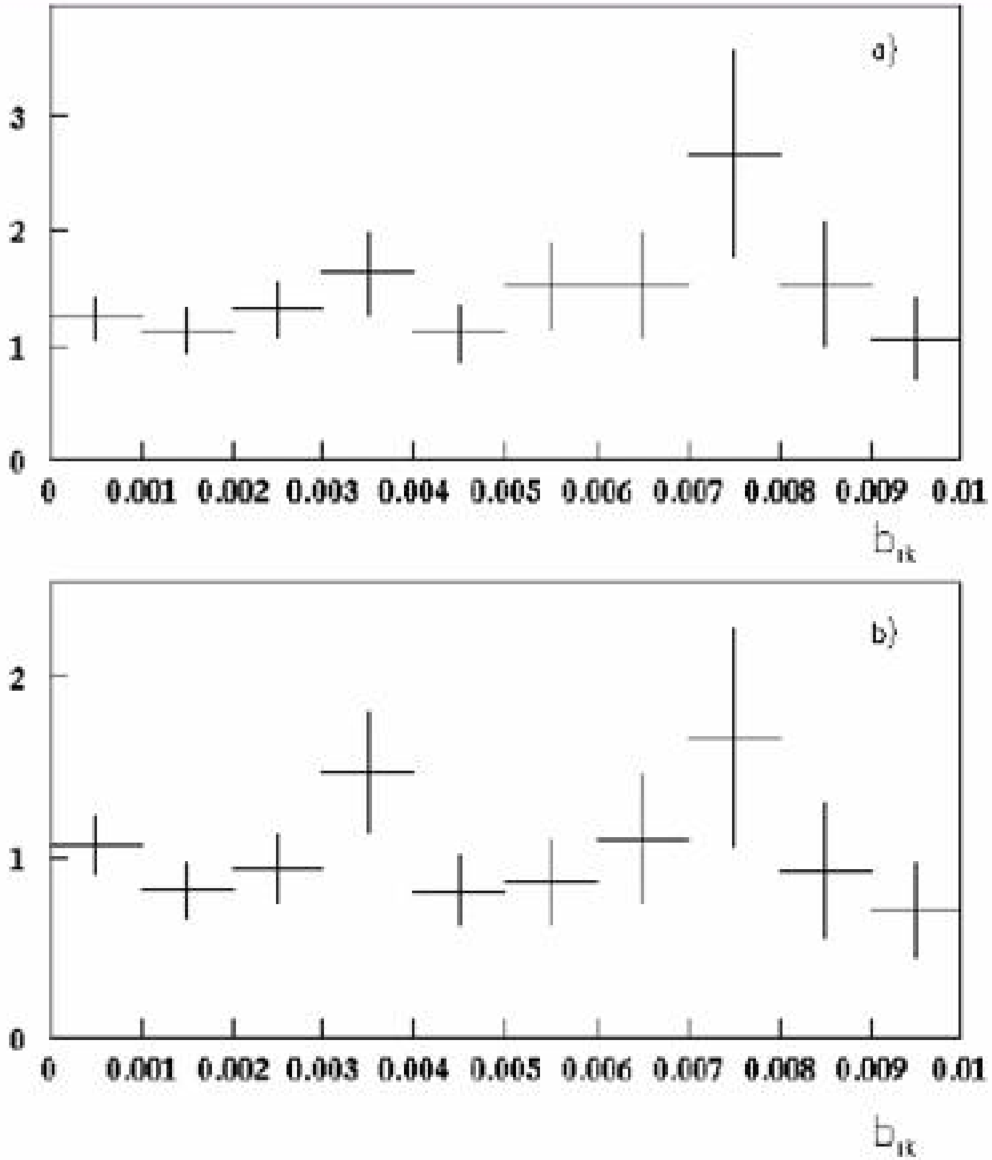
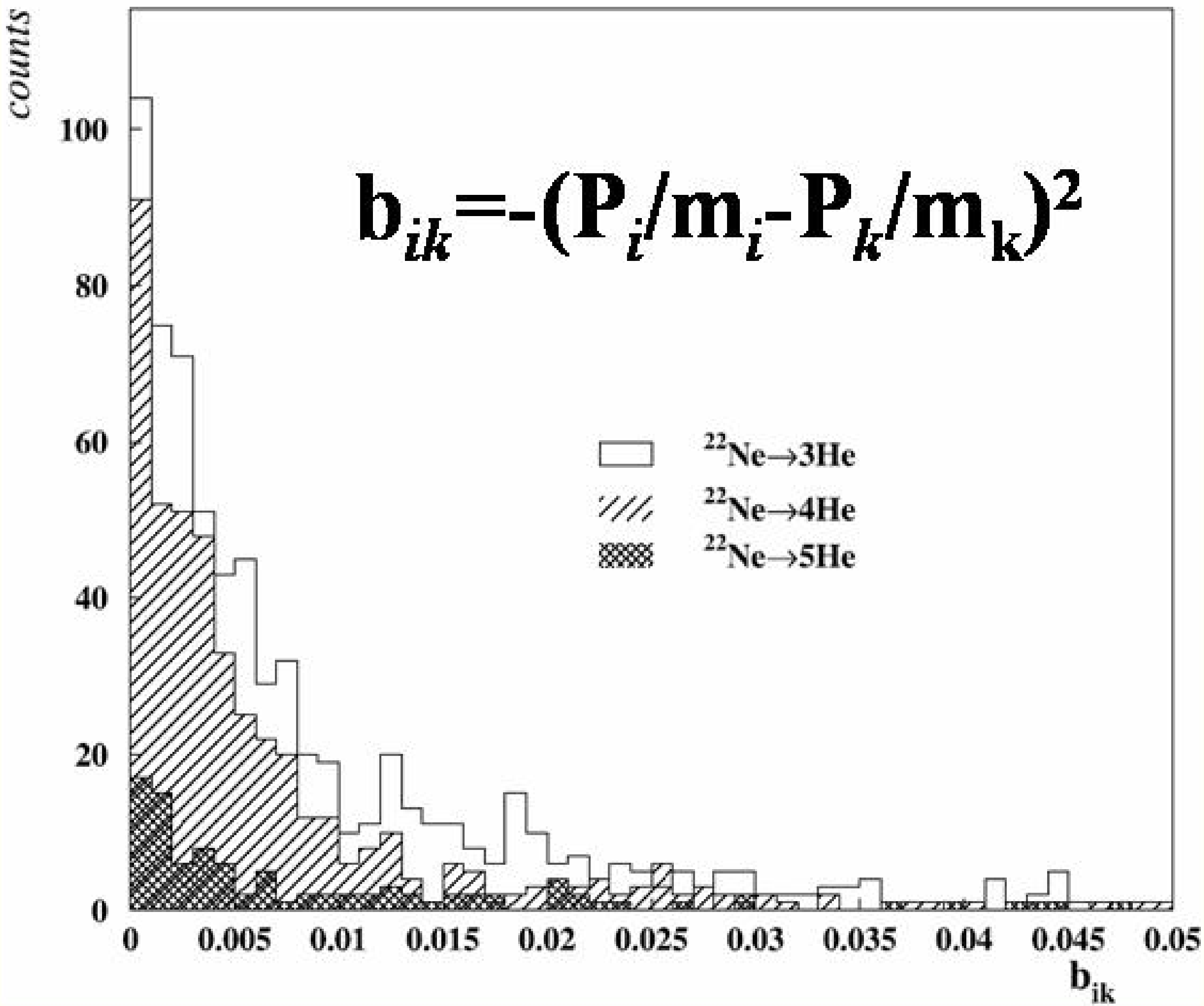


Fig. 3. The ratio of the b_{ik} distributions for the fragmentation channels $^{22}Ne \to 3\alpha$ (a) an $^{22}Ne \to 4\alpha$ (b).



The b_{ik} distribution for the fragmentation channels $^{22}Ne \to n\alpha$

Boltzmann constant, k /approx 10^{-4} eV K^{-1}

Typical Temperature Range, Ŧ /approx $5 \cdot 10^{8\text{-}9}$ K per α

$p_\alpha = \sqrt{(2 m_\alpha \cdot T_\alpha)}$ p_α /approx 20-120 MeV

Planck constant, ħ /approx 200 MeV fm

$\lambda = \hbar / p$ de Broglie wave lengths /approx 1-10 fm

$\lambda^{coh}{}_{\alpha}$ /approx R_α $\lambda^{coh}{}_{He}$ /approx R_{He}

$T_\alpha / T_{He} = Ŧ_\alpha / Ŧ_{He} = (R_{He}/R_\alpha)^2$ /approx 10^{10}

Macroscopic quantum coherence phenomena in atomic physics /approx 1 K

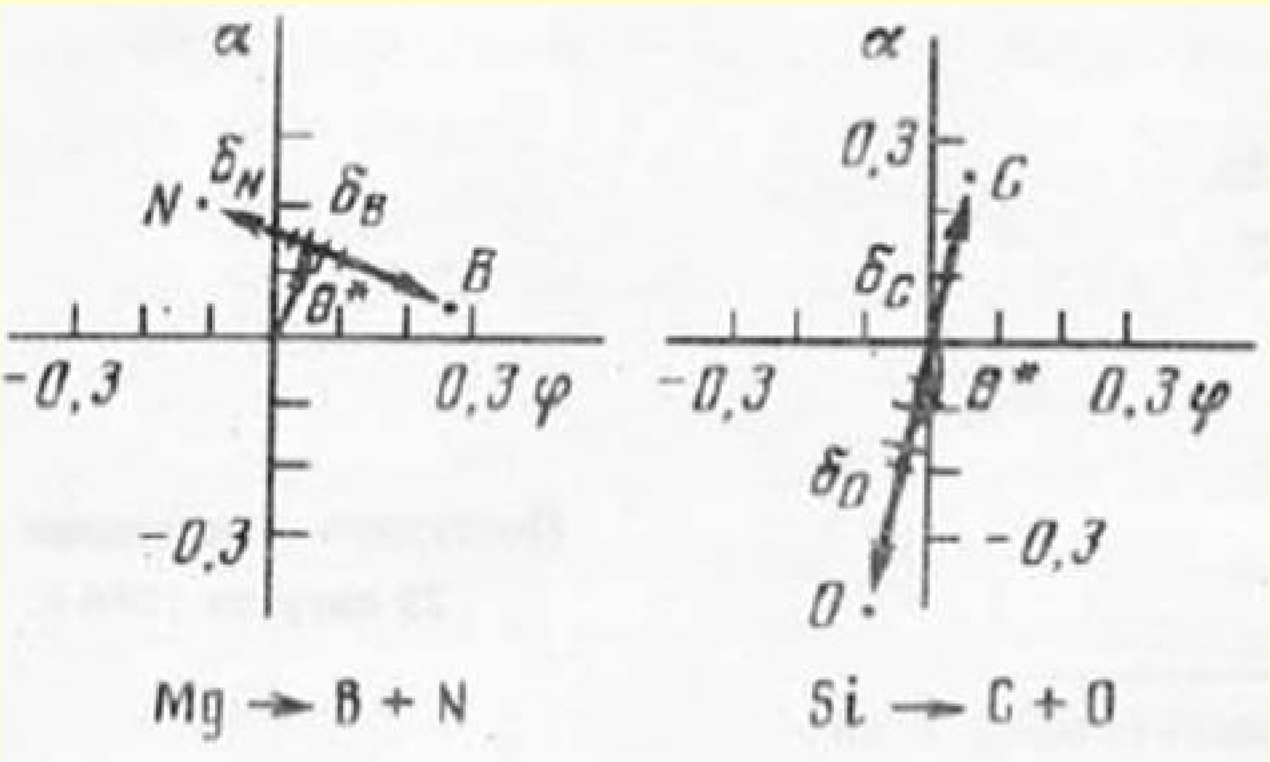
Macroscopic quantum coherence phenomena in nuclear physics /approx 10^{10} K

Письма в ЖЭТФ, том 44, вып. 7, стр. 306 – 308 *10 октября 1986 г.*

НАБЛЮДЕНИЕ РАСПАДА (ДЕЛЕНИЯ) РЕЛЯТИВИСТСКИХ ЯДЕР ^{24}Mg И ^{28}Si НА ДВА БЛИЗКИХ ПО ЗЯРЯДУ ФРАГМЕНТА

В.Г.Богданов, Н.П.Кочеров, Ф.Г.Лепехин[1), В.А.Плющев, Б.Б.Симонов[1), З.И.Соловьева, О.Е.Шигаев

В ядерной фотоэмульсии обнаружены распады релятивистских ядер Mg → B + N и Si → → C + O, происшедшие в результате неупругих периферических взаимодействий.



сообщения
объединенного
института
ядерных
исследований
дубна

Р1-91-85

ОБРАЗОВАНИЕ ДВУХ МНОГОЗАРЯДНЫХ ФРАГМЕНТОВ ПРИ ФРАГМЕНТАЦИИ РЕЛЯТИВИСТСКОГО ЯДРА ^{28}Si НА ЯДРАХ ФОТОЭМУЛЬСИИ

Сотрудничество: Дубна - Ереван - Ленинград

1991

При изучении топологических характеристик процесса фрагментации релятивистских ядер ^{22}Ne и ^{28}Si с импульсом около 4 А·ГэВ/с было показано[1, 2], что реакция происходит по трем группам каналов:

а) с полным расщеплением ядер до одно- и двухзарядных фрагментов — (ПР);

б) с сохранением одного многозарядного фрагмента с $Z \geq 3$ — (1f);

в) с образованием двух многозарядных фрагментов — (2f).

Последний класс событий на ^{22}Ne составляет 0,5% (22 соб. из 4300), а на ^{28}Si — 1,8% (35 соб. из 1980) от полного числа неупругих взаимодействий. Среди событий фрагментации ядер ^{28}Si было обнаружено одно, которое представляло собой 2f-расщепление ядра кремния на углерод и кислород без какого-либо видимого возбуждения ядра-мишени и было интерпретировано как деление легкого ядра[3].

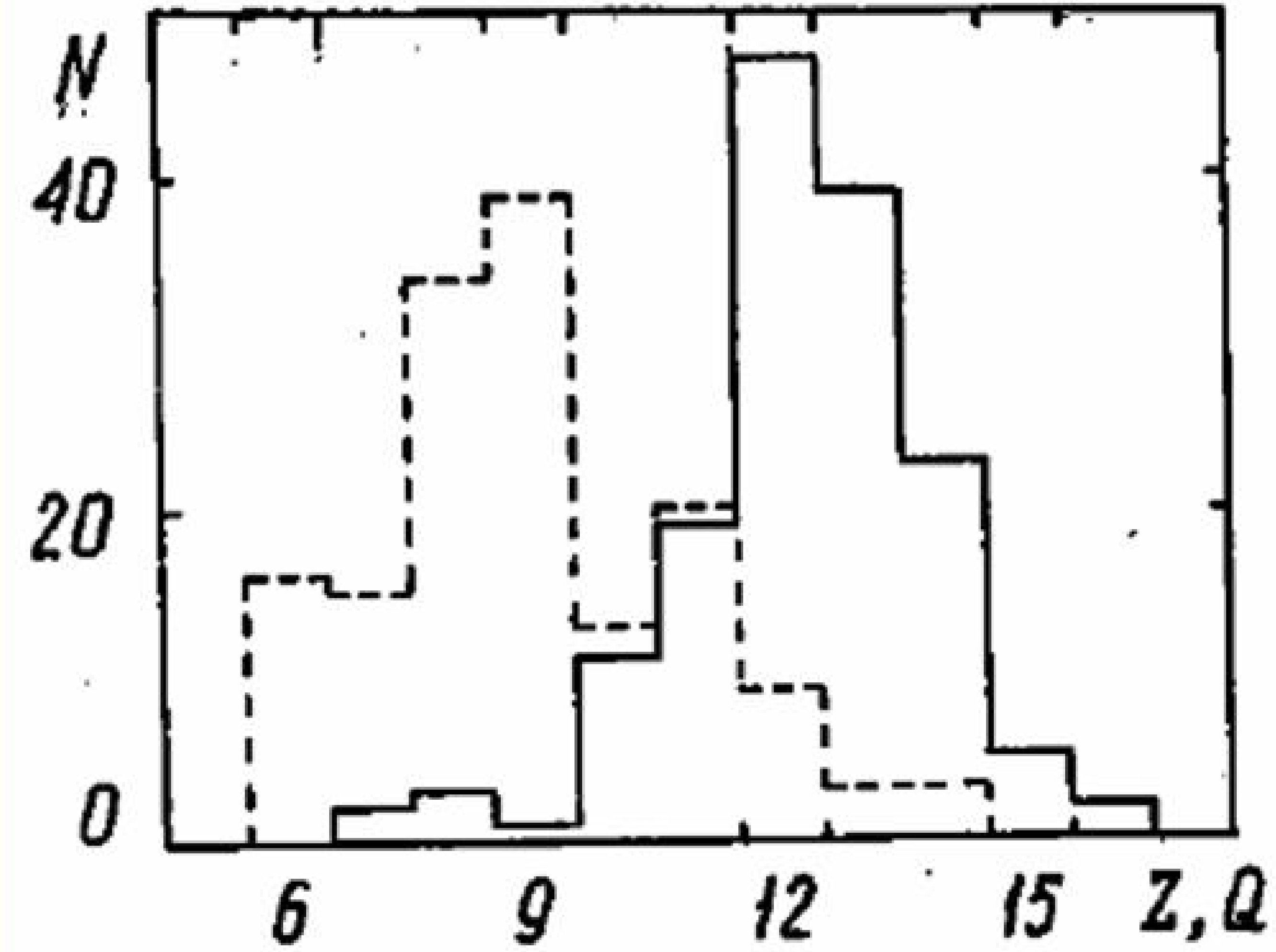


Рис.1. Распределения 2f-событий по $Q = \sum Z_{f1}$ — сплошная гистограмма и $Z = Z_{f1} + Z_{f2}$ — штриховая.

z_{f2} \ z_{f1}	3	4	5	6	7	8	9	10	Σ
3	16	15	26	21	3	7			88
4		8	18	2	6	1	1	1	37
5			8	7	6	1			22
6				2	1	2			5
Σ	16	23	52	32	16	11	1	1	

Рис.3. Зарядовая матрица для 2f-событий.

