

Inhabited Europe

How plasma torch of the meteorite impact could have promoted arising of extraterrestrial form of the living matter

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- The life on the Earth arose when first forms of living matter could replicate itself and pass this property to future generations.
- Long term investigations show the necessity of following conditions :
 - the a biotic synthesis of homochiralic polymeric macromolecular structures,
 - realization of pre biotic selection of molecules with have ability of self assembling and ordering,
 - breaking of mirror symmetry for this molecules in processes of monomers creation.
- It has been shown that creation of the living matter based on statistical sampling with replacement of monomers is impossible. (F. Frank 1953, M. Eigen 1970, I. Prigojin 1980, V. Goldanskij, V. Avetisov 1986)

The long search for natural phenomena corresponding to these conditions was unsuccessful.

But in this period in the laboratory the real possibility to synthesize key monomers forming different biopolymers has been shown; (F. Weller 1828, J. Leb 1906, A. Oparin 1924, S. Miller, H. Urey 1953, S. Fox 1977.)

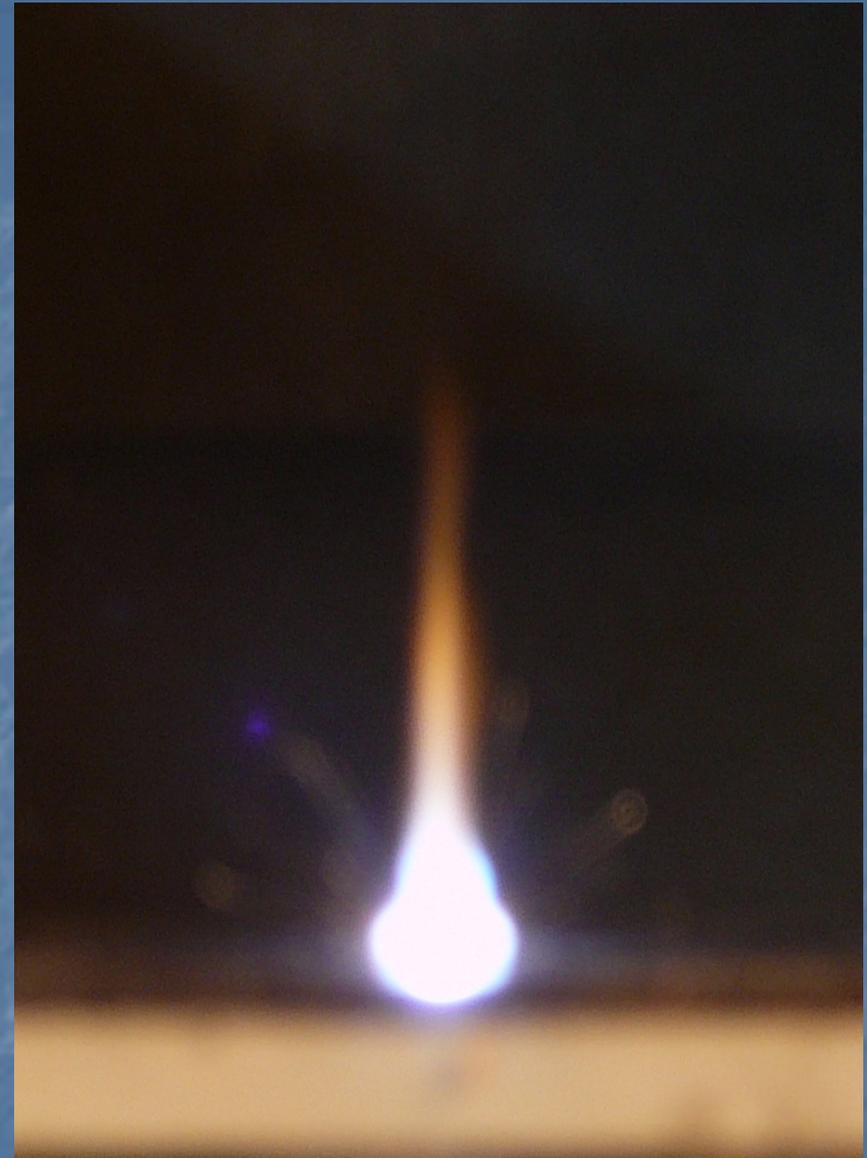
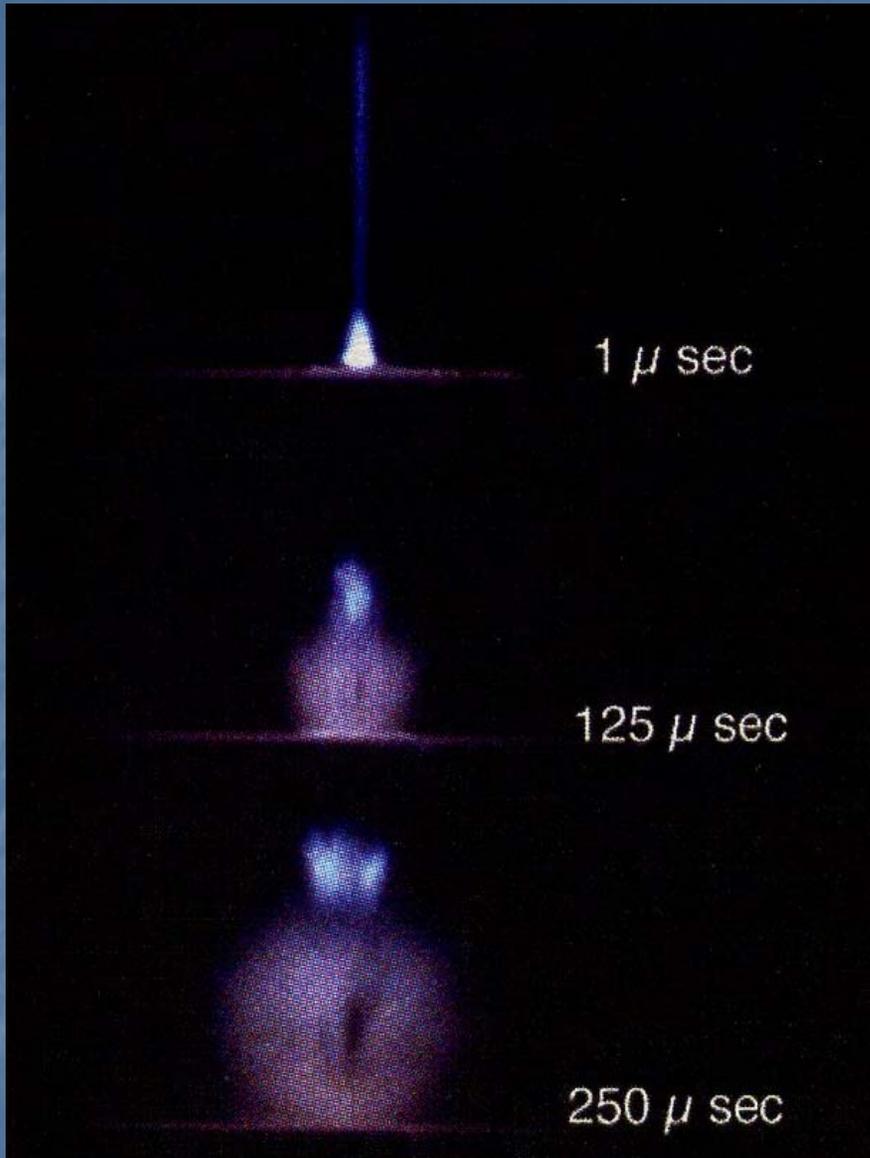
The system approach has been used according to which the abilities of these analogs of natural phenomena were considered jointly with main requirement for origin of life. This approach helped in solving the main problem.