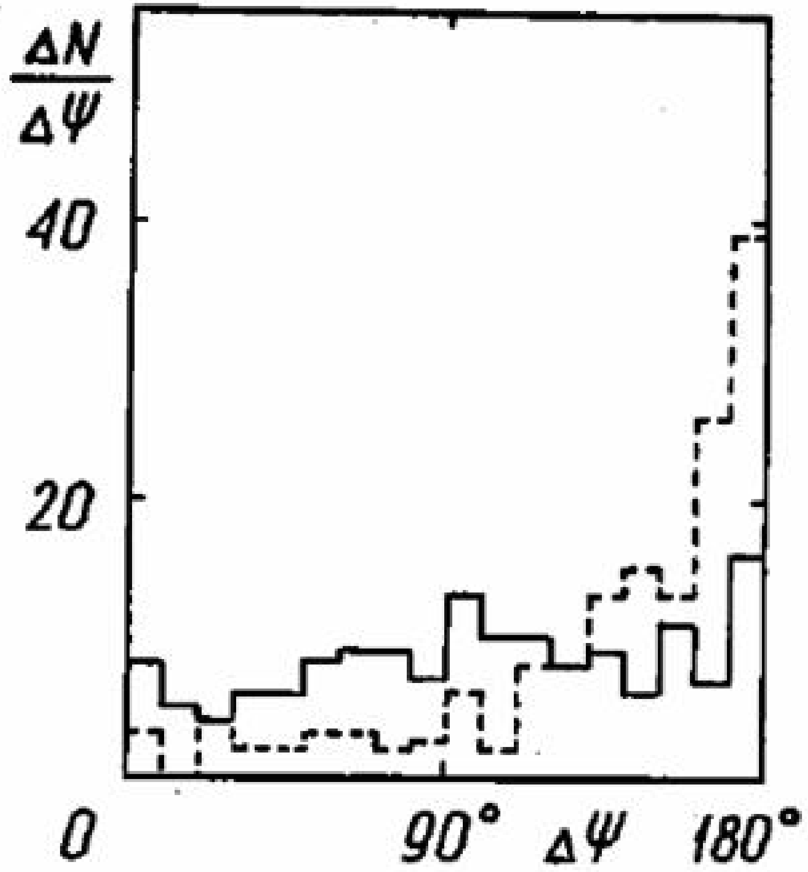
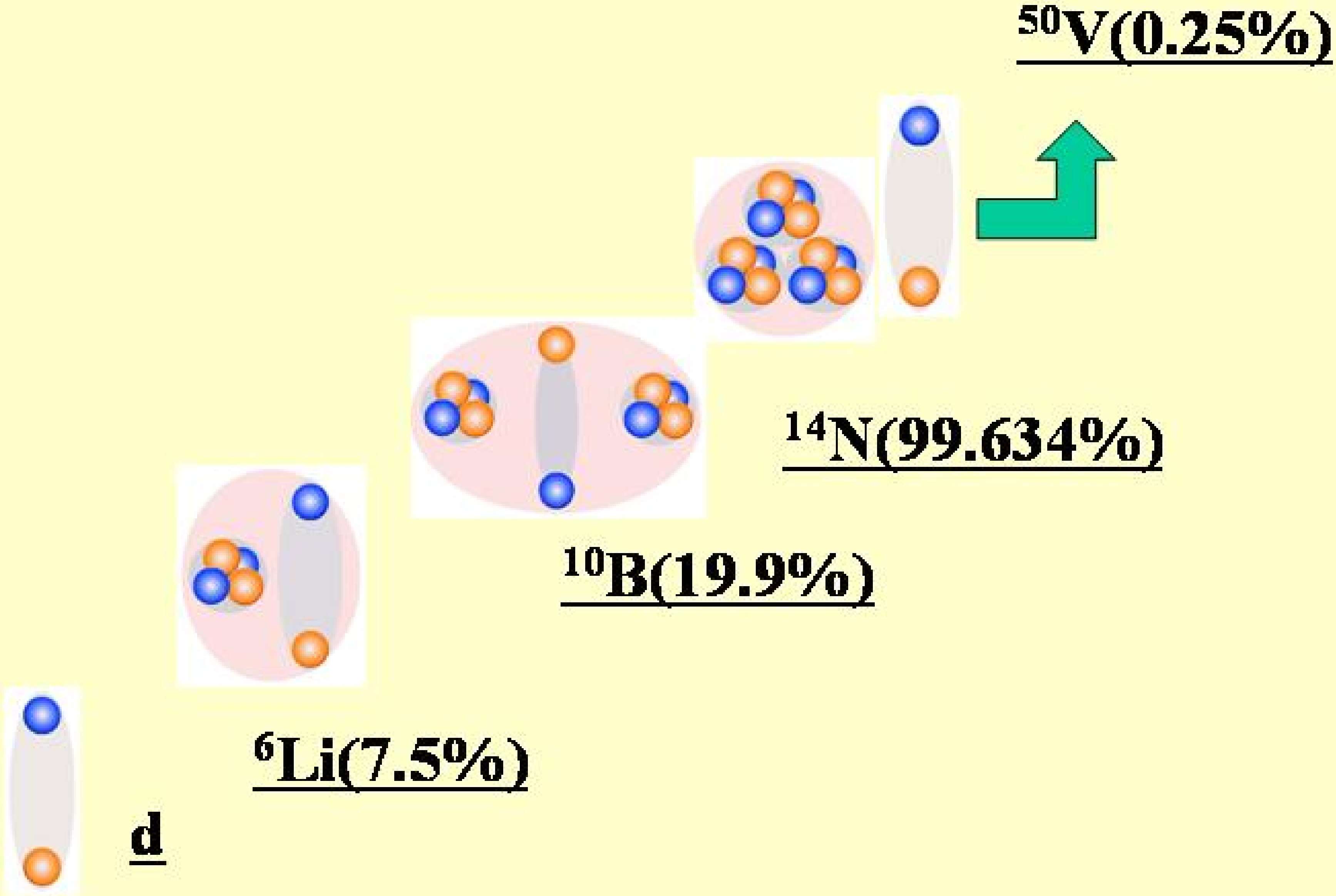
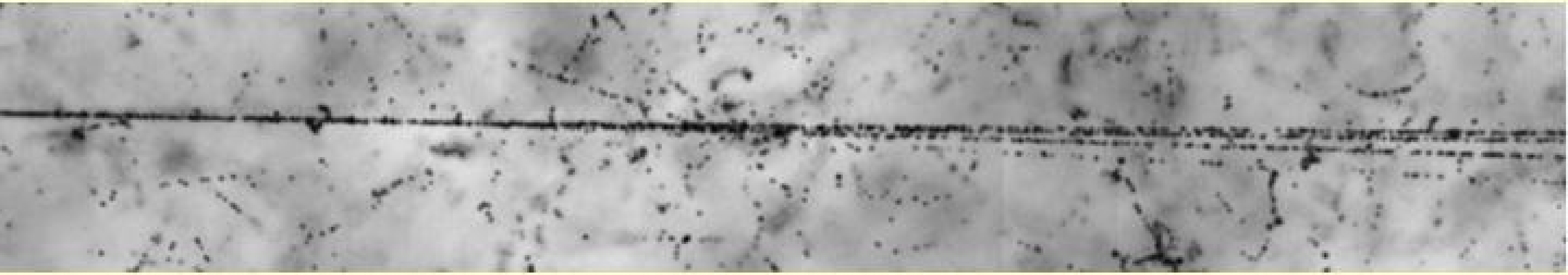


Рис.5. Распределение по $\Delta\Psi$ для $2f$-событий в лабораторной системе — сплошная гистограмма и в системе спектатора — штриховая гистограмма.

Deuteron-Alpha Clustering in Light Nuclei

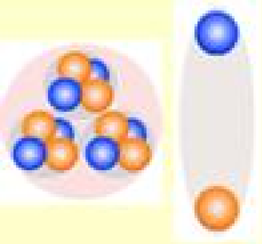


2.9A GeV/c ^{14}N Dissociation



^{14}N nucleus, like the deuteron, ^{6}Li and ^{10}B, belong to a rare class of even-even stable nuclei. It is interesting to establish the presence of deuteron clustering in relativistic ^{14}N fragmentation.

^{6}Li	(He + p)/(He + d) ≈ 1
^{10}B	(2*He + p)/(2*He + d) ≈ 1
^{14}N	(3*He + p)/(3*He + d) ≈ 2:1



2.1 A GeV ^{14}N

By systematic scanning over primary tracks, 42 «white» stars have already been found among 540 inelastic events.

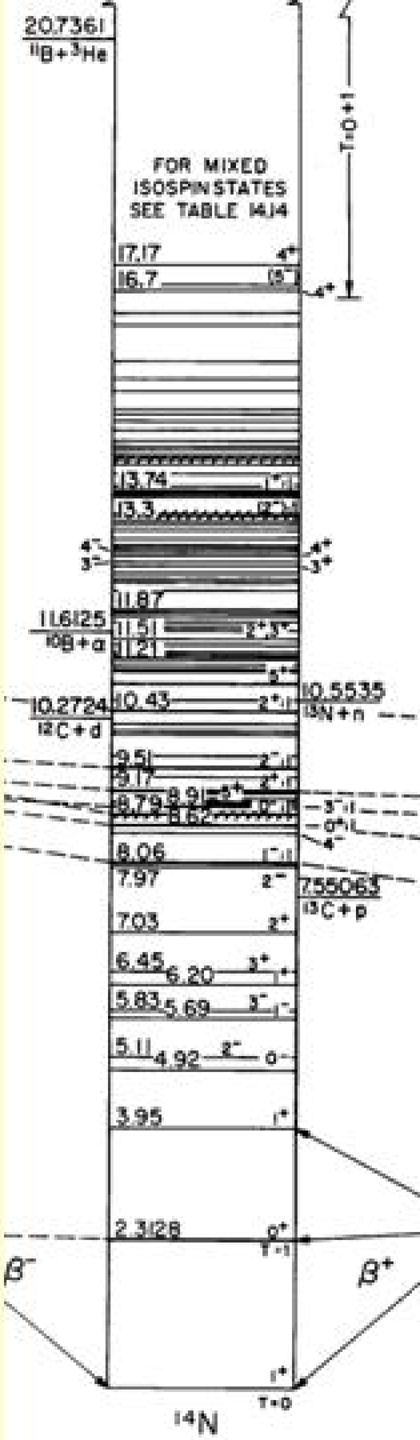
The secondary tracks of «white» stars are concentrated in a forward 8° cone. They are distributed over the charge modes as follows:

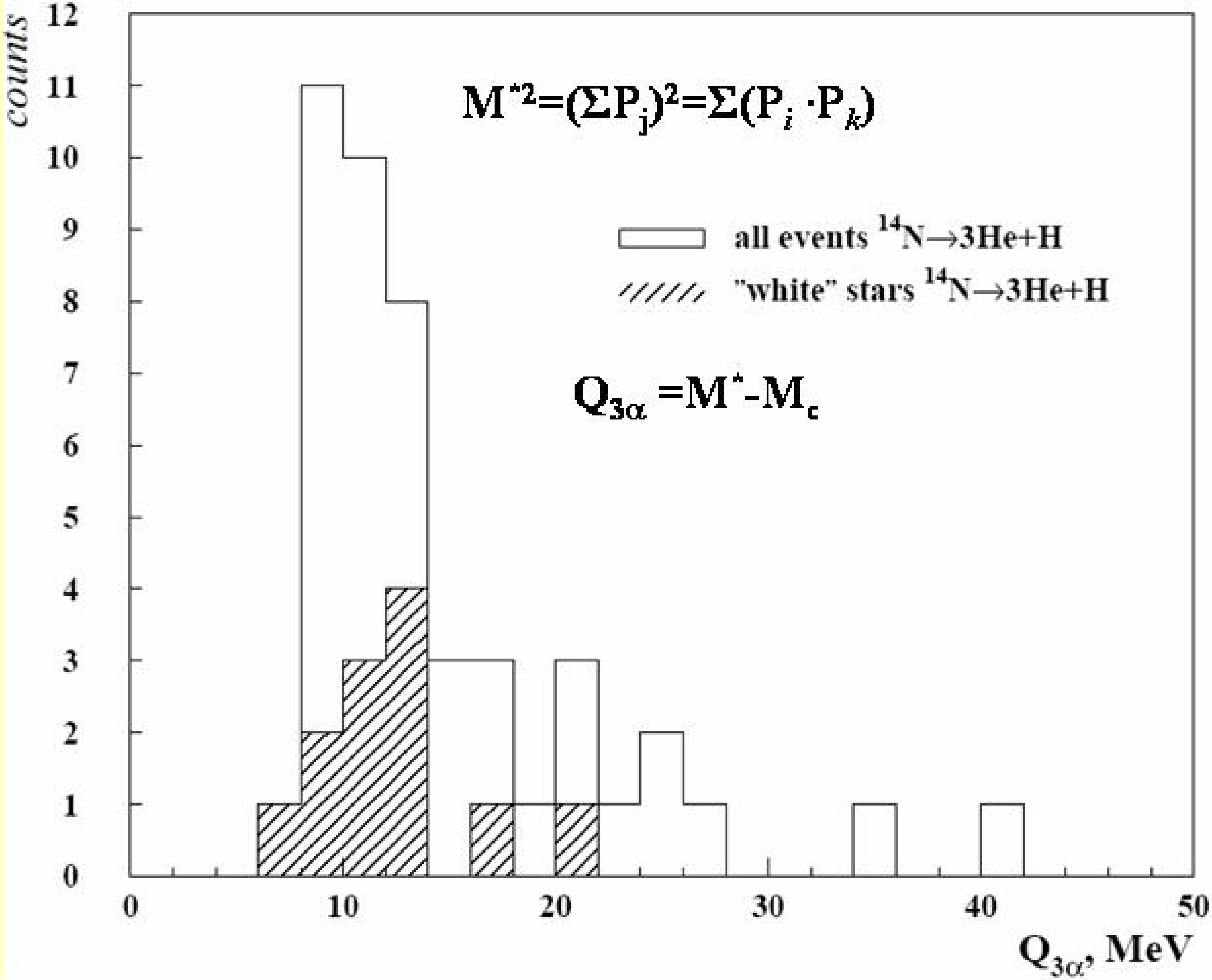
3He+H - 33%,

C+H - 31%,

B+2H - 7%, B+He - 7%,

Be+He+H - 2%, Li+He+2H - 2%, Li+4H 2%.





counts
$M^{*2}=(\Sigma P_j)^2=\Sigma(P_i \cdot P_k)$
all events $^{14}N \rightarrow 3He+H$
"white" stars $^{14}N \rightarrow 3He+H$
$Q_{3\alpha} = M^* - M_c$
$Q_{3\alpha}$, MeV
0 1 2 3 4 5 6 7 8 9 10 11 12
0 10 20 30 40 50

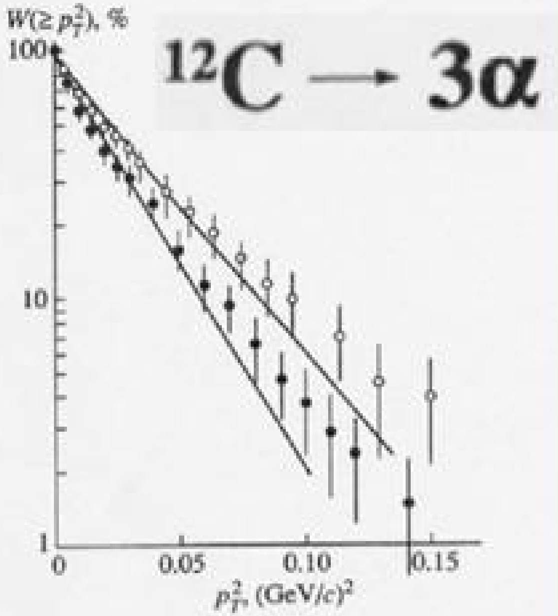
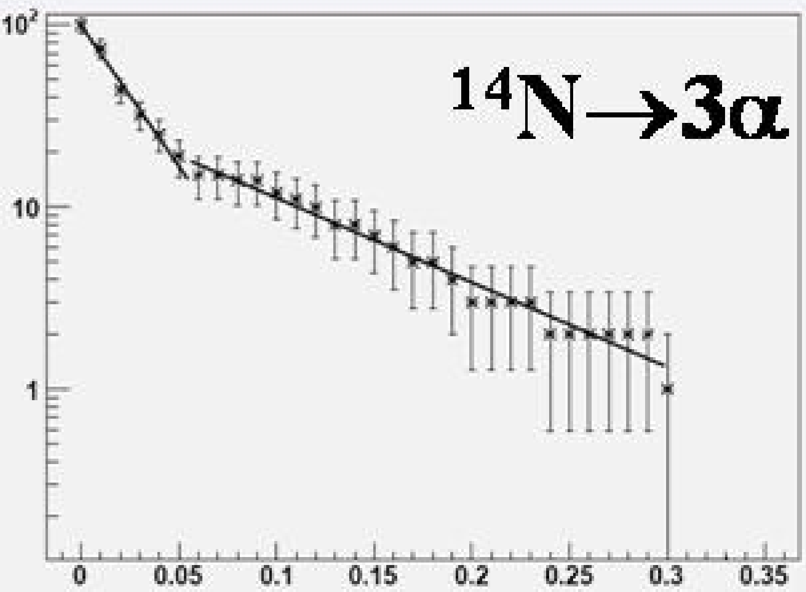


Fig. 1. p_T^2 distribution of α particles from the reaction $^{12}C \longrightarrow 3\alpha$ in ordinary (○, [3]) and lead-enriched (●) emulsions. The straight lines represent distributions (1) at $2\sigma^2 = \langle p_T^2 \rangle$.



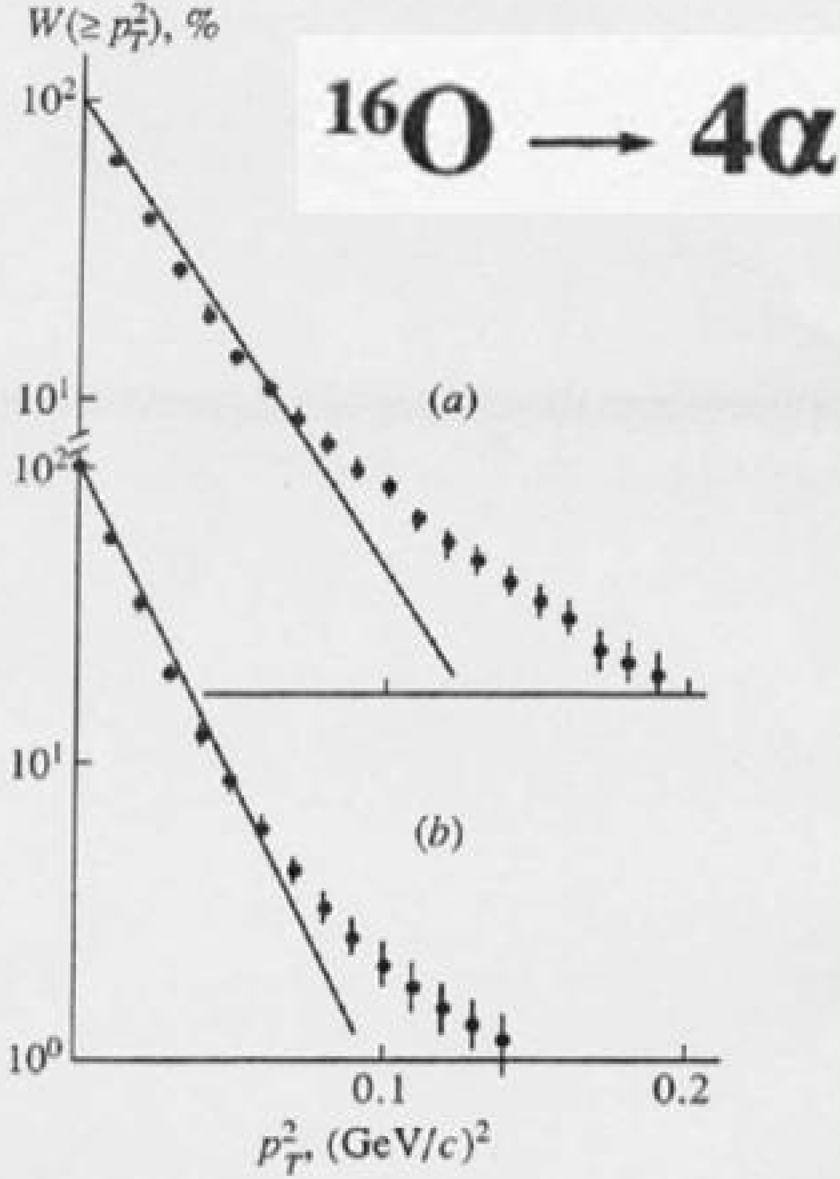
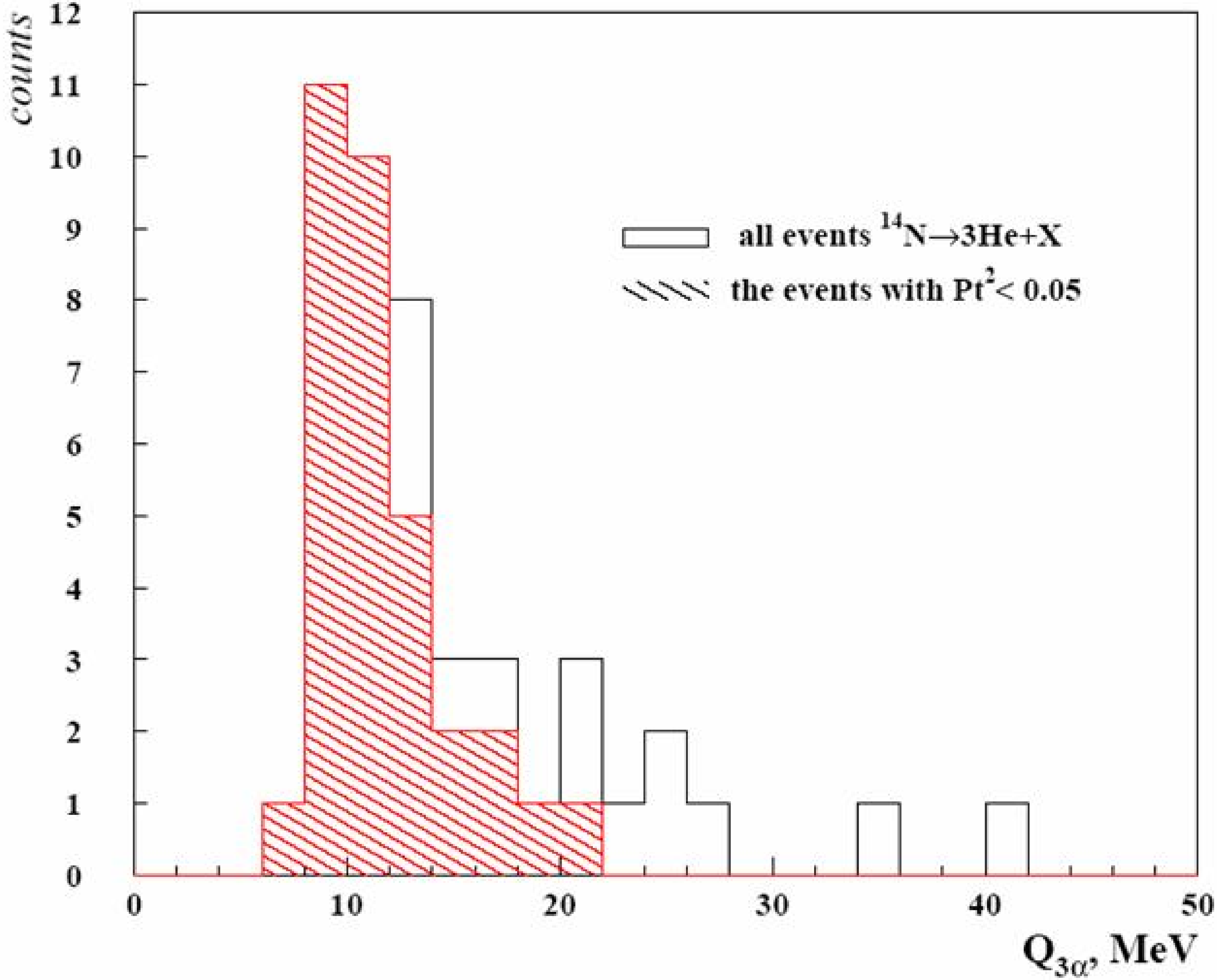
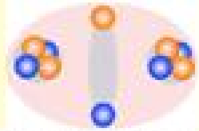


Fig. 2. Inclusive p_T^2 distribution of α particles for (*a*) the complete event sample and (*b*) events with $-t <$ 0.1 (GeV/*c*). The straight lines are the Rayleigh distributions with $\langle p_T^2 \rangle$ corresponding to the observed values.


counts
12
11
10
9
8
7
6
5
4
3
2
1
0
0
10
20
30
40
50
all events $^{14}N \rightarrow 3He+X$
the events with $Pt^2 < 0.05$
$Q_{3\alpha}$, MeV

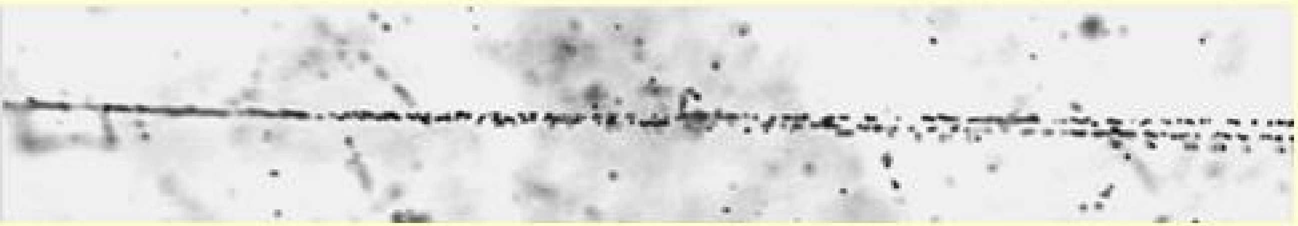
1.9 A GeV ^{10}B

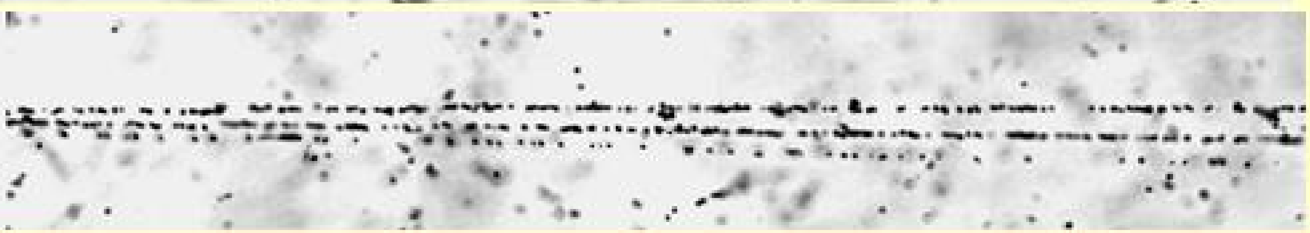


Physics of Atomic Nuclei, Vol. 67, No. 3, 2004, pp. 514–517. Translated from Yadernaya Fizika, Vol. 67, No. 3, 2004, pp. 533–536.
Original Russian Text Copyright © 2004 by Adamovich, Bradnova, Vokal, Gerasimov, Dronov, Zarubin, Kovalenko, Kotel'nikov, Krasnov, Larionova, Lepekhin, Malakhov, Orlova, Peresadko, Polukhina, Rukoyatkin, Rusakova, Salmanova, Simonov, Chernyavsky, Haiduc, Kharlamov, Just.

ELEMENTARY PARTICLES AND FIELDS
Experiment

Investigation of Clustering in Light Nuclei by Means of Relativistic-Multifragmentation Processes

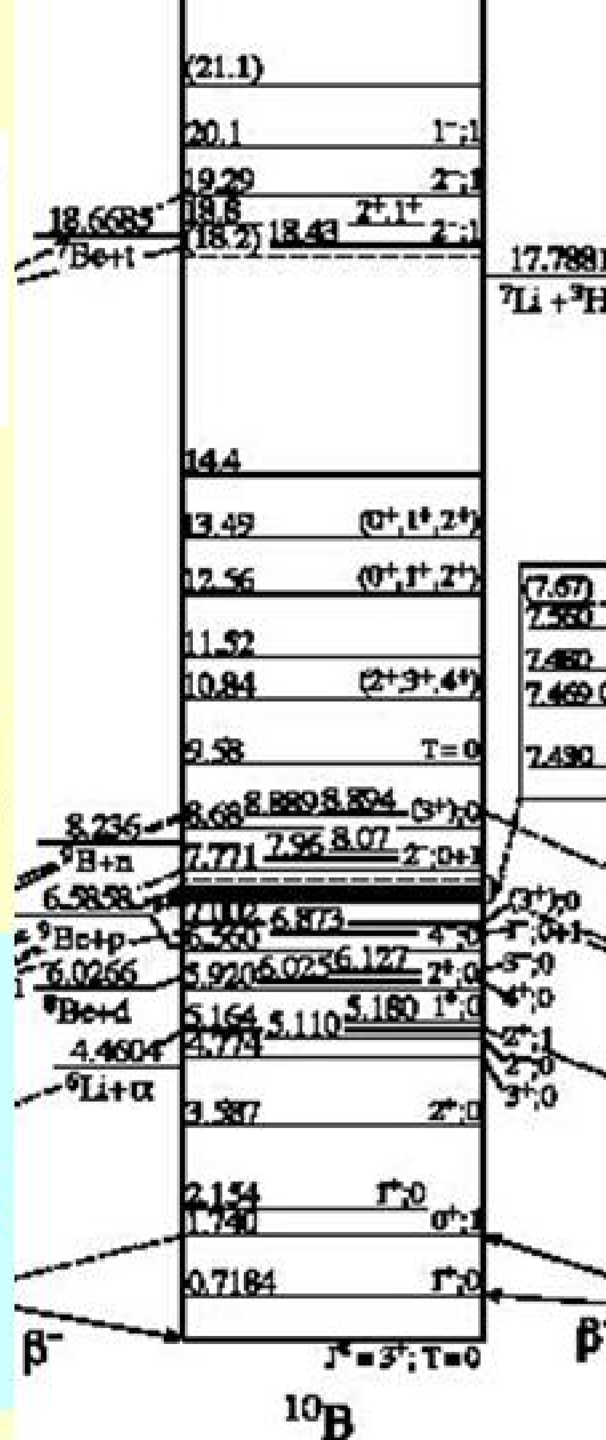




^{10}B is disintegrated to 2 doubly charged and 1singly charged particles in 70% of "white" stars.

A singly charged particle is the deuteron in 40% like in case of ^{6}Li.

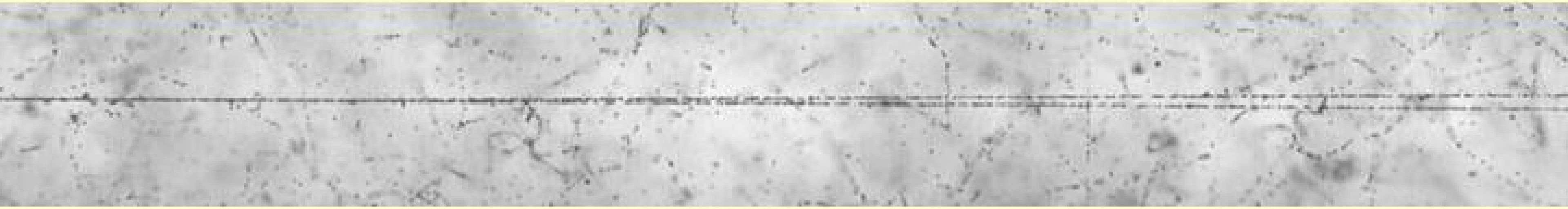
^{8}Be contribution is 20%. $^{10}B \to ^{9}Bep$ – 3%



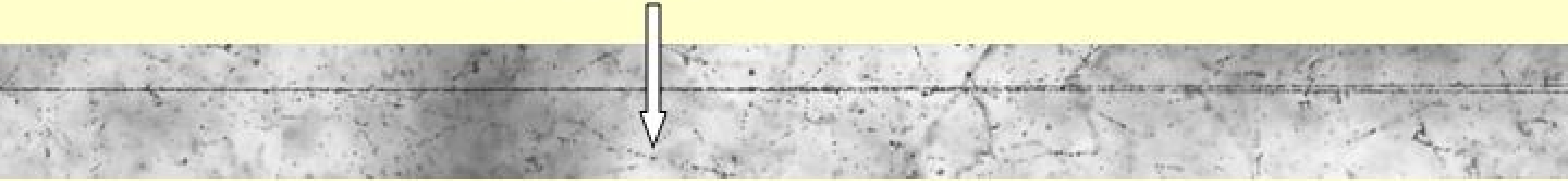
1.3A GeV ^{9}Be dissociation in 2+2.