So, the new features of plasma torch generated with the meteorite impact and final conditions of impact crater could meet the main requirements needed for creation of the primary forms of life.

□ If the velocity of meteorite is higher than ~ 20 km/s, it's body and part of the Earth surface form high-temperature, completely ionized and atomized plasma torch and the impact crater.

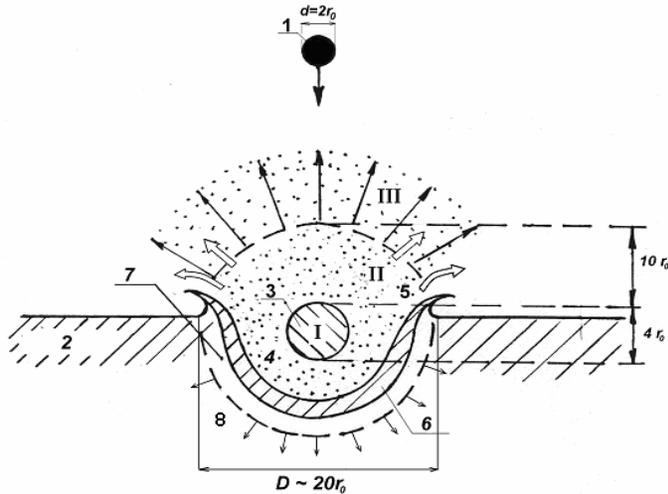


□ This phenomenon is called Super High Velocity Impact (SHVI).



The plasma torches generated under the influence of SHVI (left) and the laser radiation (right) are identical.

During adiabatic expansion, in a mode of «free» fly, the medium of plasma torch has the following unique properties:



- **association** of the elements in a new compounds in plasma-chemical processes;
- insure of **irreversible** character of the reactions with fast remove of an intermediate products from the area of the reactions;
- involving of these products in the subsequent processes leading to their **complication**;
- fast **self-assembly and ordering** of OC due to the processes of plasma catalysis;
- hypothetically, **breaking of mirror symmetry**.

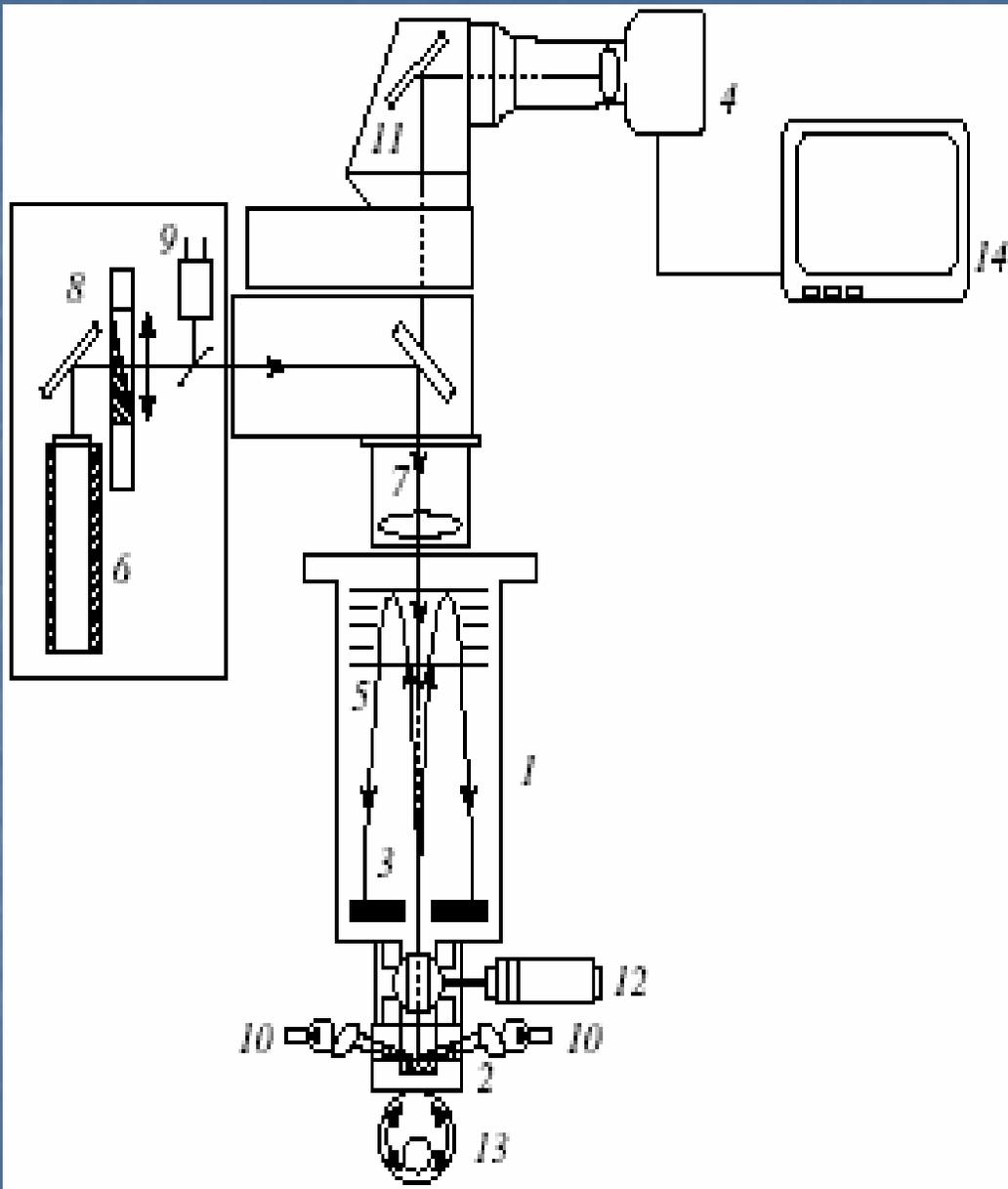
The most important, new properties of SHVI and of plasma torch includes:

- Power density in the impact exceeds solar in $\sim 10^{13}$ - 10^{14} times.
- The initial density of a substance is higher than atmospheric in $\sim 10^6$ times.
- Plasma-chemical reactions go in the torch $\sim 10^9$ times faster than in laboratory condition.
- The temperature of the plasma during «free» expansion decreases quickly from $\sim 10^5$ - 10^6 °K to the temperature of an environment.
- Possibility of **unlimited chances** to form «right» OC
- Possibility of changing the initial conditions in a **huge range**
- Possibility of **injecting** the synthesized OC into a **subsurface aria**.

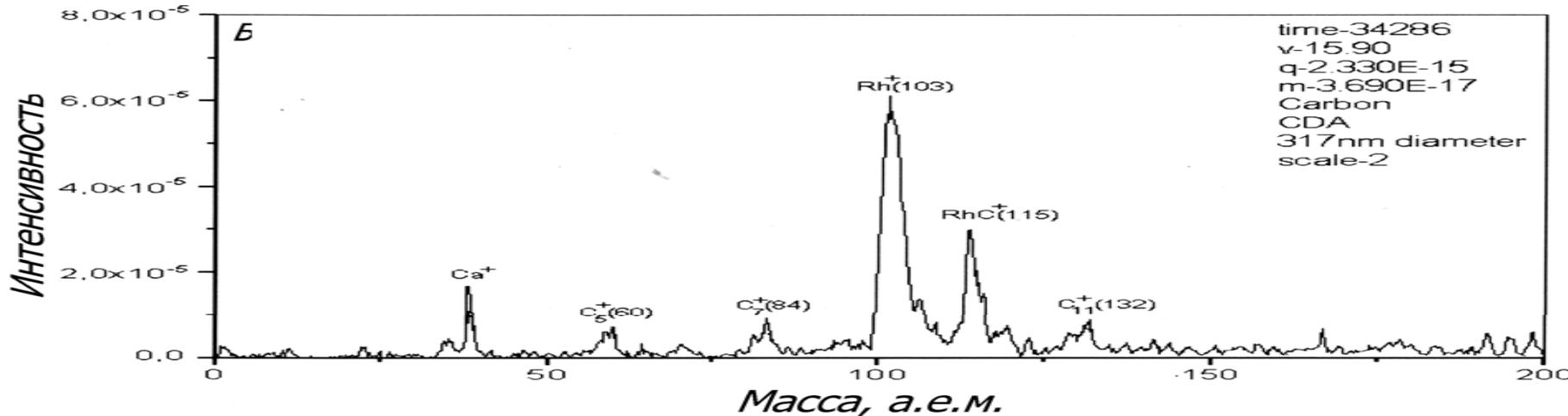
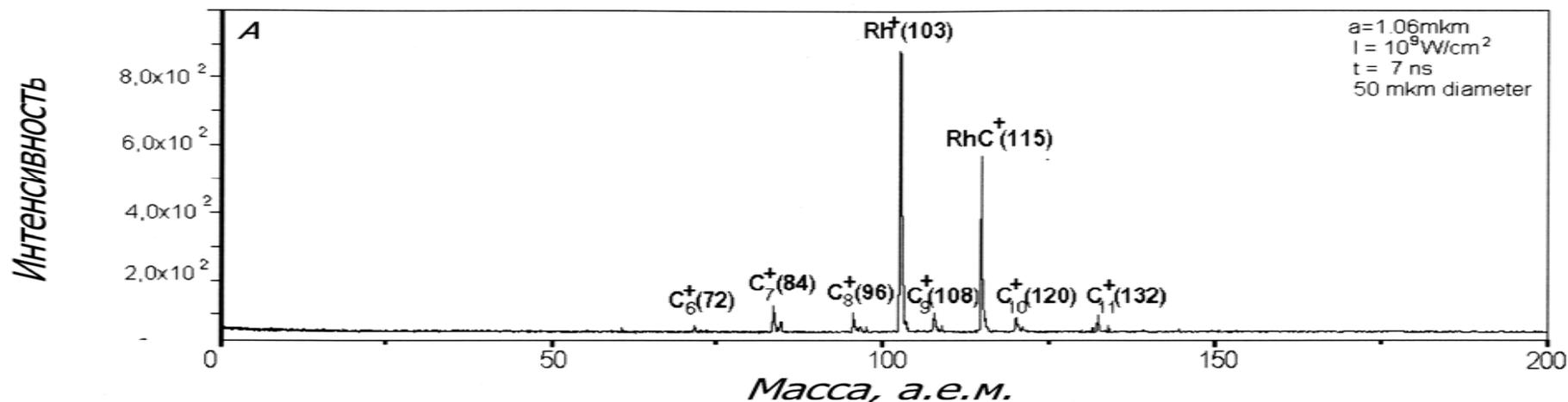
Investigation of SHVI plasma synthesis in the laboratory conditions have serious limitations, but nevertheless it can be realized:

- ❑ in the direct experiments on the dust particle accelerator,
- ❑ in the experiments modeling impact plasma torch by laser influence.

In the second case are modeled only plasma processes, but not the processes of crater formation.

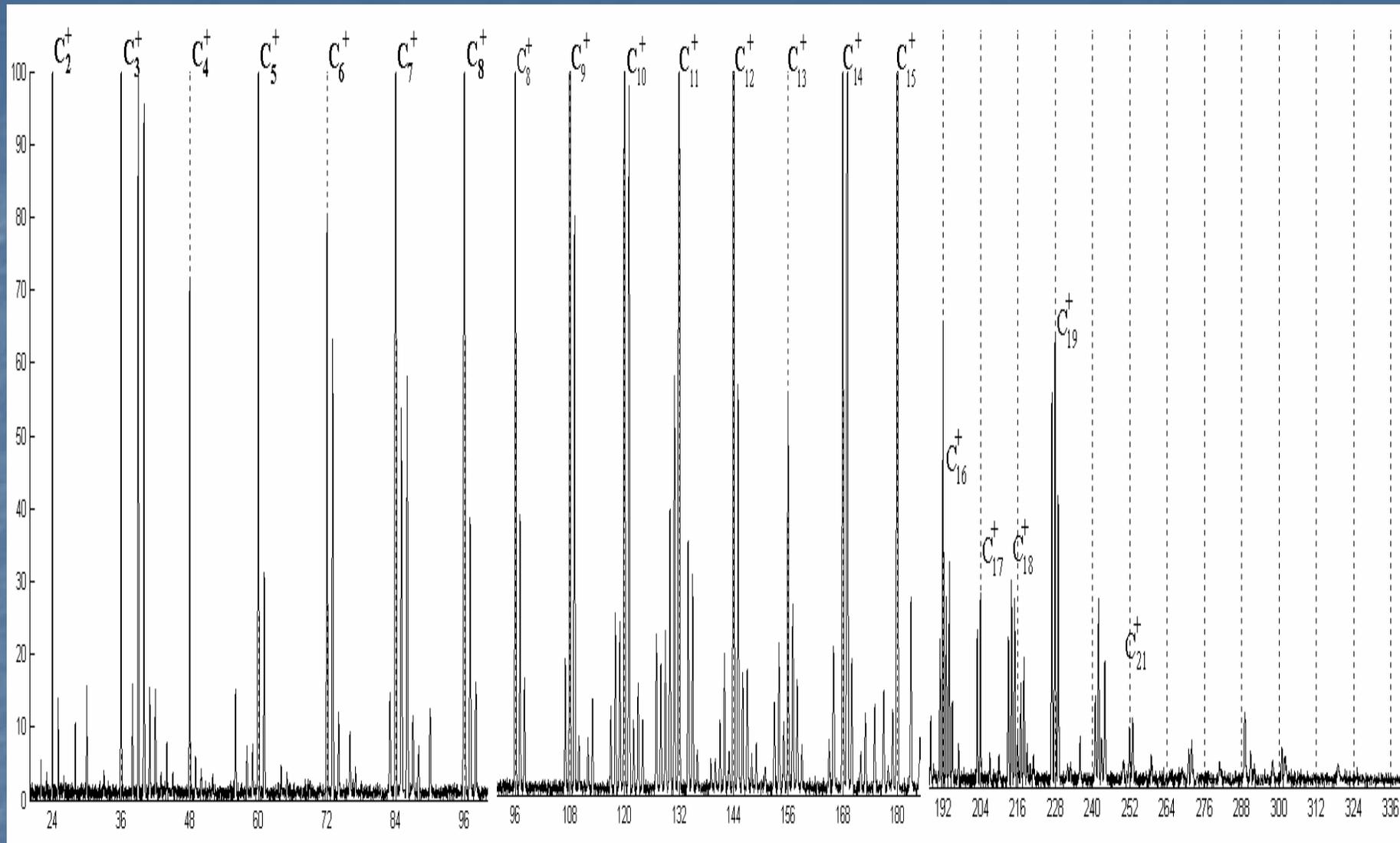


A scheme of the LASMA- TOF laser mass-reflectron:
 1—vacuum chamber,
 2—interchangeable carriage with sample,
 3—detector,
 4—TV camera,
 5—reflector,
 6—laser,
 7—focusing lenses,
 8—neutral filter,
 9—radiation power meter,
 10—target illuminator,
 11—microscope,
 12—motorized vacuum valve,
 13—carriage adjusting system,
 14—monitor.