$^{10}B \to {}^{9}Be$, Nuclotron, 2004.

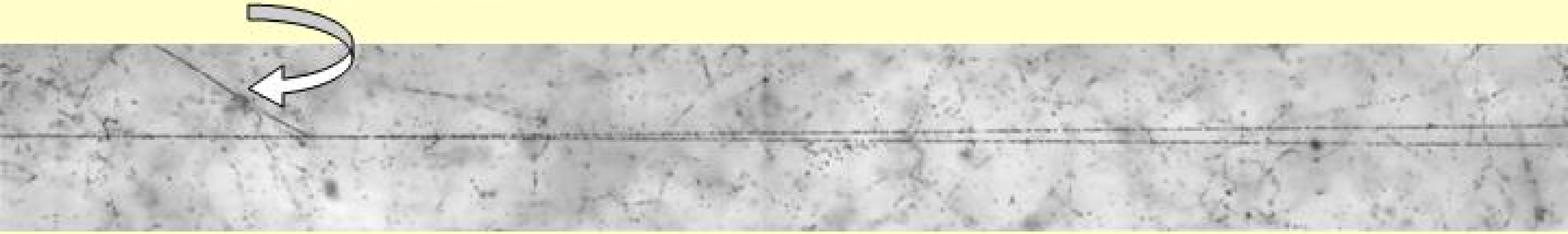
"white" star

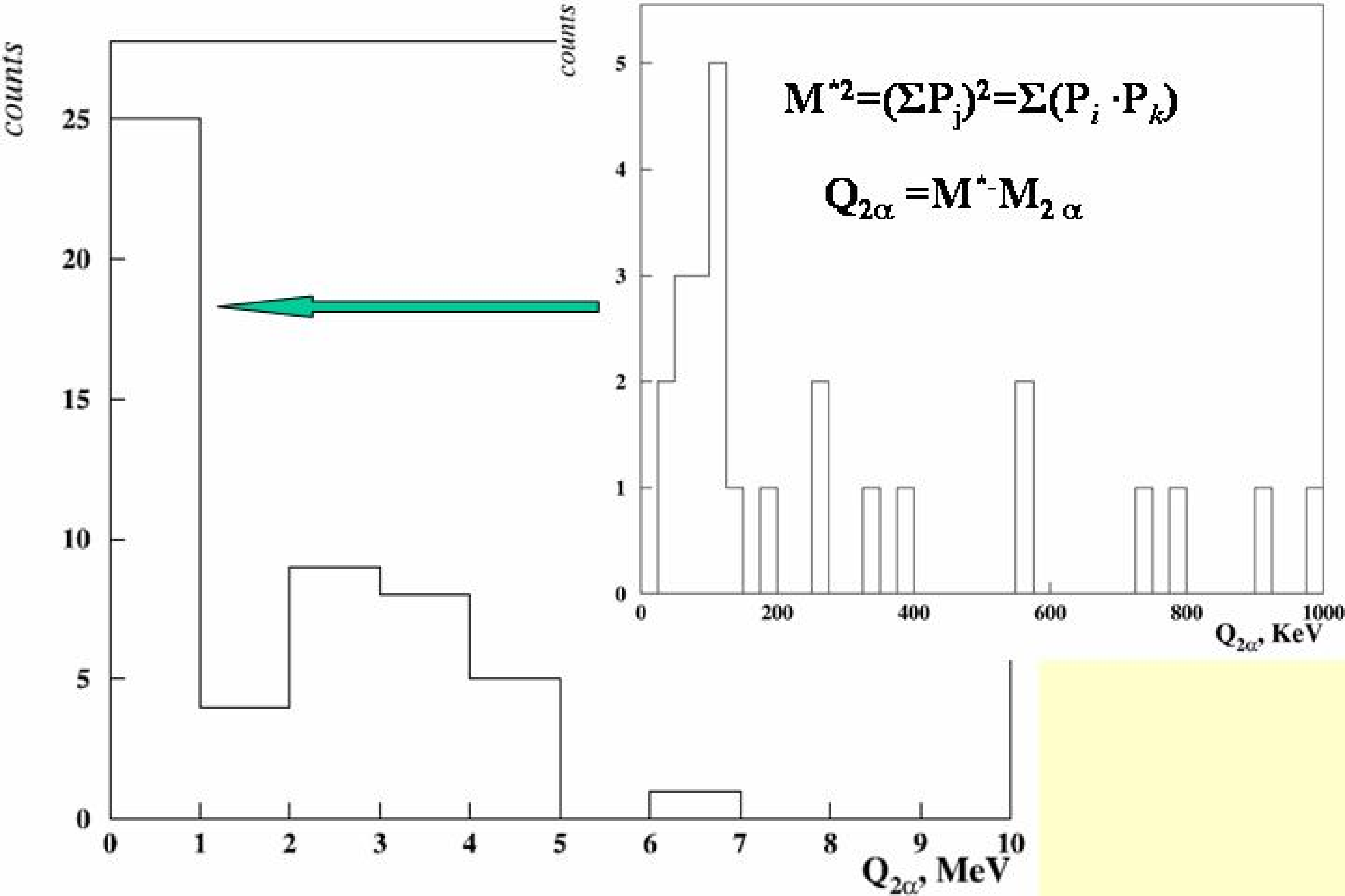


with recoil proton



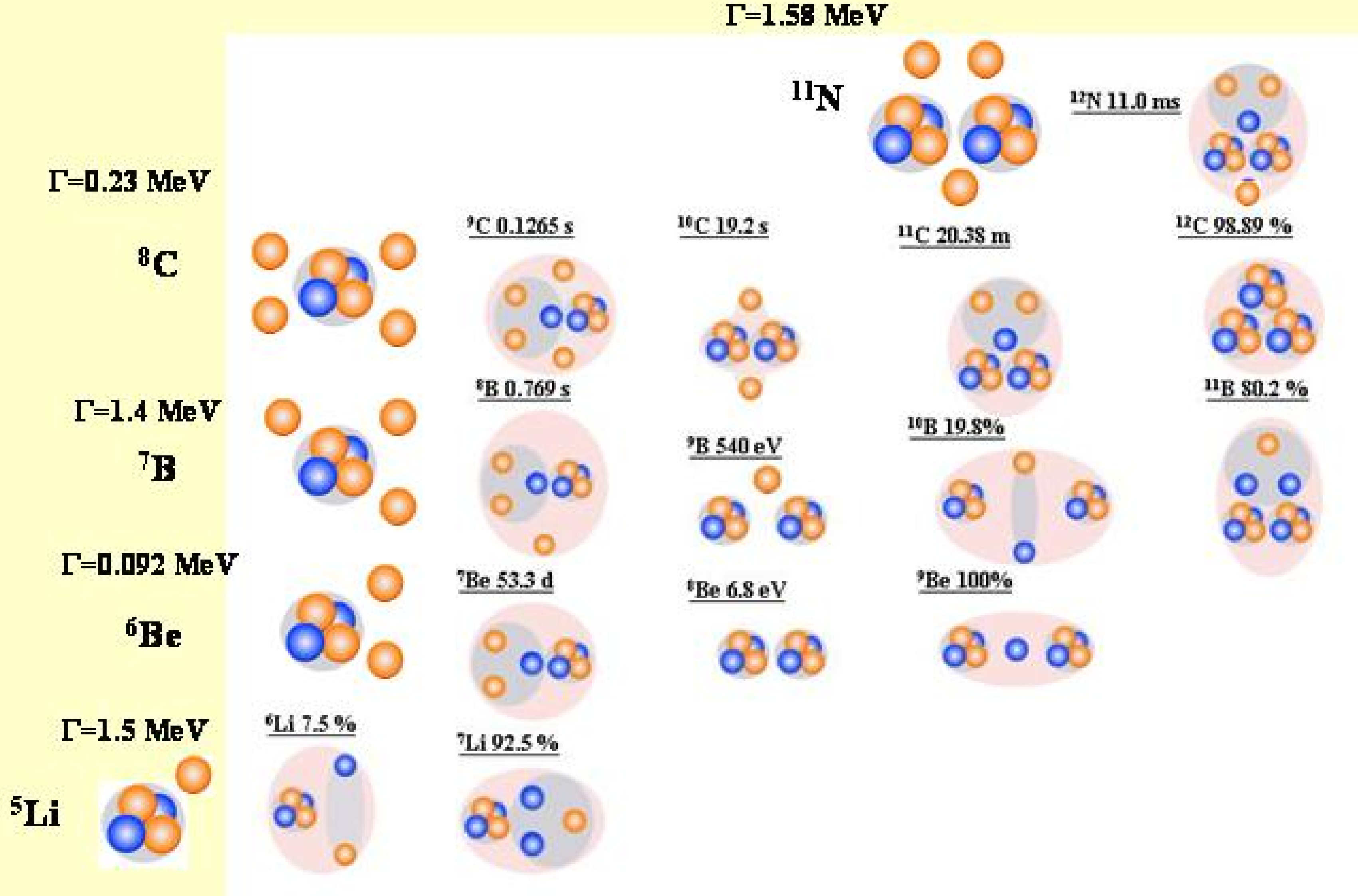
with heavy fragment of target nucleus

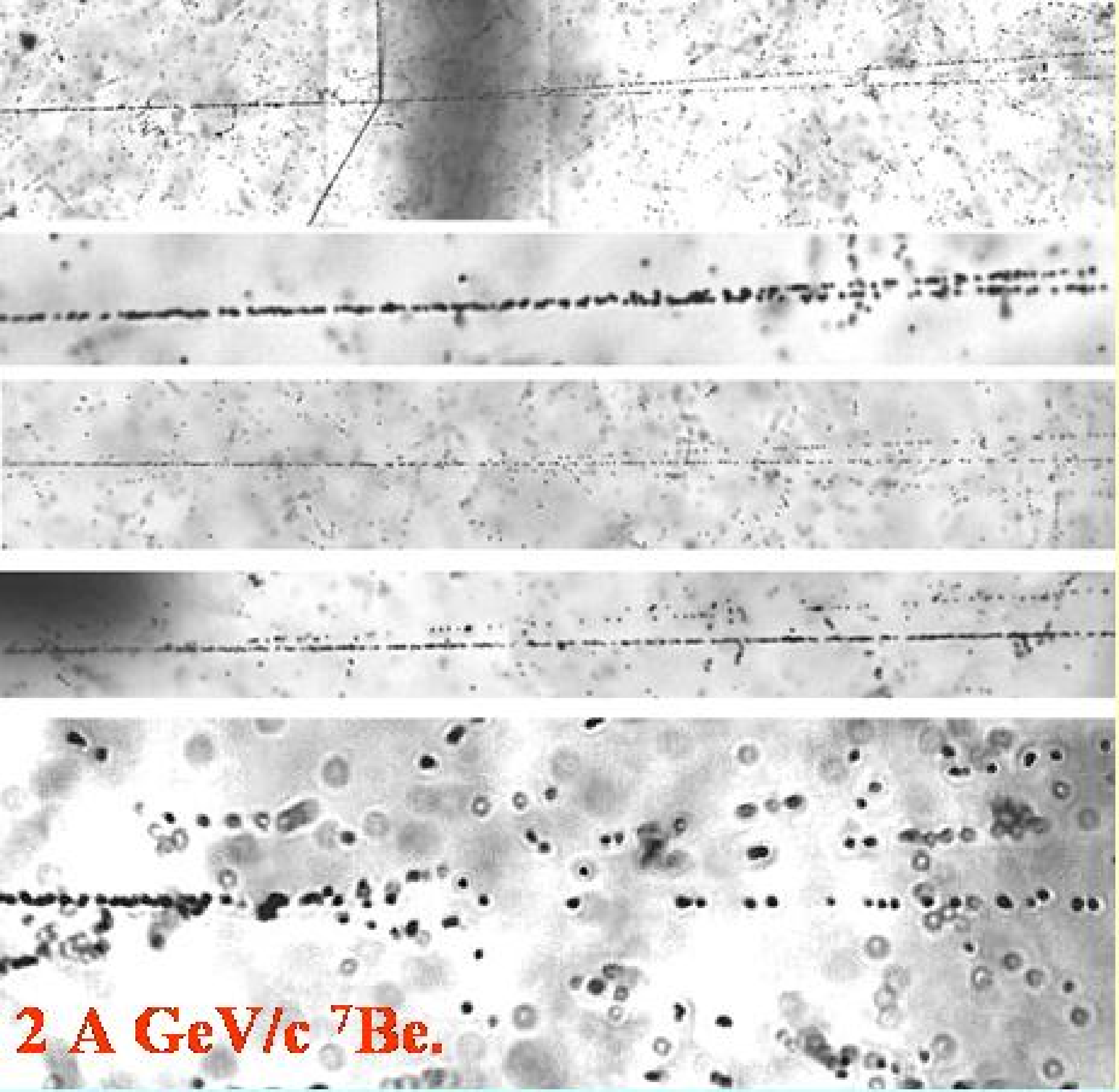


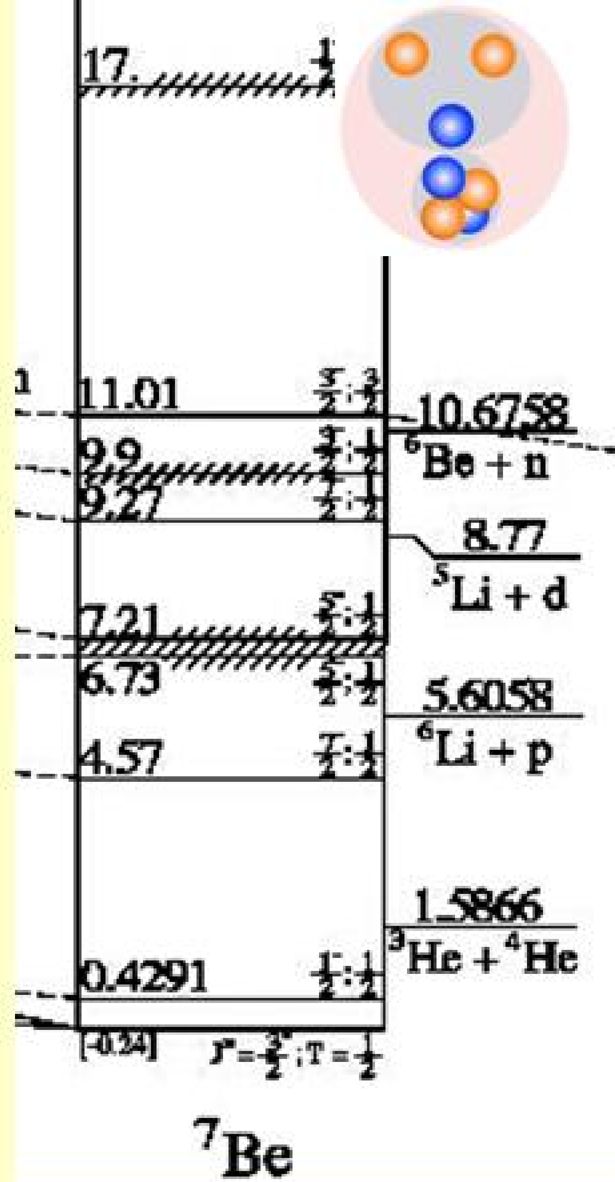


The $Q_{2\alpha}$ distribution for the fragmentation channels $^{9}Be \rightarrow 2\alpha$.