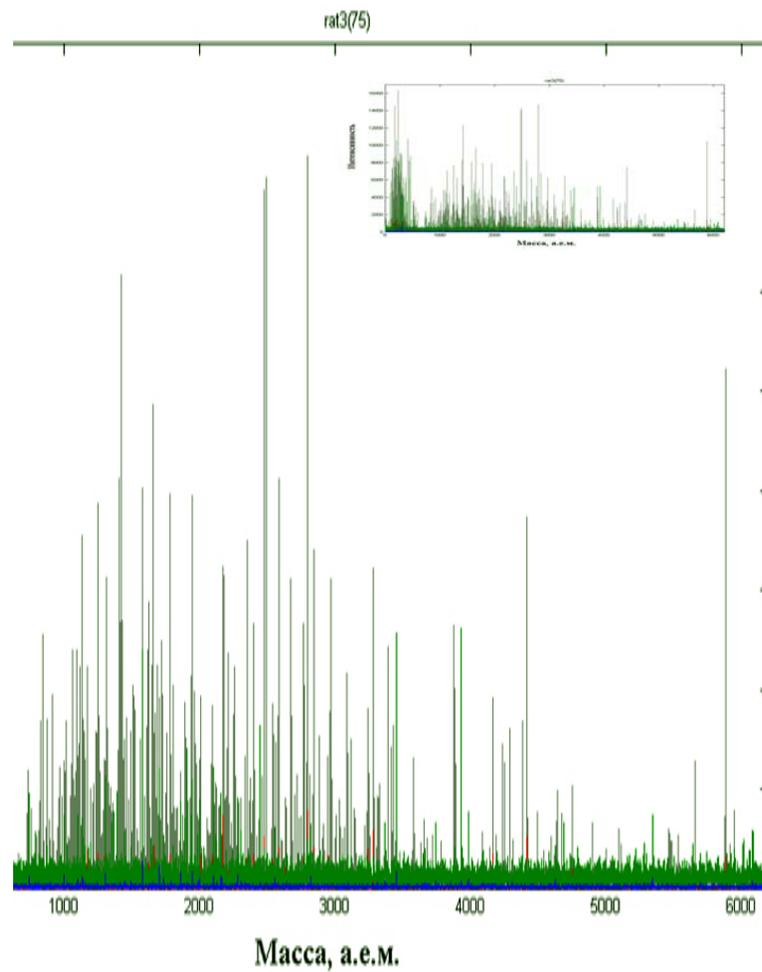
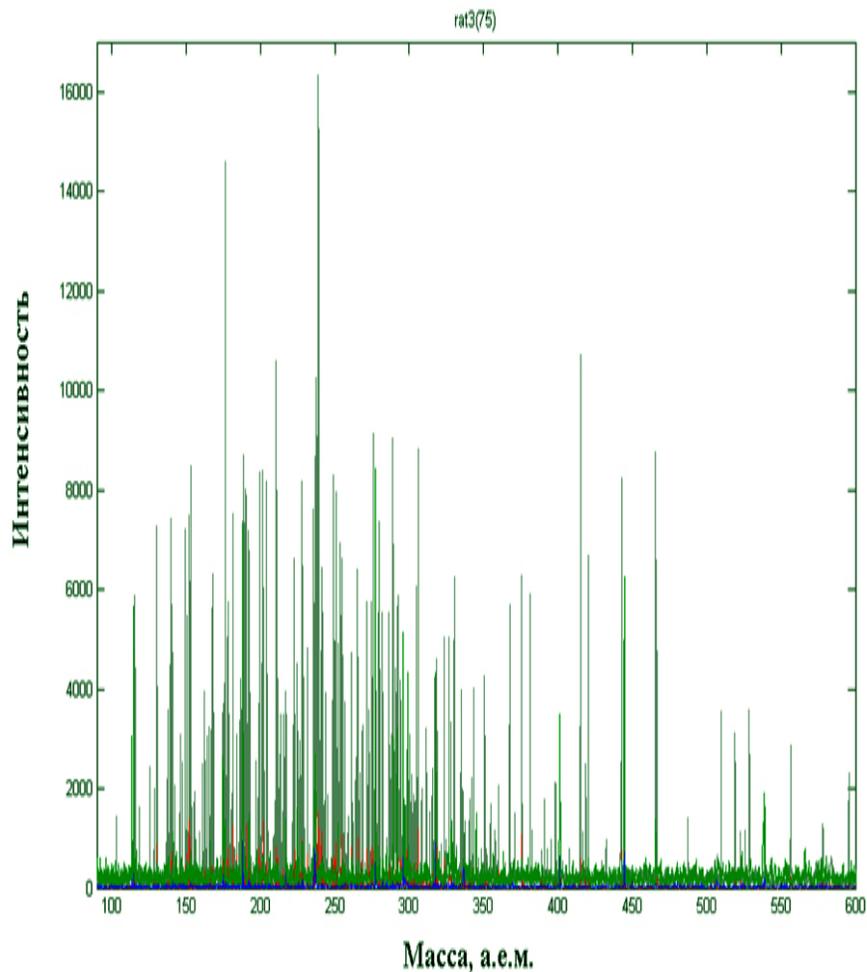
Comparison of mass spectra from laser modeling of SHVI and ones obtained in the dust-impact experiments. Spectra were obtained: (a) under the impact of laser radiation on the target made of the pure C and Rh mechanical mixture (b) in dust-impact experiments using the dust particle accelerator with the impact of carbon particles on the pure Rh target.

This ensured the identity of chemical composition of the initial components.



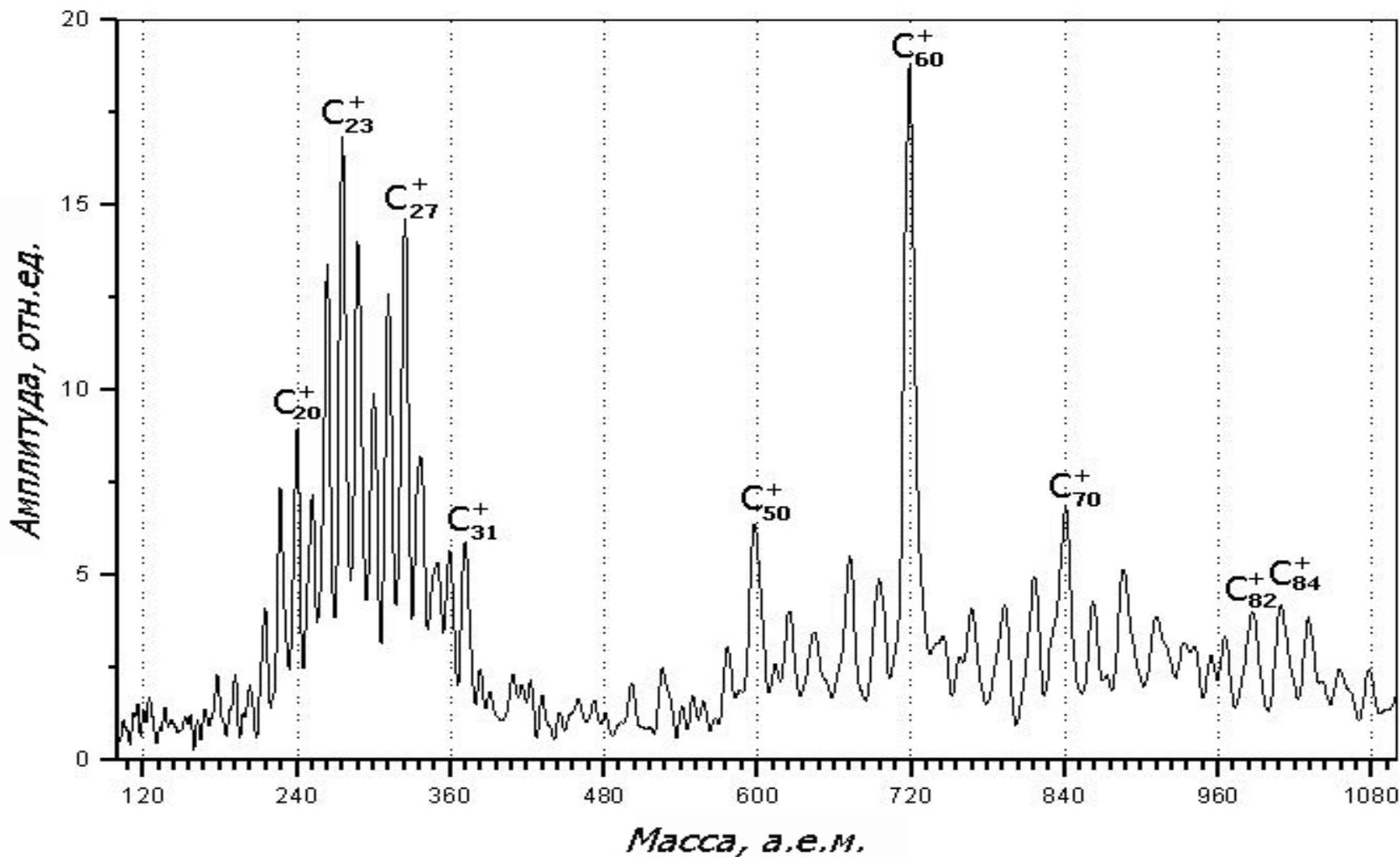
Typical mass spectra of OC synthesized in a laser-generated plasma torch under the action on pure carbon and its mechanical mix of NH_4NO_3 for the spot diameter $\sim 50\text{mkm}$ and pulse duration $\sim 1\text{ns}$.

In similar spectra were identified 11 amino acids and carbines.

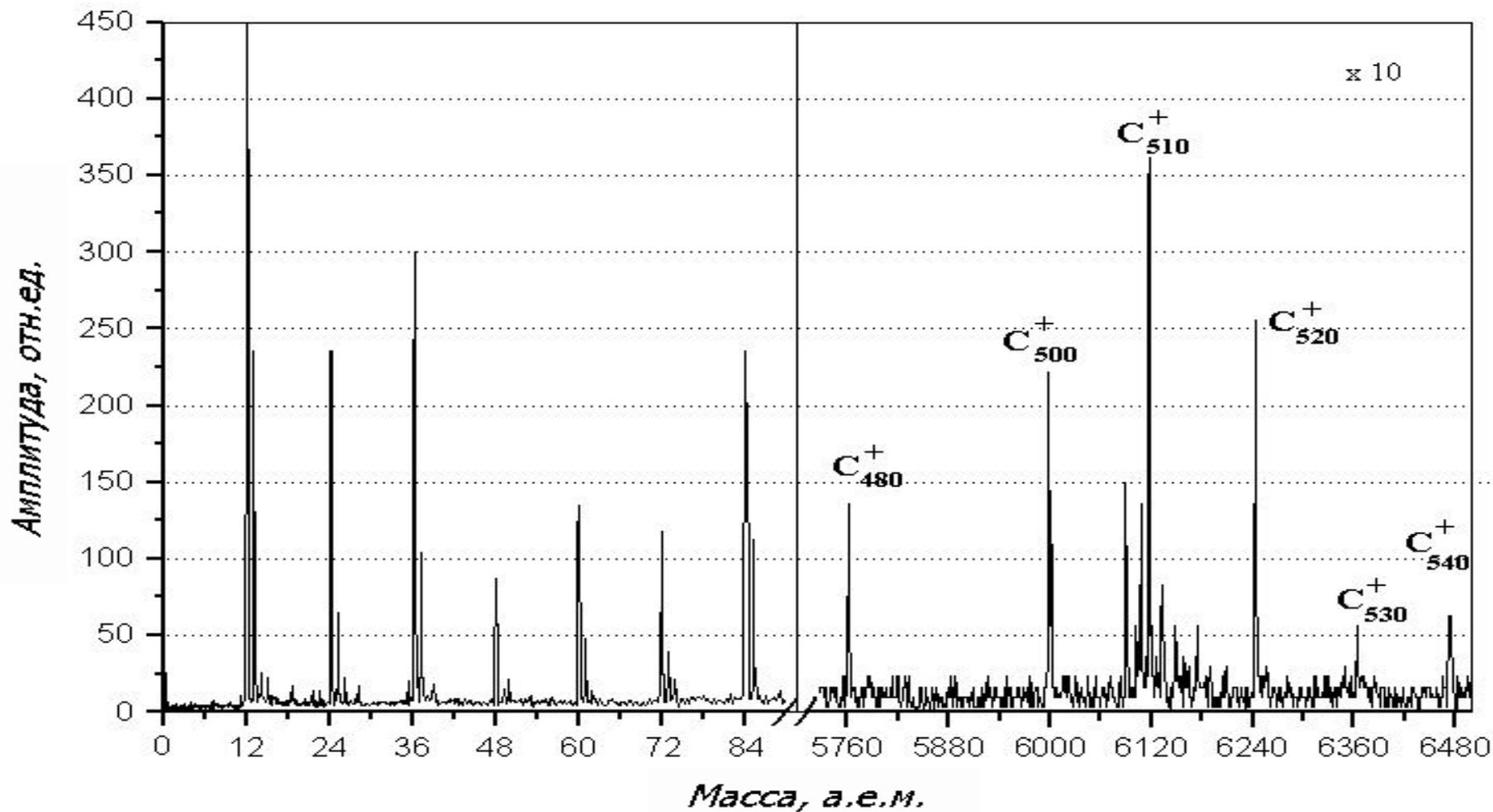


Typical mass spectra of OC synthesized in a laser-generated plasma torch under the action on pure carbon and its mechanical mix of $(\text{NH}_4)_2\text{HPO}_4$ for the spot diameter $\sim 50\text{mkm}$ and pulse duration $\sim 1\text{ns}$.