Toward stability frontier

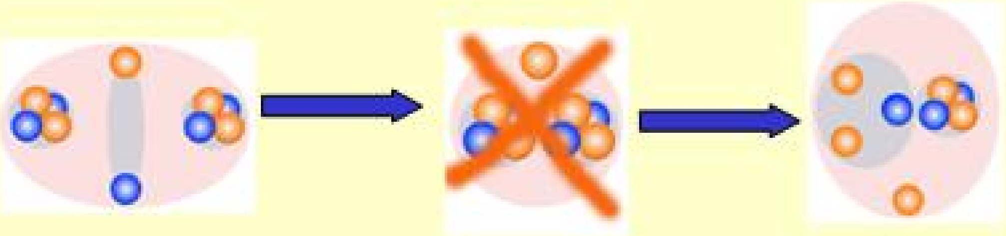




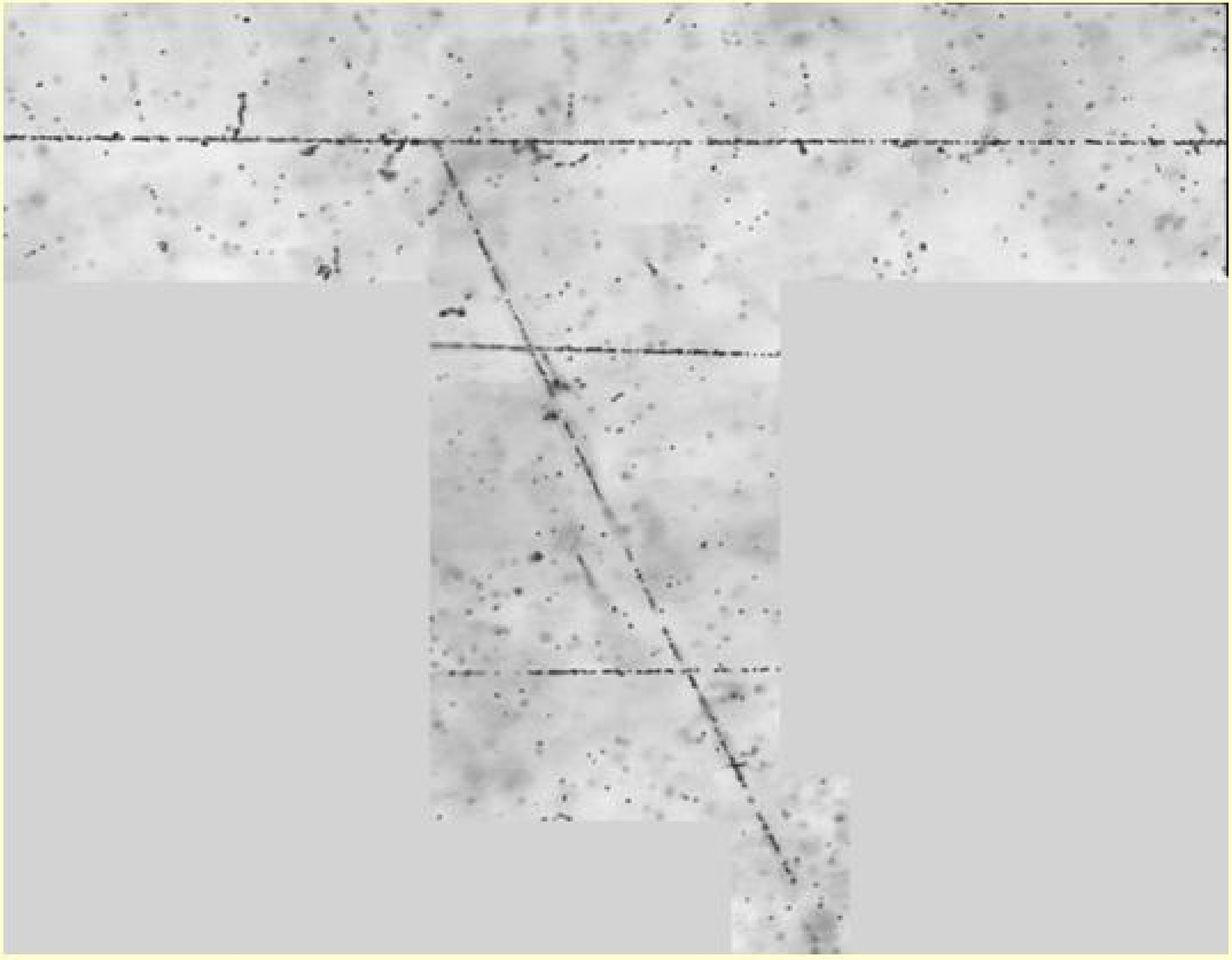


Splitting to HeHe with two target fragments,

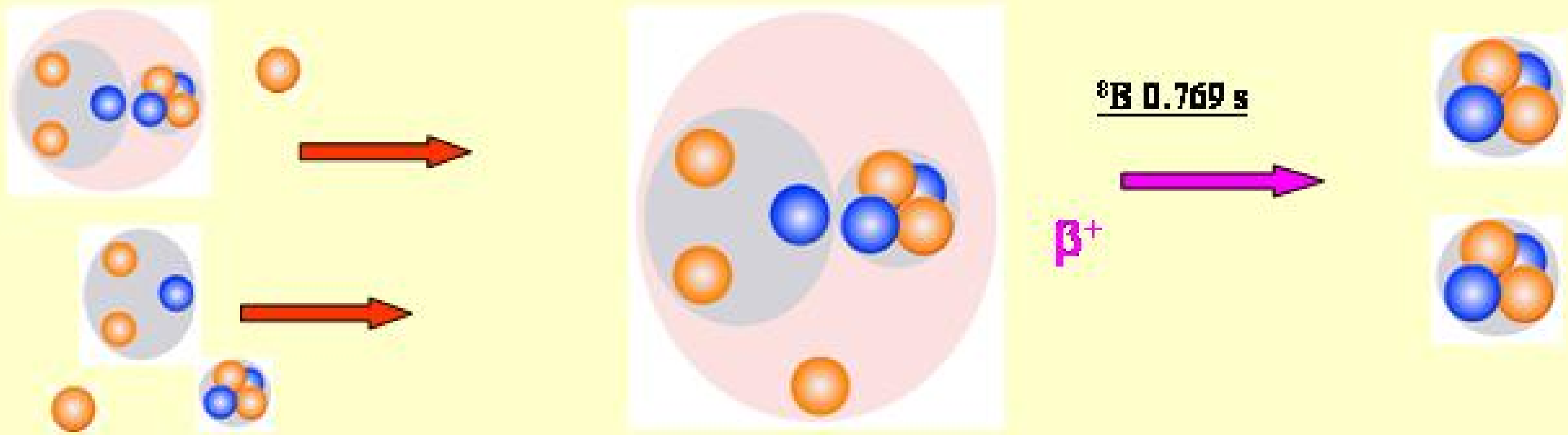
HeHe, HeHH, ^{6}Lip, and 4H.



2 A GeV/c $^{10}B \rightarrow {}^{8}B$



“Ternary H&He Process”



The ^{10}B nuclei with a momentum of 2A GeV/c and an intensity of about 10^8 nuclei per cycle were accelerated at the JINR nuclotron. A beam of secondary nuclei of a magnetic rigidity corresponding to Z/A = 5/8 ($^{10}B \to {}^8B$ fragmentation) was provided for emulsions.

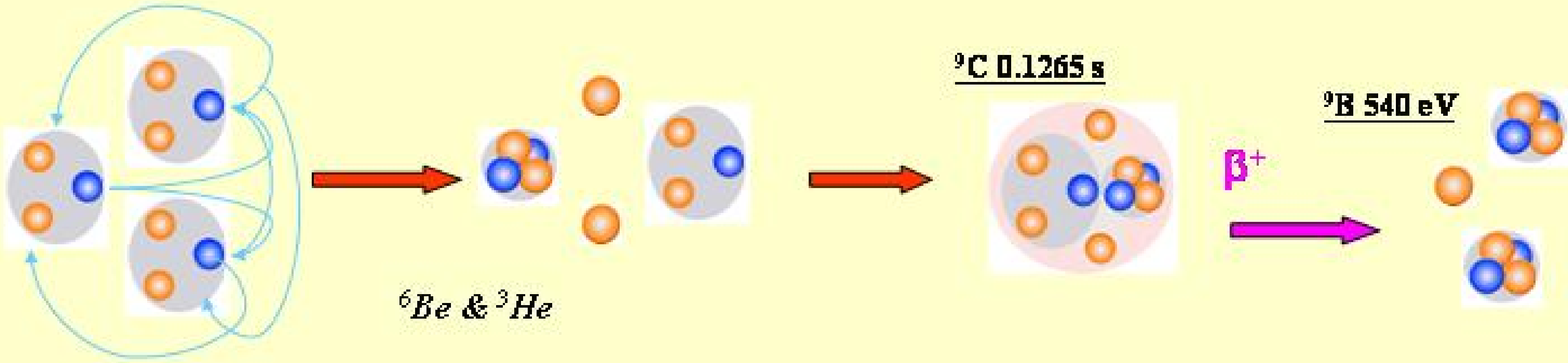
We plan to determine the probabilities

$^8B \to {}^7$Bep (18), ^{3,4}He^{3}Hep (11), HeHHp (12) , ^{6}Lipp (1), and HHHpp (3).

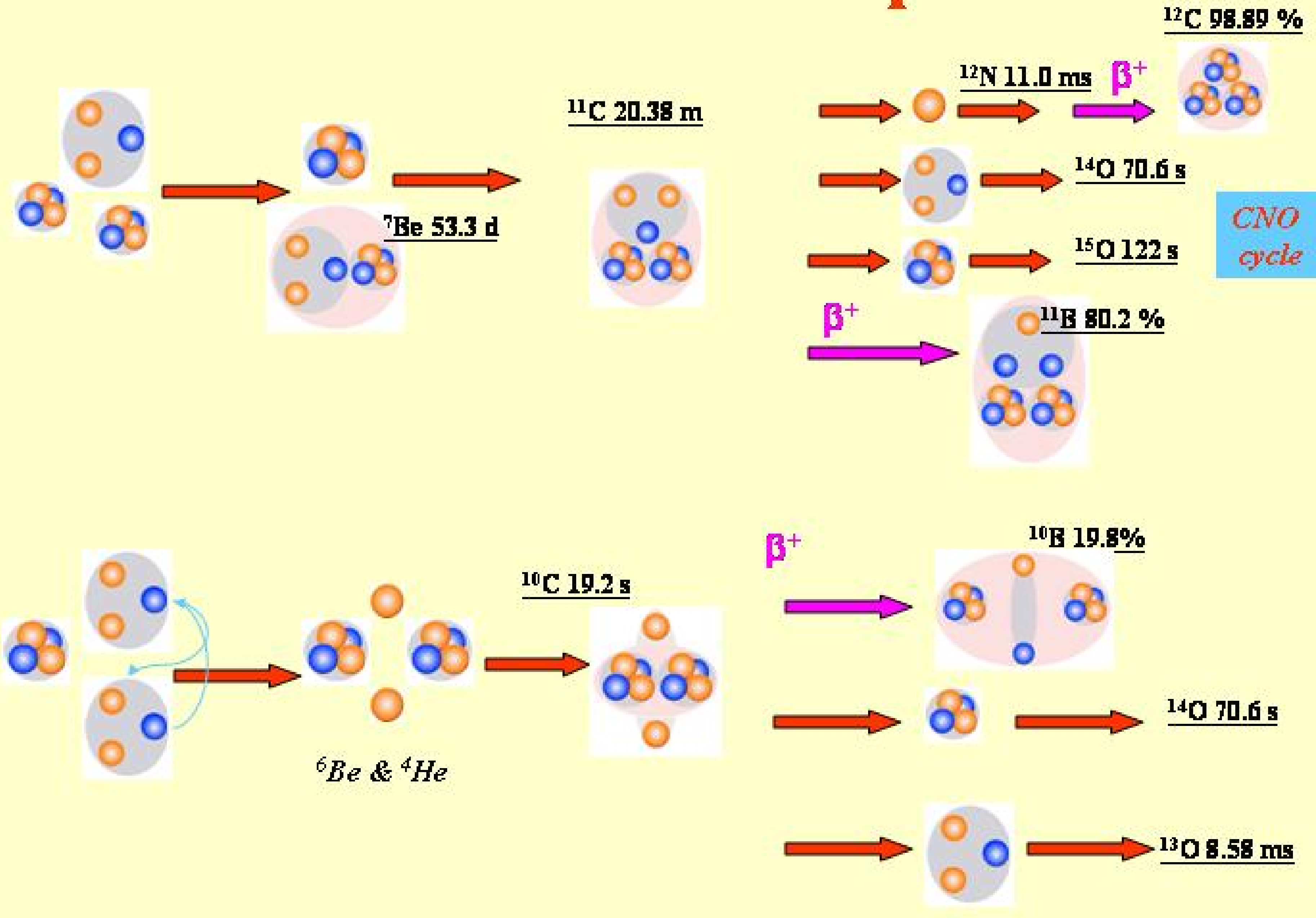
"Ternary ^{3}He Process"

2 A GeV/c Carbon beam of a magnetic rigidity Z/A = 6/9 ($^{12}C \rightarrow {}^9C$) was provided for emulsions to determine the probabilities

$^9C \rightarrow {}^8Bp$ (1), ^7Bepp (2), HeHepp (7), HeHHpp (5), HeHeHe (3).



“3He Process: mixed isotope fusion”

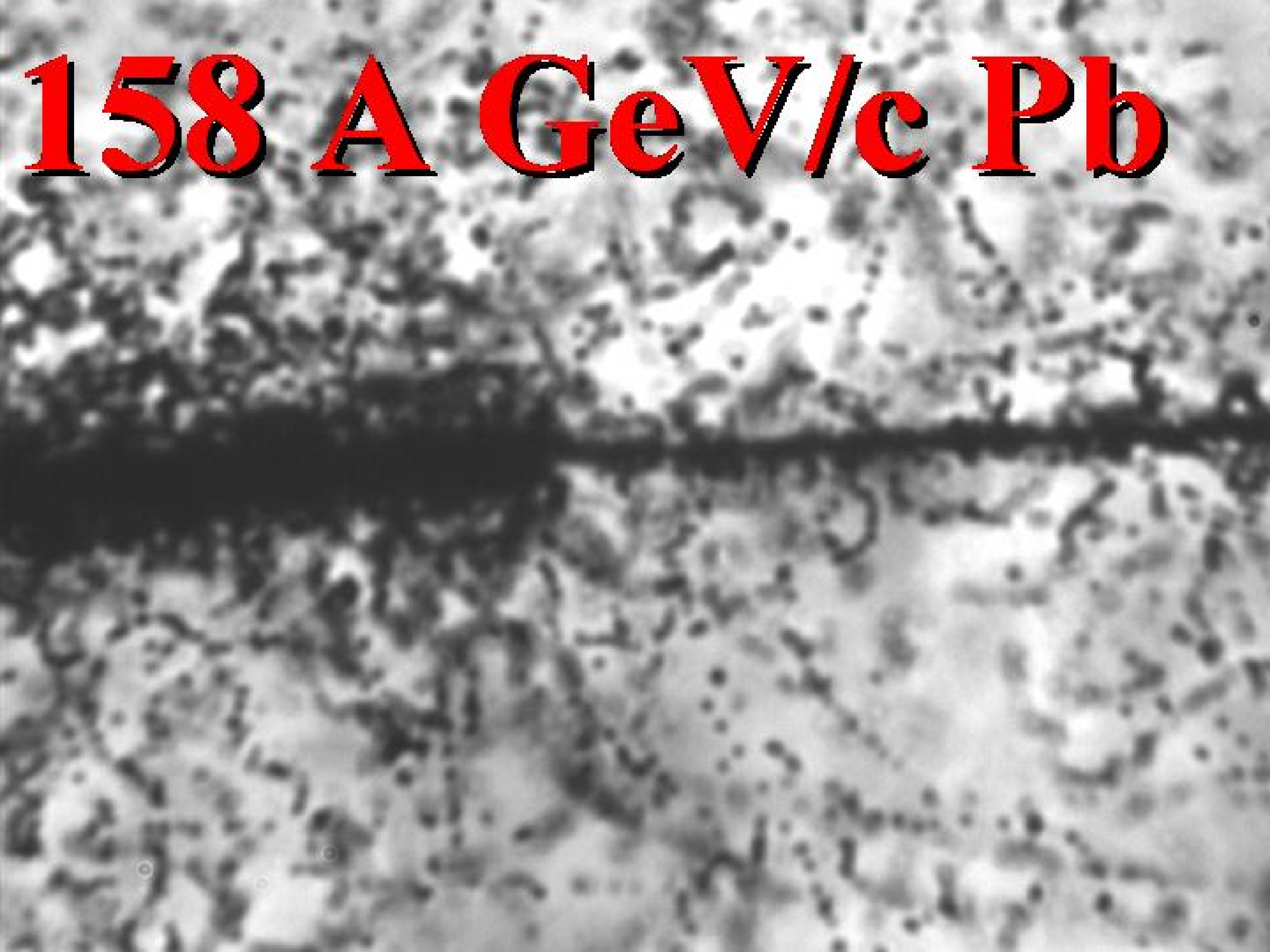


Fragmentation of relativistic nuclei provides an excellent quantum "laboratory" to explore the transition of nuclei from the ground state to a gas-like phase composed of nucleons and few-nucleon clusters having no excited states, i. e. d, t, ^{3}He, and α.