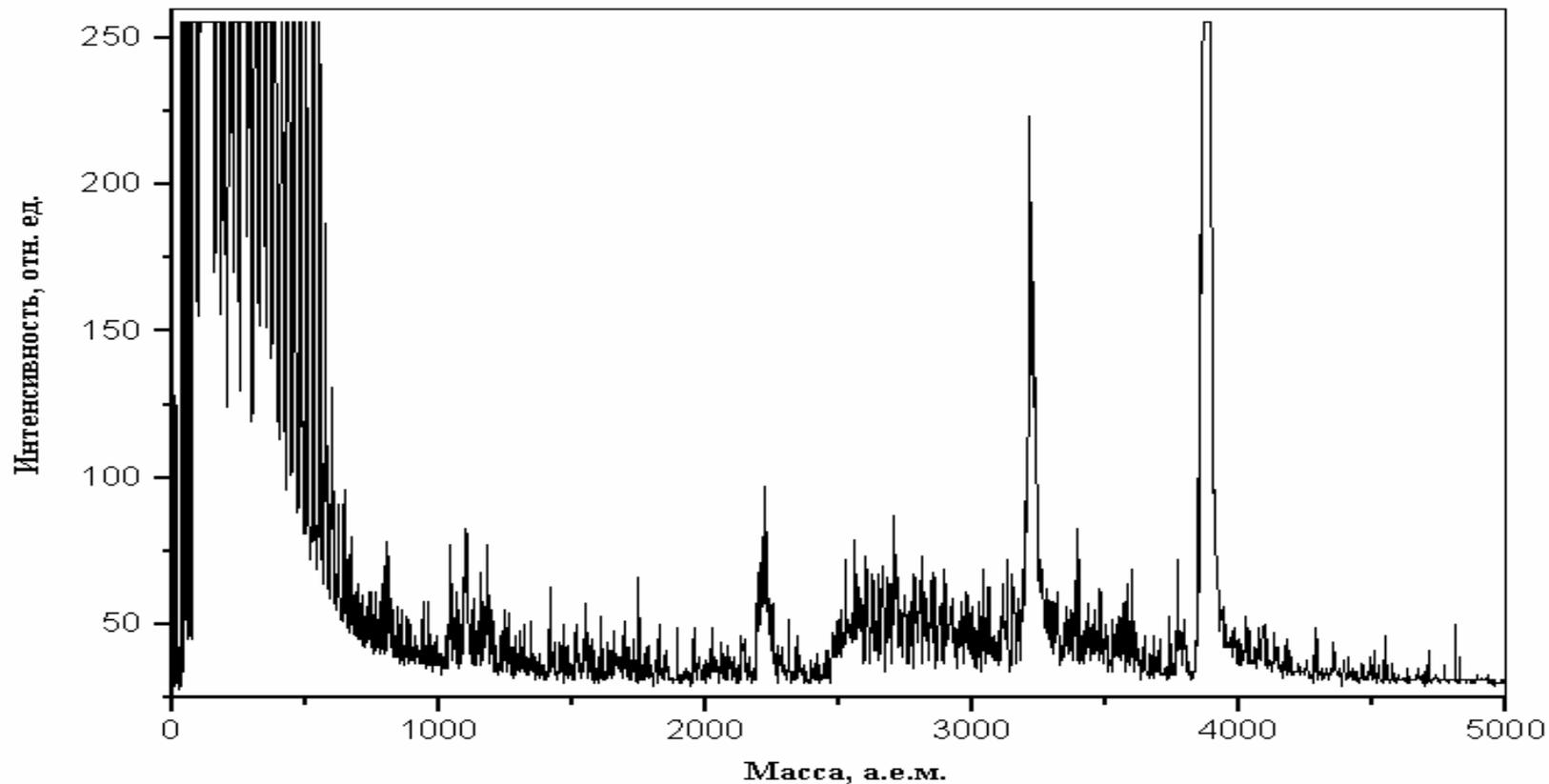
According to preliminary interpretation observed mass peaks may contain nucleotides (left) and its oligomers (right)



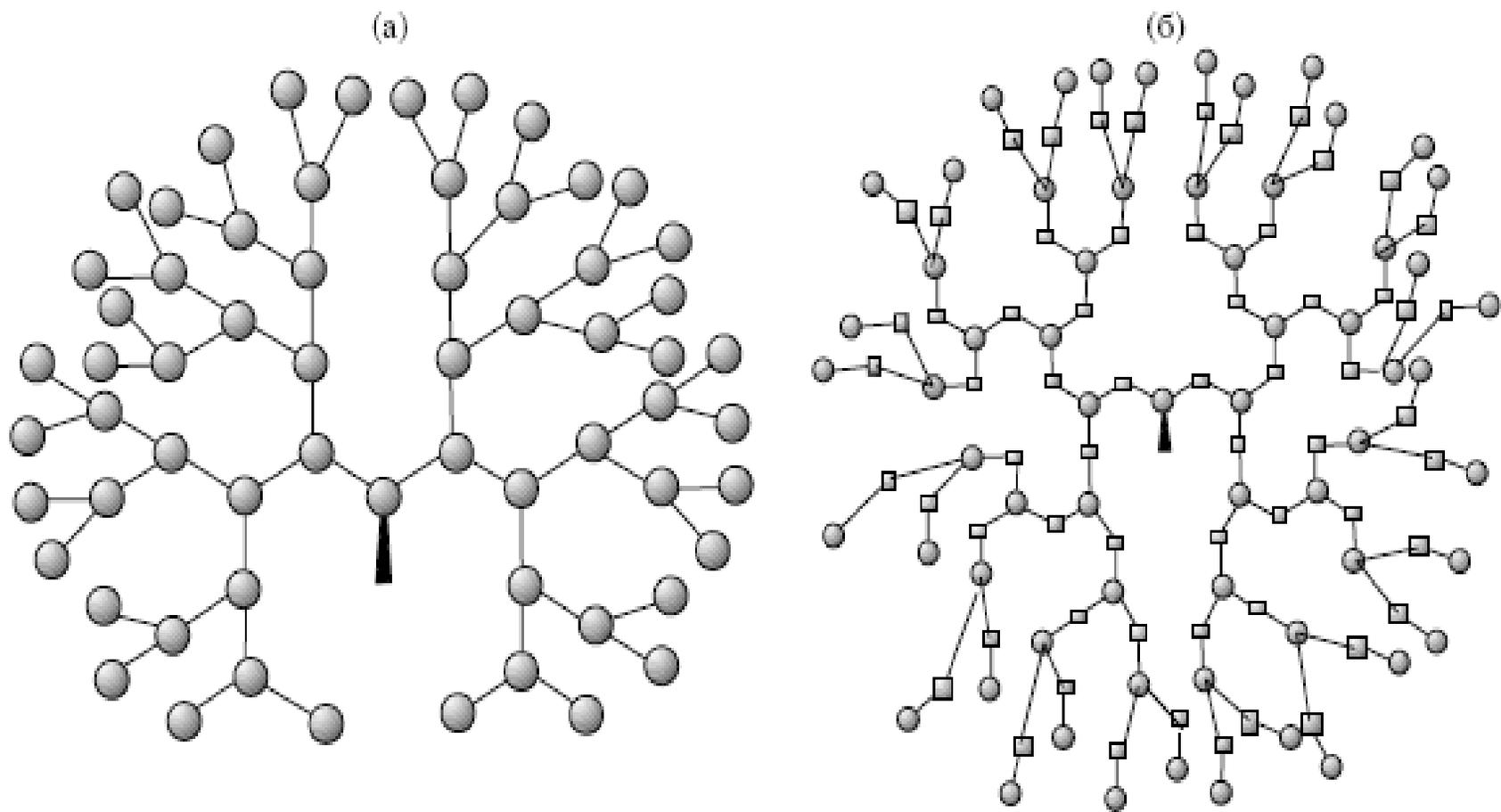
Mass spectrum of the **fullerenes and their fragments**. The spectrum obtained in laboratory experiments with $d_L \sim 2$ mm and $W_L \sim 10^9$ W cm⁻². Peaks corresponding to the masses from 19 to 31C with a step 1C with high probability may be referred to the individual fragments of the fullerenes, as well as 50, 60, 70 and 82-84C mass peaks with a step 2C– to the fullerenes itself.



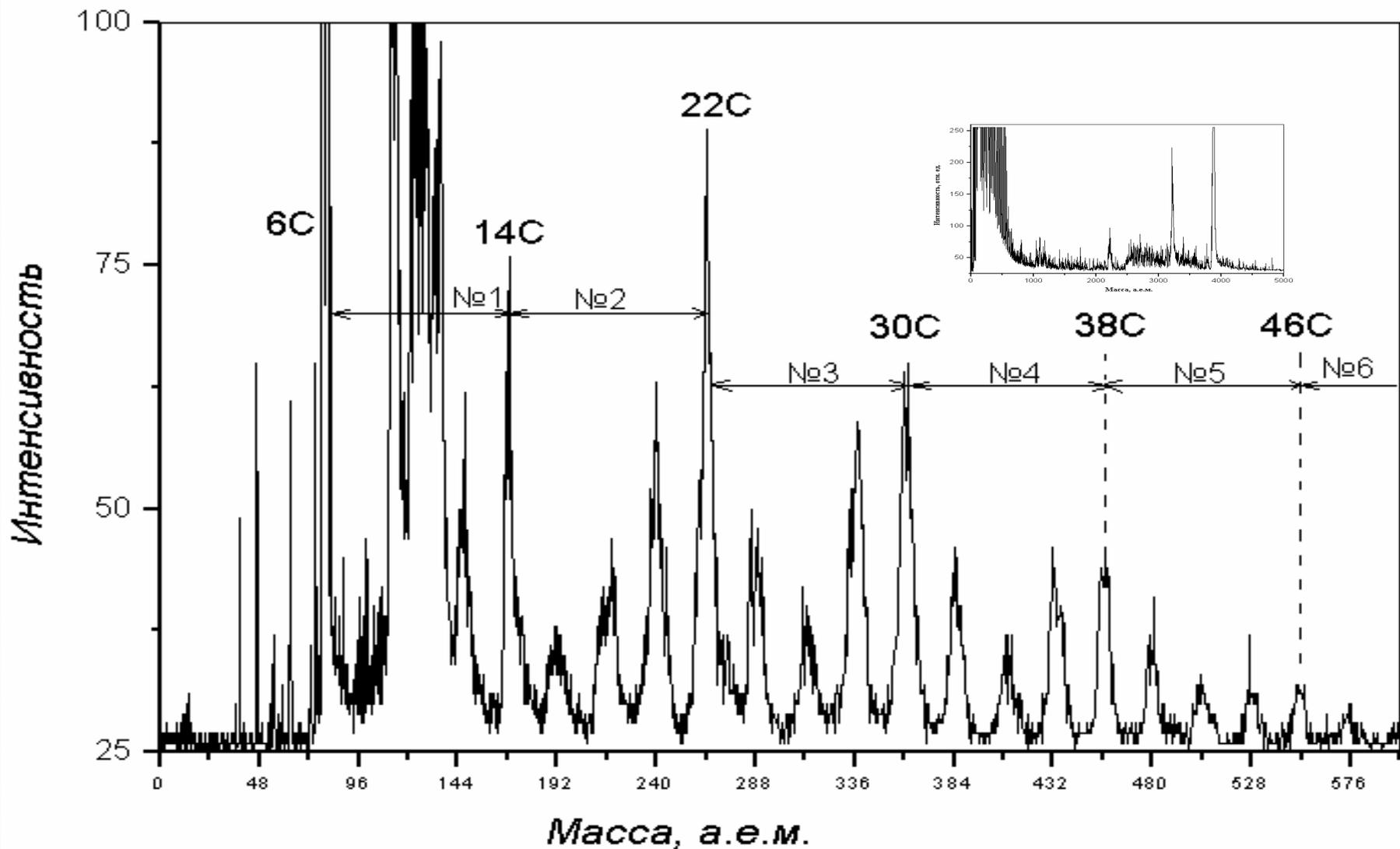
Fragments of mass spectrum of the **giant fullerenes**. Typical spectra of carbon and hydrocarbon structures were obtained with the $d_L \sim 2$ mm and $W_L \sim 10^9$ W cm⁻². Mass peaks containing from 480 to 540 C atoms correspond to the typical mass of "onion"-like fullerenes, representing enclosed each into other quasi-spheres, with following quantities of C: 60, 240, 540, 960... Mass peaks at 12-96 a.m.u. represent carbon and hydrocarbon ion-radicals.