The research challenge is to find indications for the formation of quasi-stable systems significantly exceeding the sizes of the fragments.

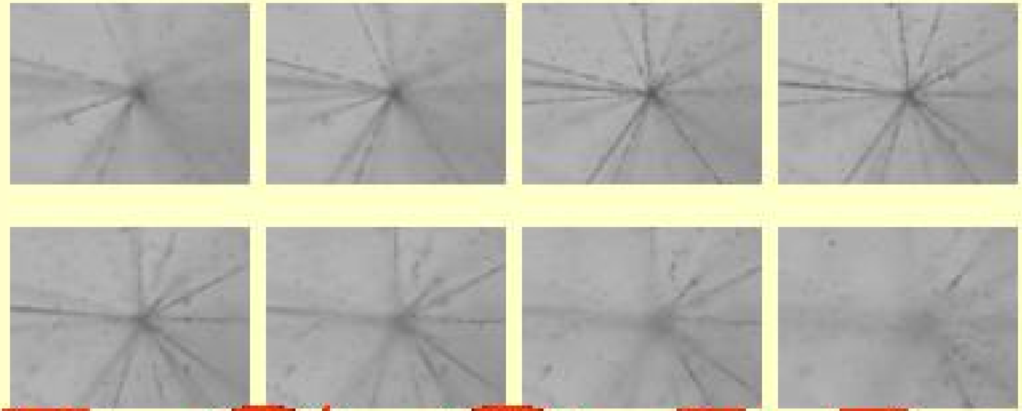
Search for such states is of interest since they can play a role of intermediate states for a stellar nuclear fusion due to dramatically reduced Coulomb repulsion.

The fragmentation features might assist one to disclose the scenarios of few-body fusions as processes inverse to fragmentation.


158 A GeV/c Pb

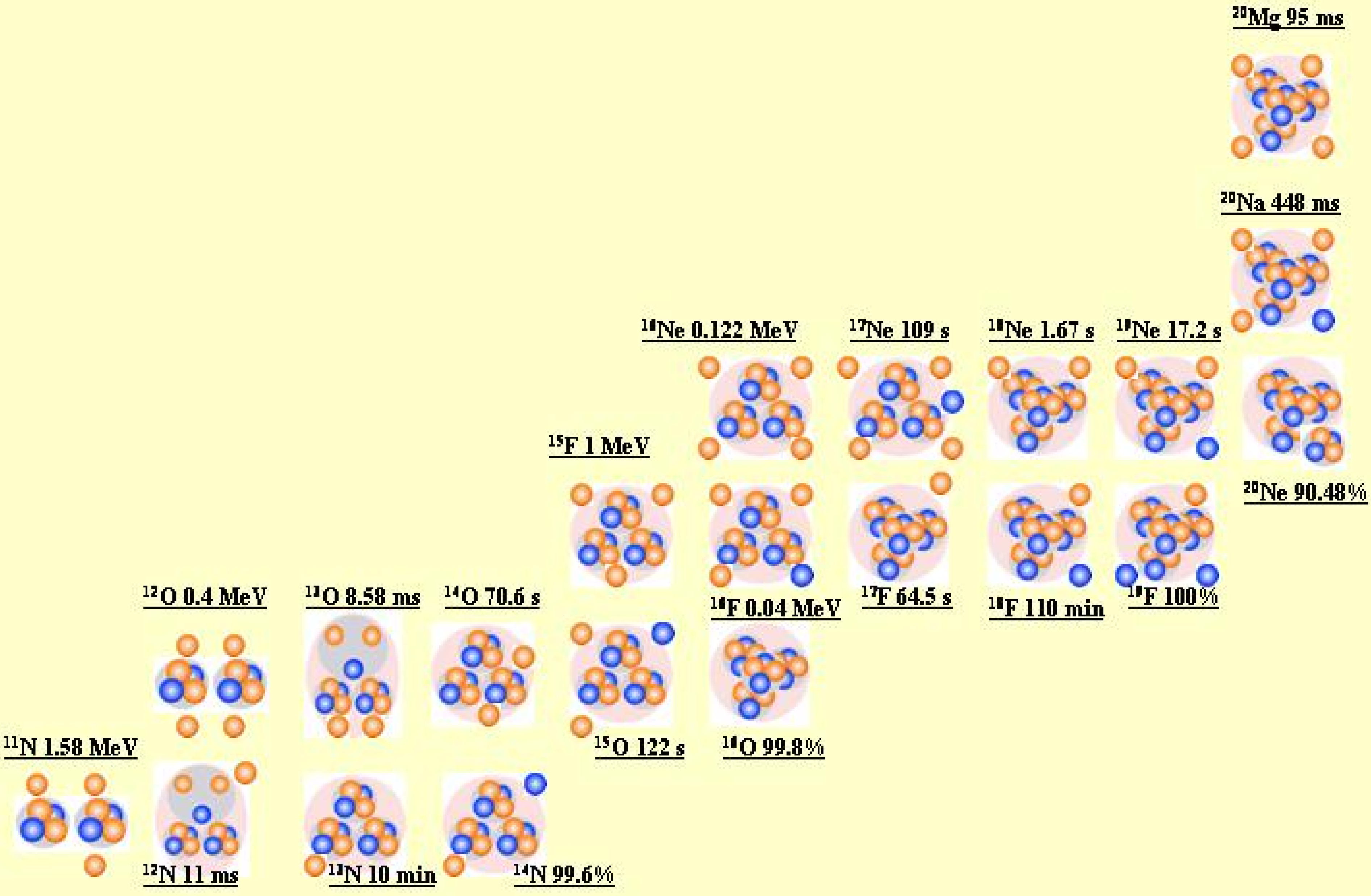
Fission Fragments in Films

Relativistic Nuclei in Emulsion

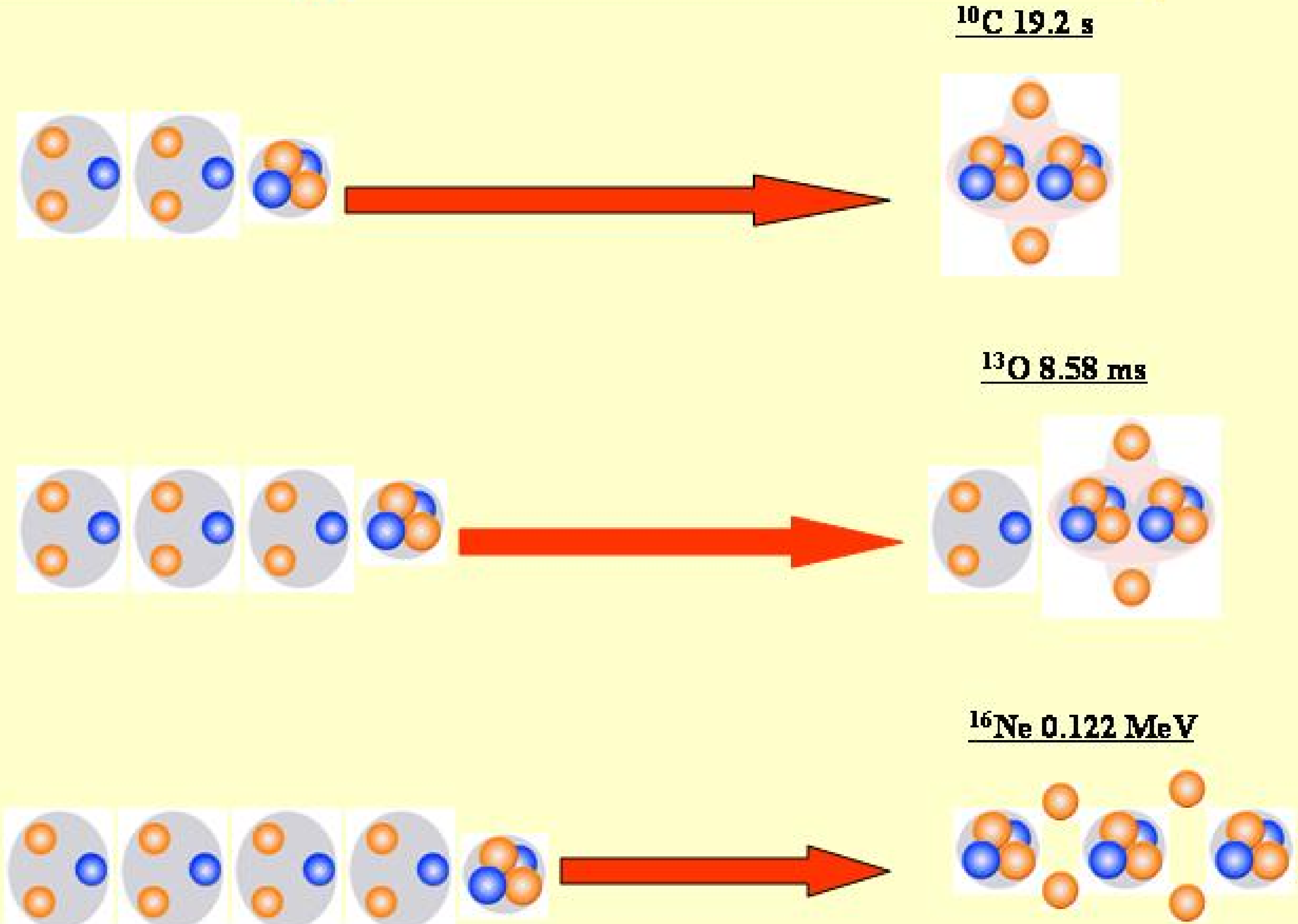


P A V I C O M

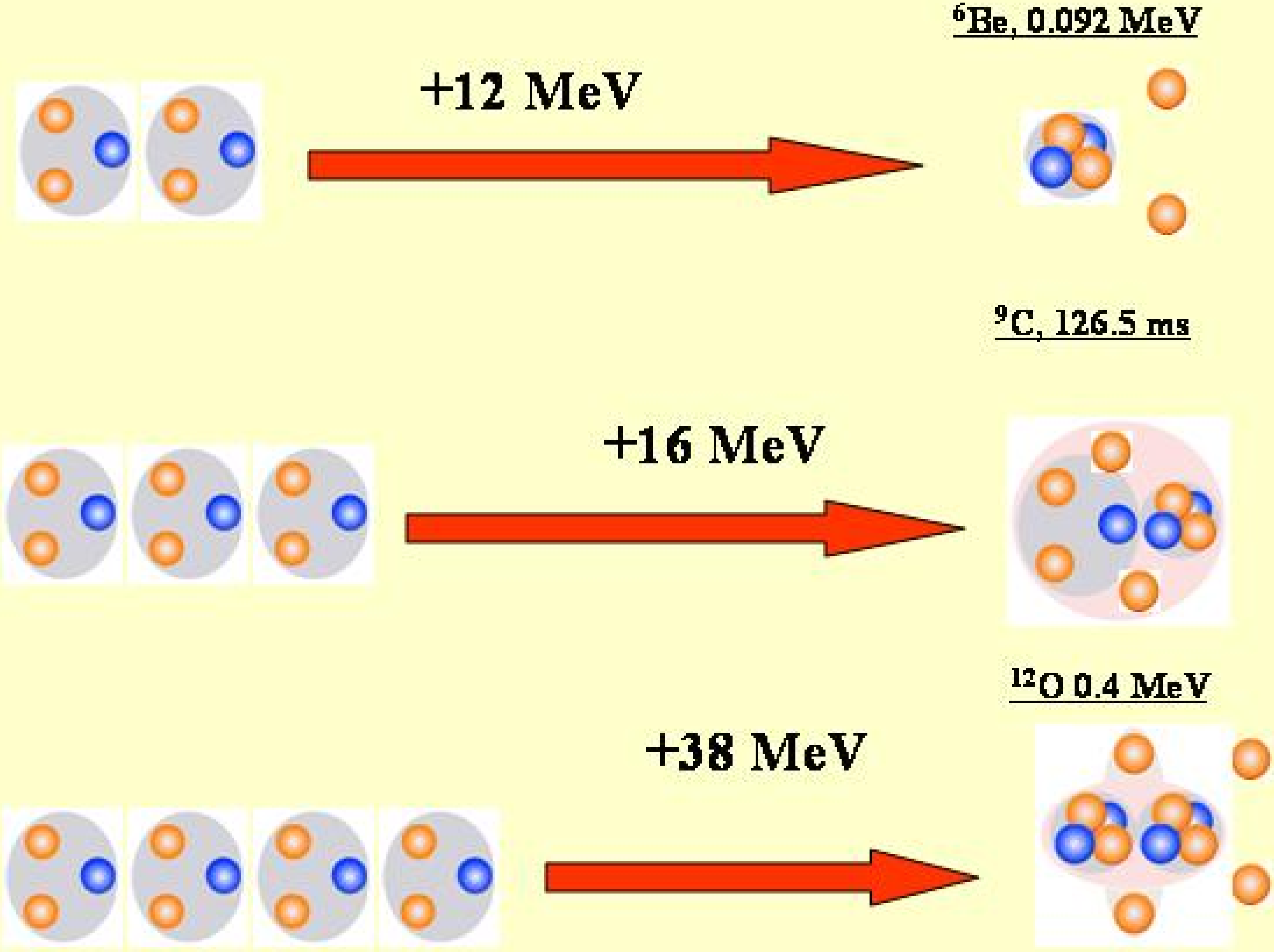
Walking along proton stability line



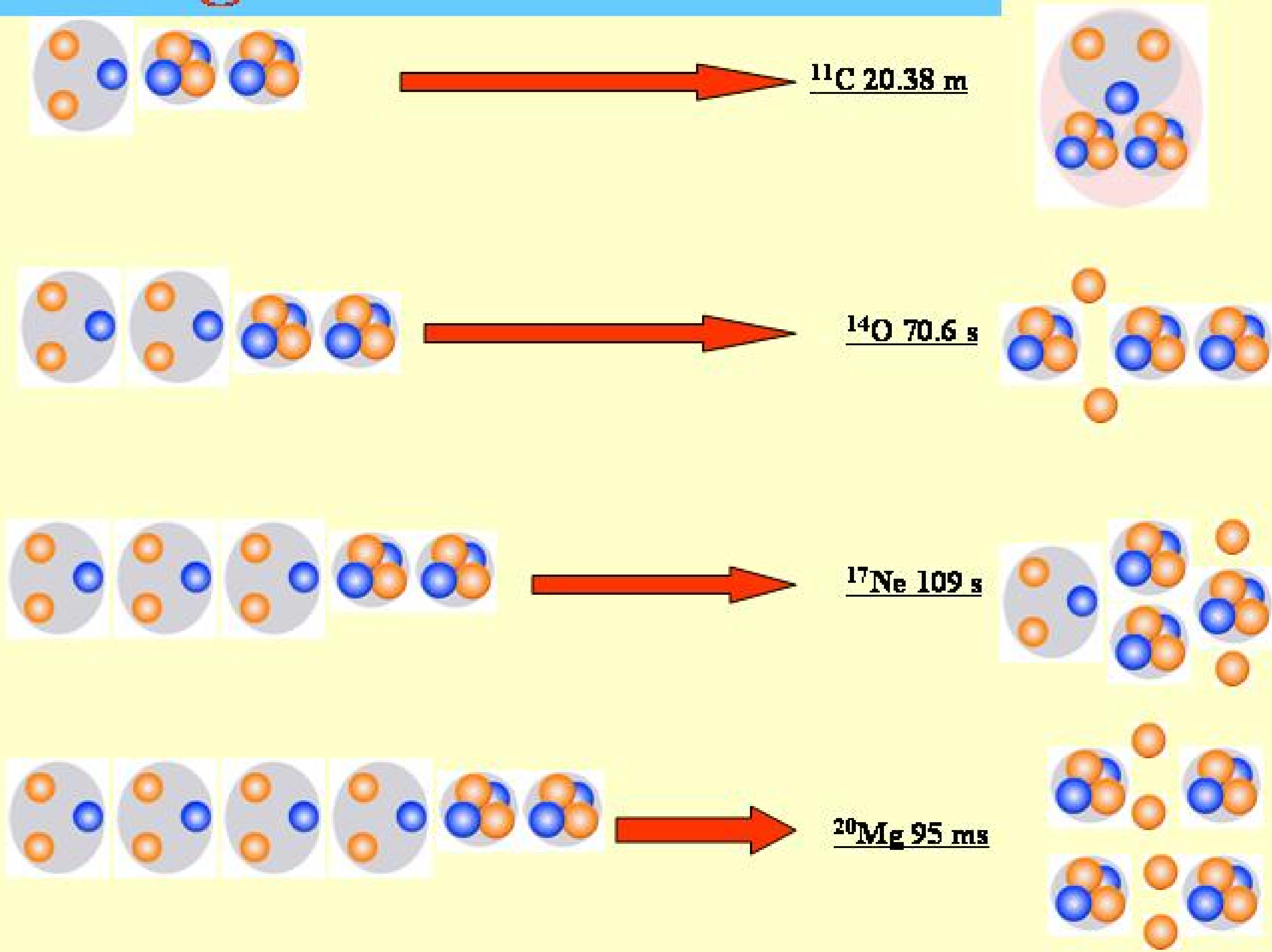
Multifragmentation in H&He



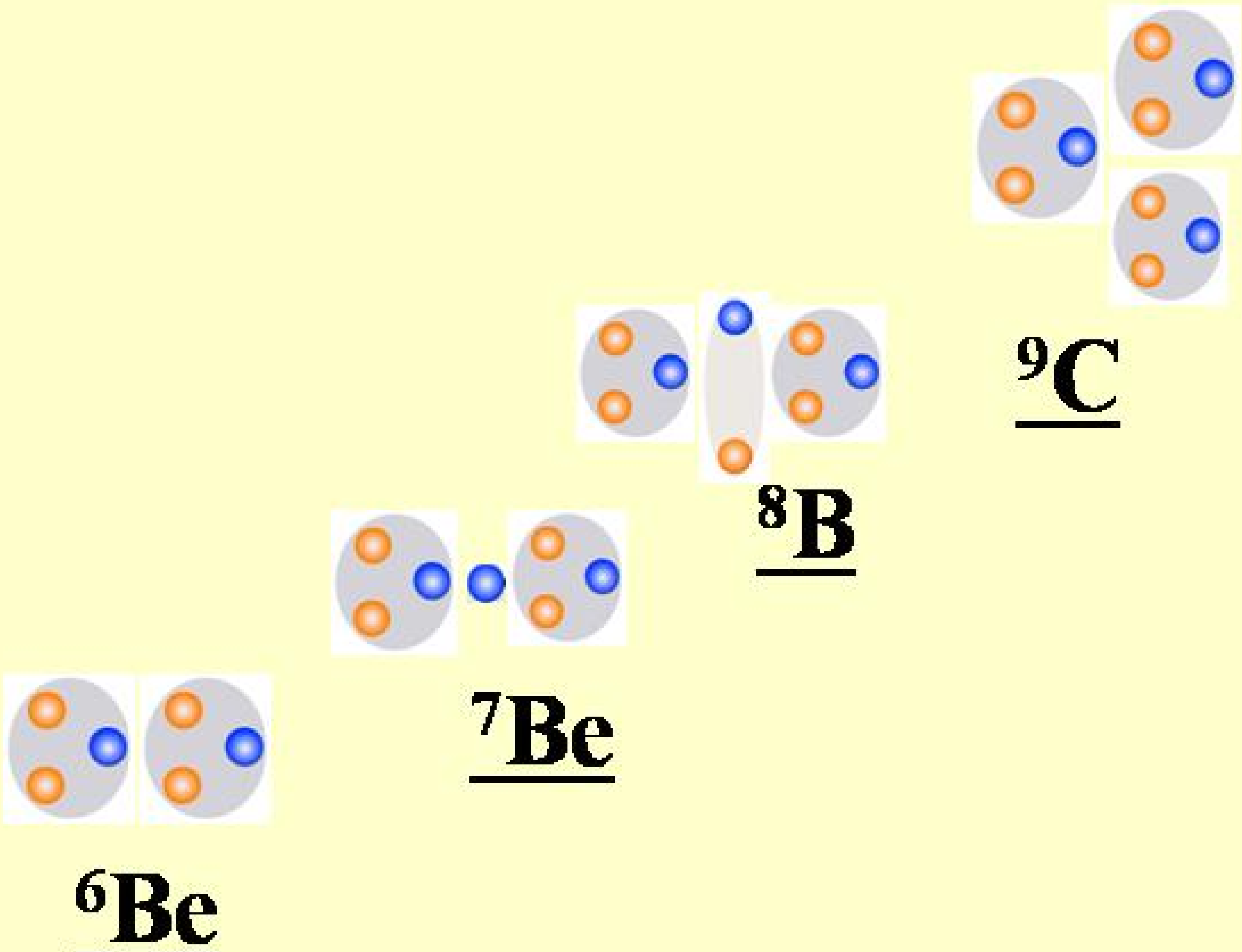
Multifragmentation in H&He

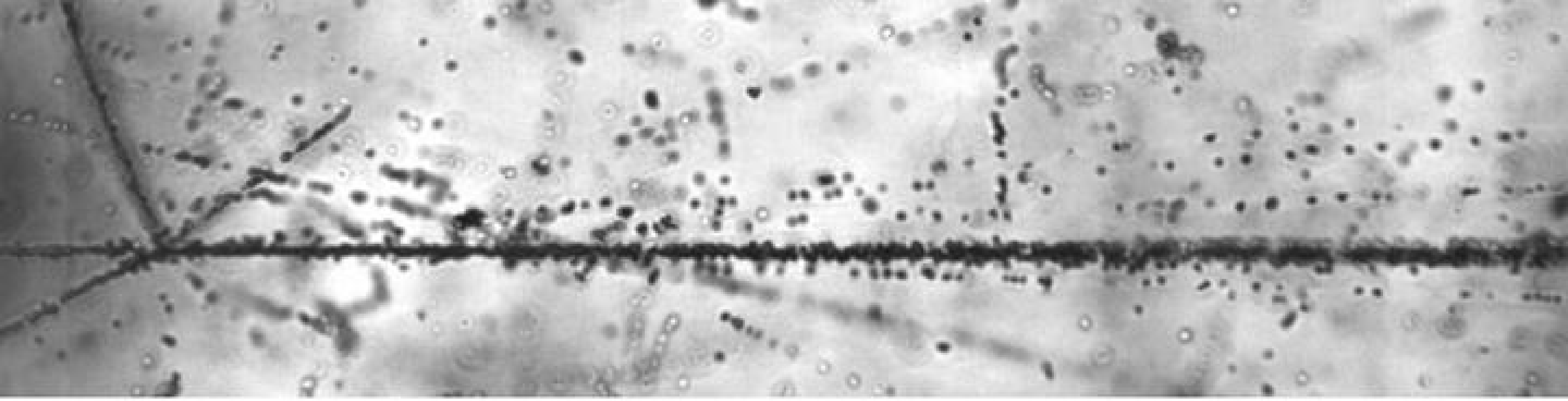


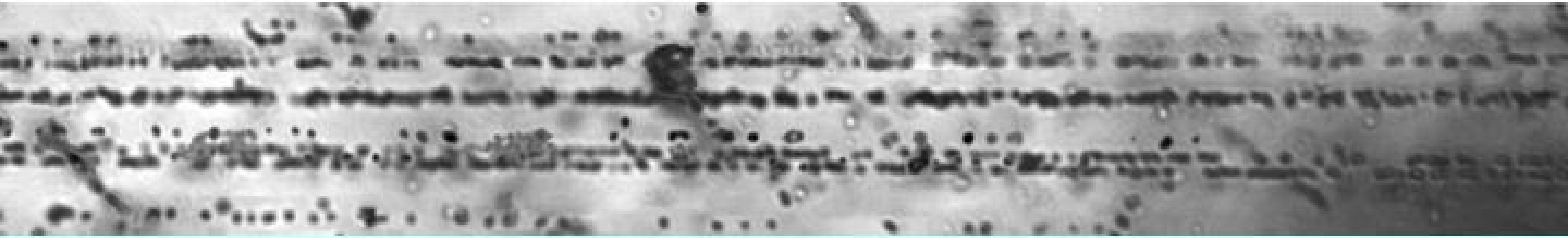
Multifragmentation in H&He



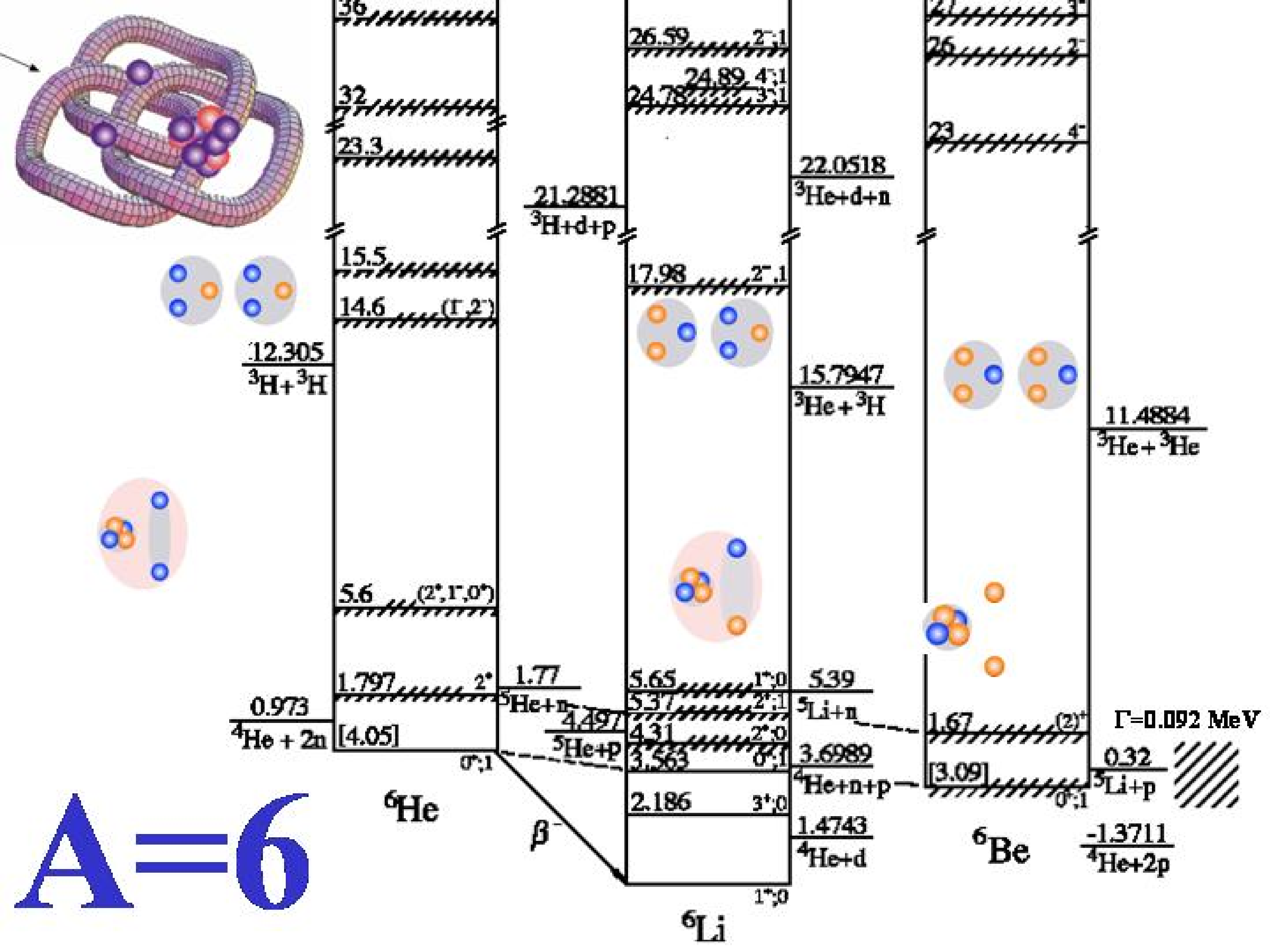
Pure ^{3}He Nucleus Clustering in Light Nuclei ?





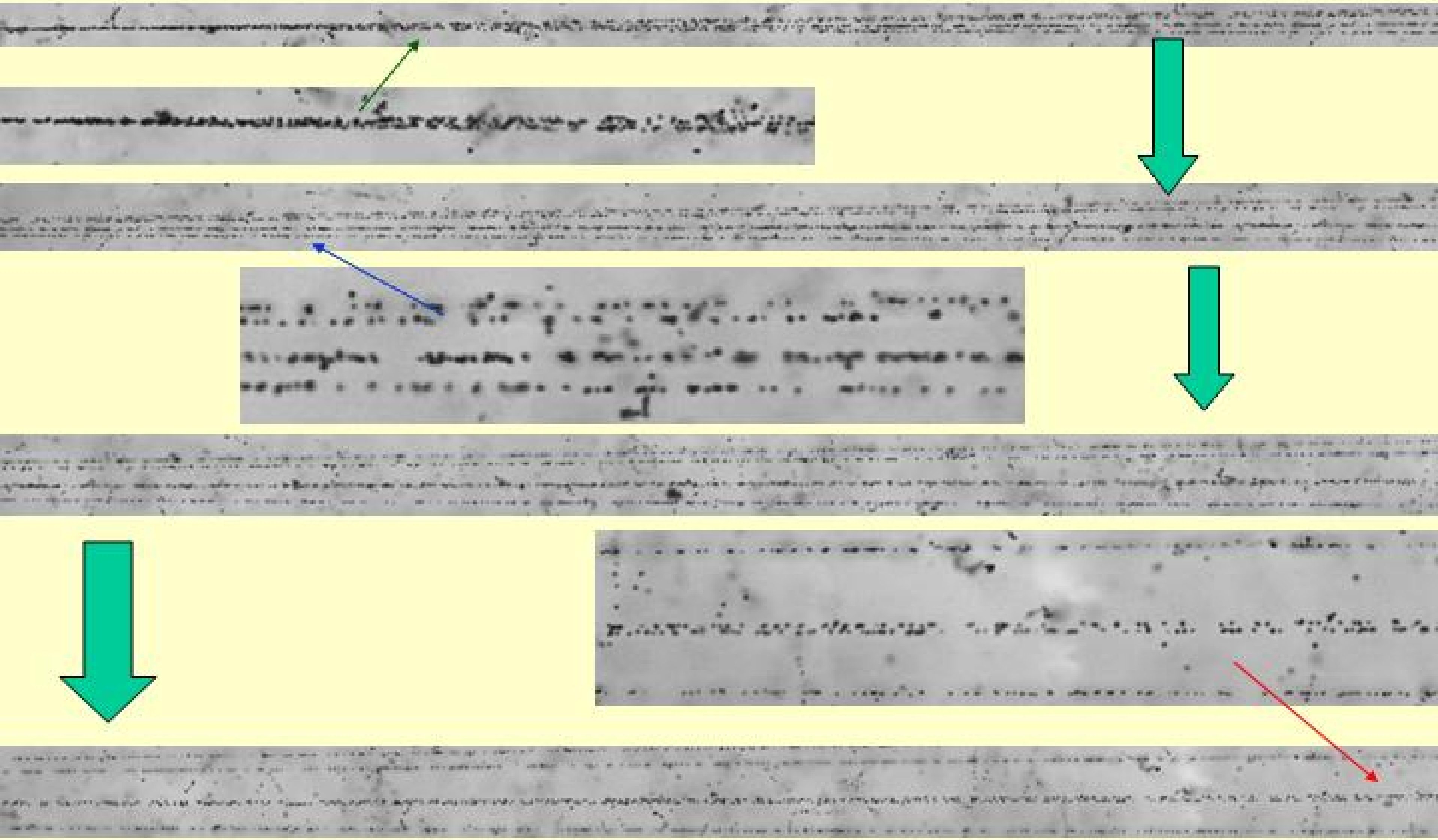


Fragmentation of a ^{28}Si of the energy of 3.65A GeV in on an emulsion nucleus. On the upper photograph one can see the interaction vertex and the jet of fragments in a narrow cone along four accompanying single-charged particles in a wide cone and three fragments of the target-nucleus. Moving toward the fragment jet direction (upper photograph) it is possible to distinguish 3 Z=1 fragments and 5 Z=2 fragments. An intensive track on the upper photograph (the third one from above) is identified as a very narrow pair of Z=2 fragments corresponding to the ^{8}Be decay. A three-dimensional image of the event was reconstructed as a plane projection by means of an automated microscope (Lebedev Institute of Physics, Moscow) of the PAVIKOM complex.

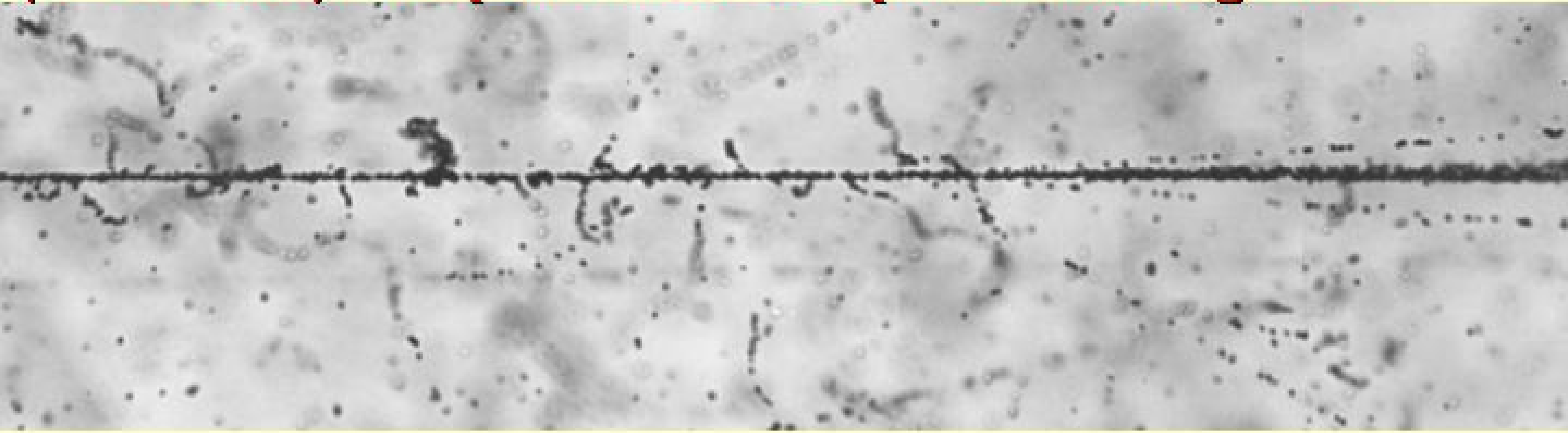


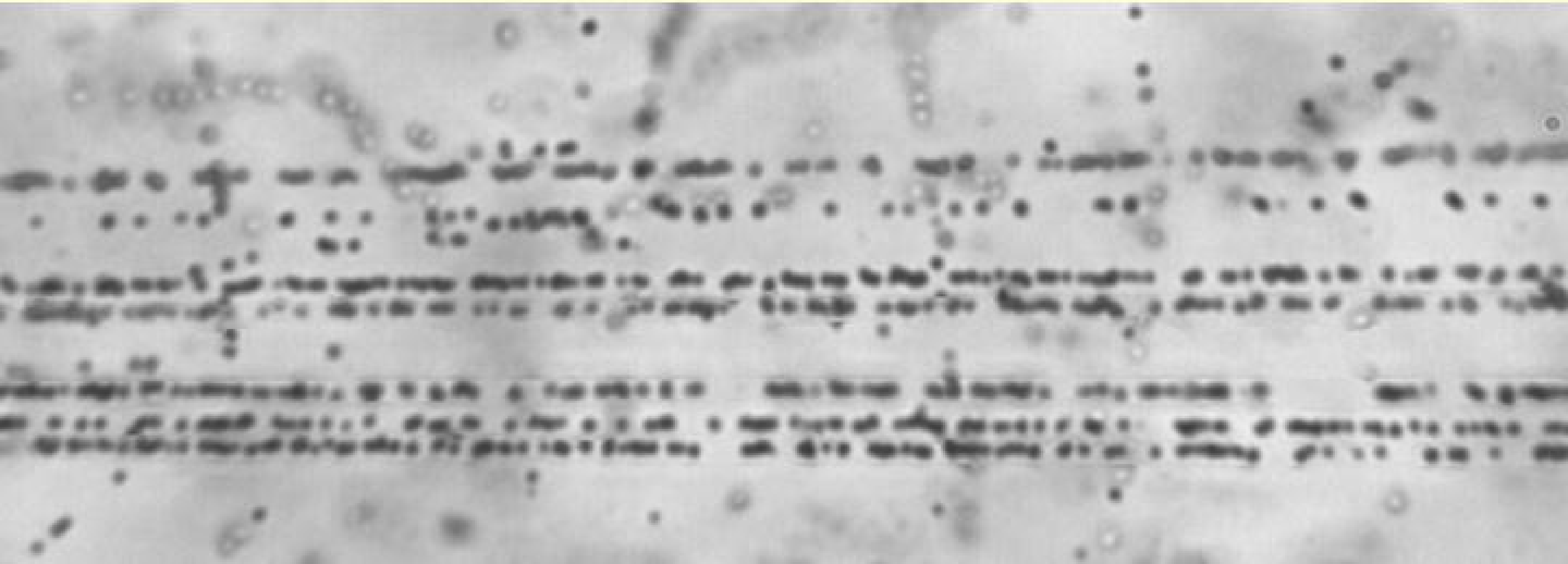
A=6
36
32
23.3
15.5
14.6
(1⁻,2⁻)
5.6
(2⁺,1⁻,0⁺)
1.797
2⁺
[4.05]
0⁺;1
12.305
$^3H+^3H$
0.973
$^4He + 2n$
^6He
21.2881
$^3H+d+p$
1.77
^5He+n
4.497
^5He+p
β⁻
26.59
2⁻;1
24.89
4⁻;1
24.78
3⁻;1
17.98
2⁻;1
5.65
1⁺;0
5.37
2⁺;1
4.31
2⁺;0
3.563
0⁺;1
2.186
3⁺;0
1⁺;0
^6Li
22.0518
$^3He+d+n$
15.7947
$^3He+^3H$
5.39
^5Li+n
3.6989
$^4He+n+p$
1.4743
^4He+d
27
3⁻
26
2⁻
23
4⁻
1.67
(2)⁺
[3.09]
0⁺;1
^6Be
11.4884
$^3He+^3He$
Γ=0.092 MeV
0.32
^5Li+p
-1.3711
$^4He+2p$

3.65A GeV ^{20}Ne Dissociation into charge state 2+2+2+2+2 with ^{8}Be pair

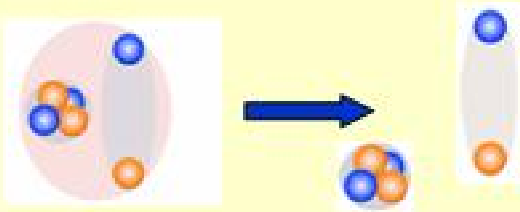


4.5A GeV/c ^{28}Si Dissociation into charge state 2+2+2+2+2+2+1 (narrow cone) with pair of ^{8}Be and triple ^{12}C* like fragments





4.5A GeV/c ^{6}Li



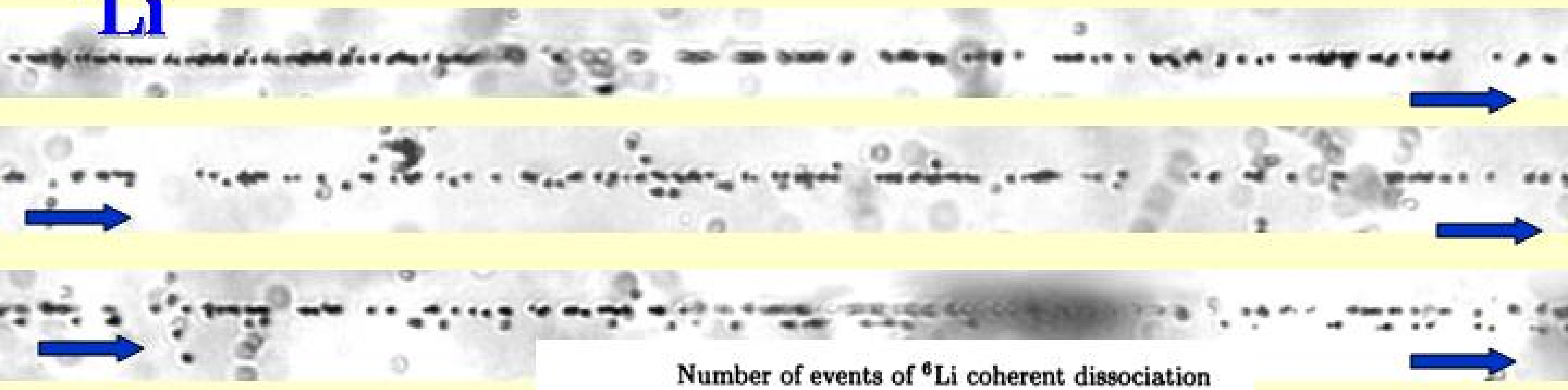
Physics of Atomic Nuclei, Vol. 62, No. 8, 1999, pp. 1378–1387. Translated from Yadernaya Fizika, Vol. 62, No. 8, 1999, pp. 1461–1471.

ELEMENTARY PARTICLES AND FIELDS
Experiment

Interactions of Relativistic ^{6}Li Nuclei with Photoemulsion Nuclei

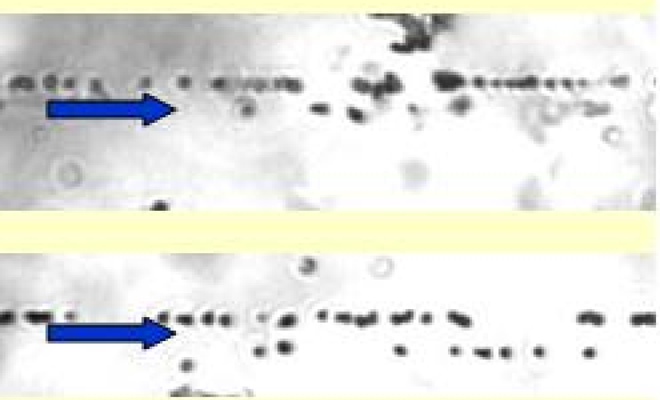
M. I. Adamovich, V. G. Bogdanov[1)], I. A. Konorov, V. G. Larionova, N. G. Peresadko, V. A. Plyushchev[1)], Z. I. Solovyeva[1)†], and S. P. Kharlamov

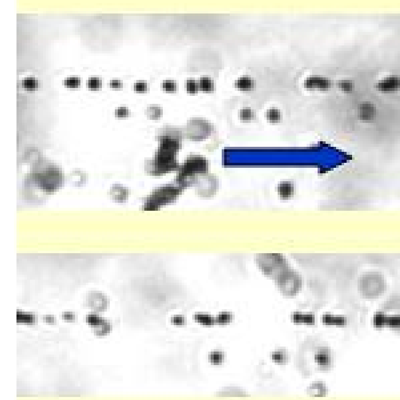
^{6}Li



Number of events of ^{6}Li coherent dissociation

Dissociation channel	Number of events	
	without the excitation of the target nucleus ($N_h = 0$)	with the excitation of the target nucleus ($N_h \neq 0$)
^{4}He + d	23	24
^{3}He + t	4	1
$t + d + p$	4	3
$d + d + d$	0	2





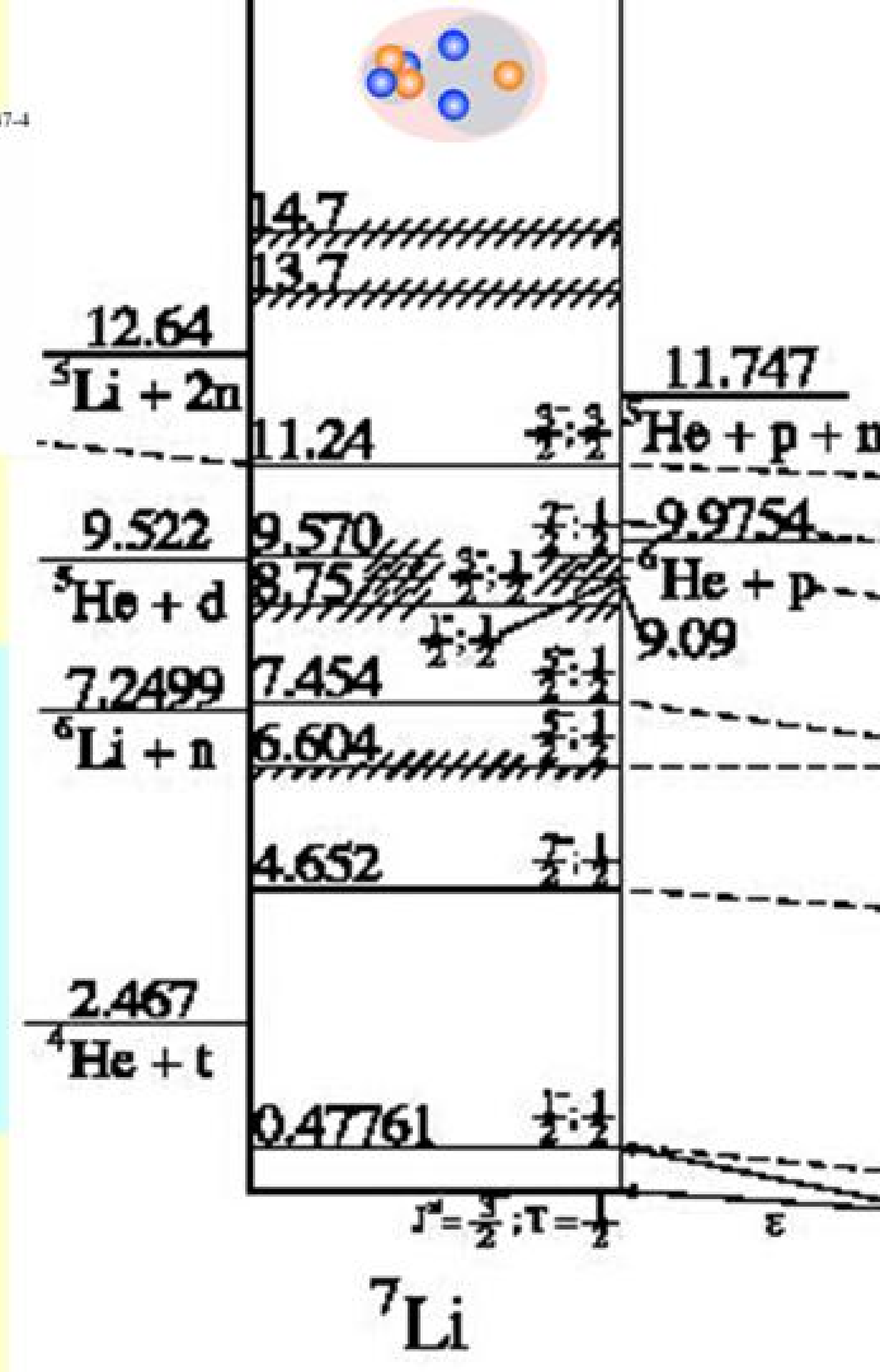
J. Phys. G: Nucl. Part. Phys. 30 (2004) 1479–1485 PII: S0954-3899(04)79647-4

Dissociation of relativistic ^{7}Li in photoemulsion and structure of ^{7}Li nucleus

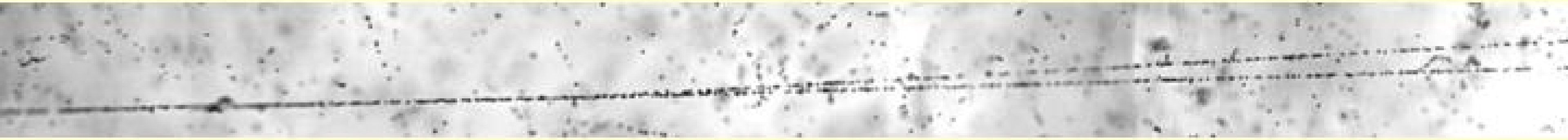
M I Adamovich[1], Yu A Alexandrov, S G Gerassimov, V A Dronov, V G Larionova, N G Peresadko and S P Kharlamov

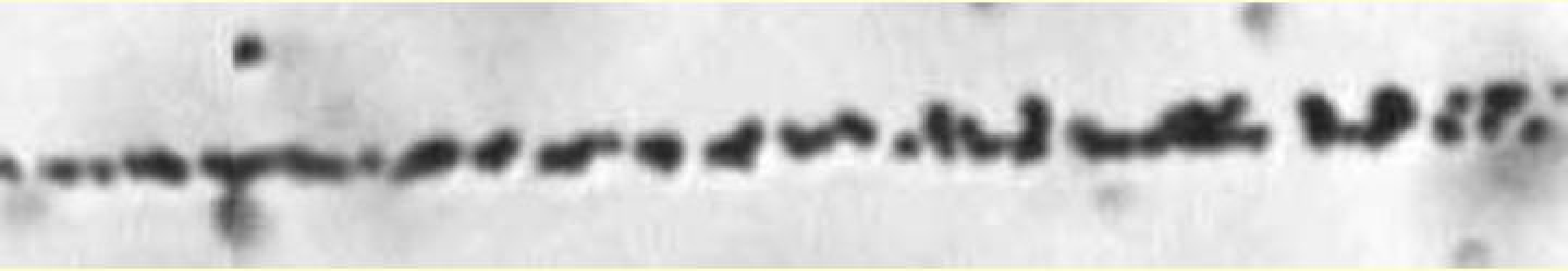
^{7}Li. About 7% of all inelastic interactions of ^{7}Li nuclei are "white" stars (80 events).

Decay of ^{7}Li nucleus to α-particle and triton - 40 events.



Relativistic ^{7}Be fragmentation: 2+2





The $^{7}Be^{*} \to \alpha {}^{3}He$ decay is occured in 22 “white stars” with 2+2 topology. In the latter, 5 “white” stars are identified as the $^{7}Be^{*} \to (n)\ {}^{3}He {}^{3}He$ decay. Thus, a ^{3}He clustering is clearly demonstrated in dissociation of the ^{7}Be nucleus.