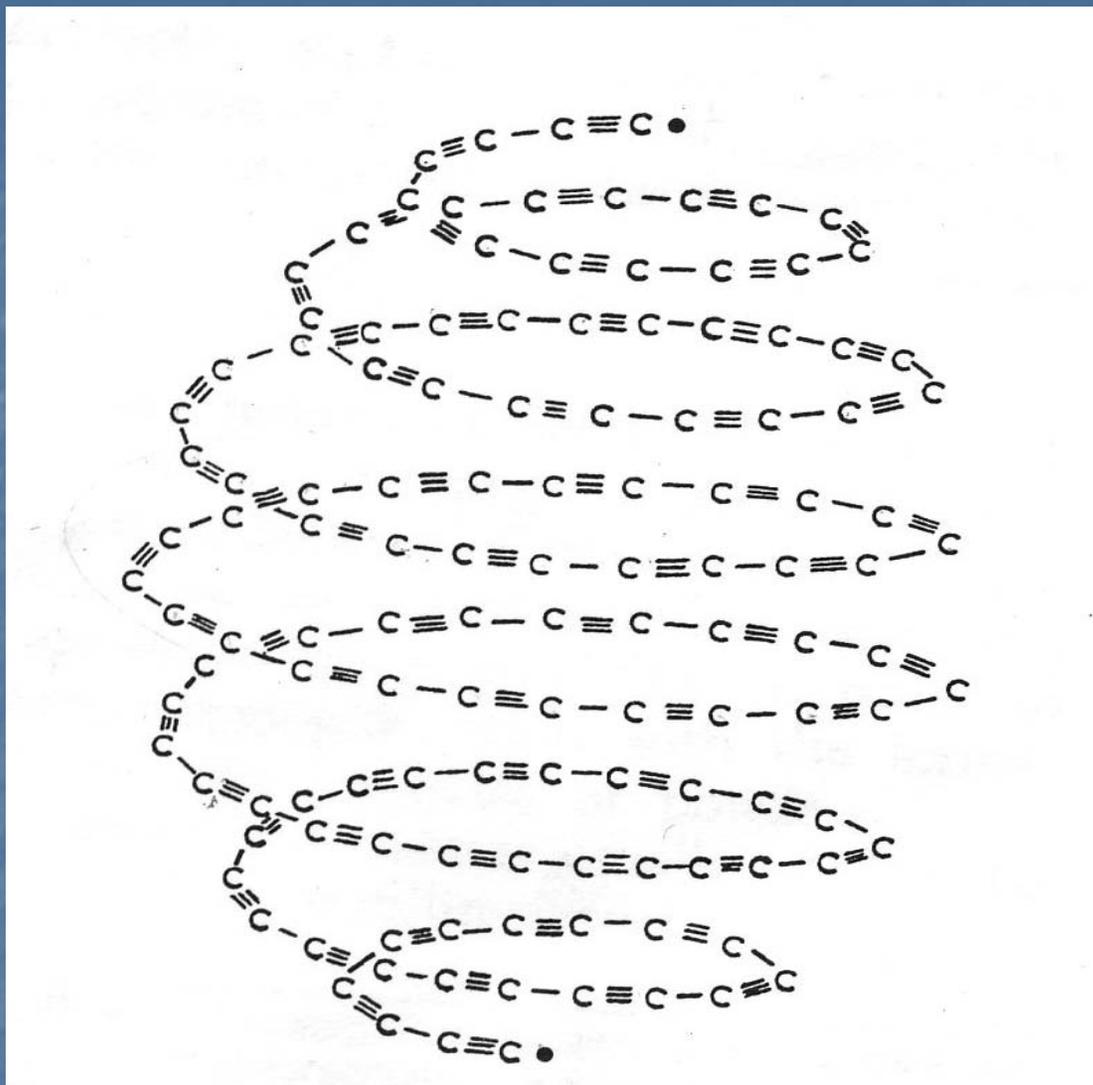
Spectrum of carbon and $^{15}\text{NH}_4^{15}\text{NO}_3$, mix received at laser radiation spot diameter 1,5-2мм. The mass peaks 2250, 3250, 3900 a.m.u. was interpreted as dendritic type, **hyperbranched polymer OC**, mass peaks in regions 1000-2000 and 2500-3100 a.m.u.- as peptides. (A full spectrum).



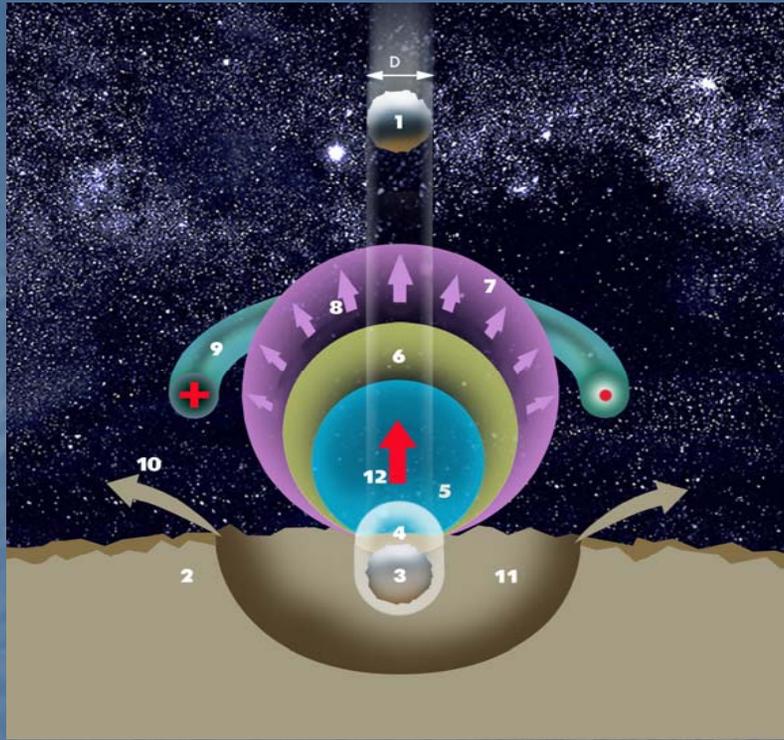
THE 5th GENERATION OF DENDRITIC MOLECULES:
homorganic (a) and heterogenic (b).



Spectrum of carbon and $^{15}\text{NH}_4^{15}\text{NO}_3$ mix, received at laser radiation spot diameter $\sim 1,5\text{-}2\text{mm}$. The mass peaks (in region № 1-6) was interpreted as branched polymer OC and cycle-alkenes (C_8) based on linear acetylenic carbon ($-\text{C}_2-\text{C}_2-$) or the «sp» carbon allotrope. (Fragment of spectrum).



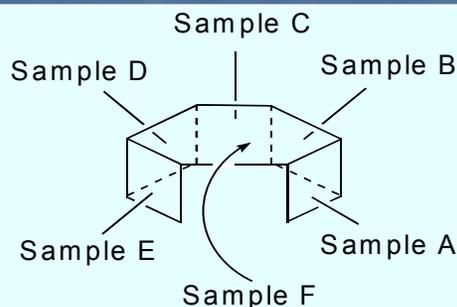
R. Lagow et al. Synthesis of linear acetylenic carbon: the «sp» carbon allotrope. (Science, Vol. 267, p. 362, 1995)



Proposed hypothesis
of **symmetry breaking**
is based on the
following experimental
results:

- imbalanced electric and magnetic fields meet the requirements of **local chirality physical fields**;
- plasma instabilities may generate **circular-polarized** radiation;
- process of symmetry breaking and isomers synthesis **synchronize** in time and space;
- amino acids of **biological and space origin** have same-L-«sign» of chirality.

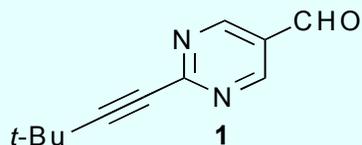
July 29, 2008 Preliminary research report. Tsuneomi Kawasaki, Kenta Suzuki, Kenso Soai.
 Dept. of Applied Chemistry, Tokyo University of Science. Asymmetric autocatalysis
 initiated by molecular matter formed under high energy collisions.



1) washed with a mixed solvent of H₂O and EtOH
 (10 times, total 2 ml)

2) washed with toluene (10 times, total 4 ml)
 3) pump (dry)

Sample A-E



Aldehyde **1** in cumene
 0.025 mmol

Aldehyde **1** in cumene
 0.10 mmol

Aldehyde **1** in cumene
 0.40 mmol

Sample A-E

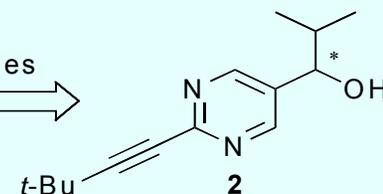
Cumene, 0 °C

i-Pr₂Zn in cumene
 0.10 mmol

i-Pr₂Zn in cumene
 0.30 mmol

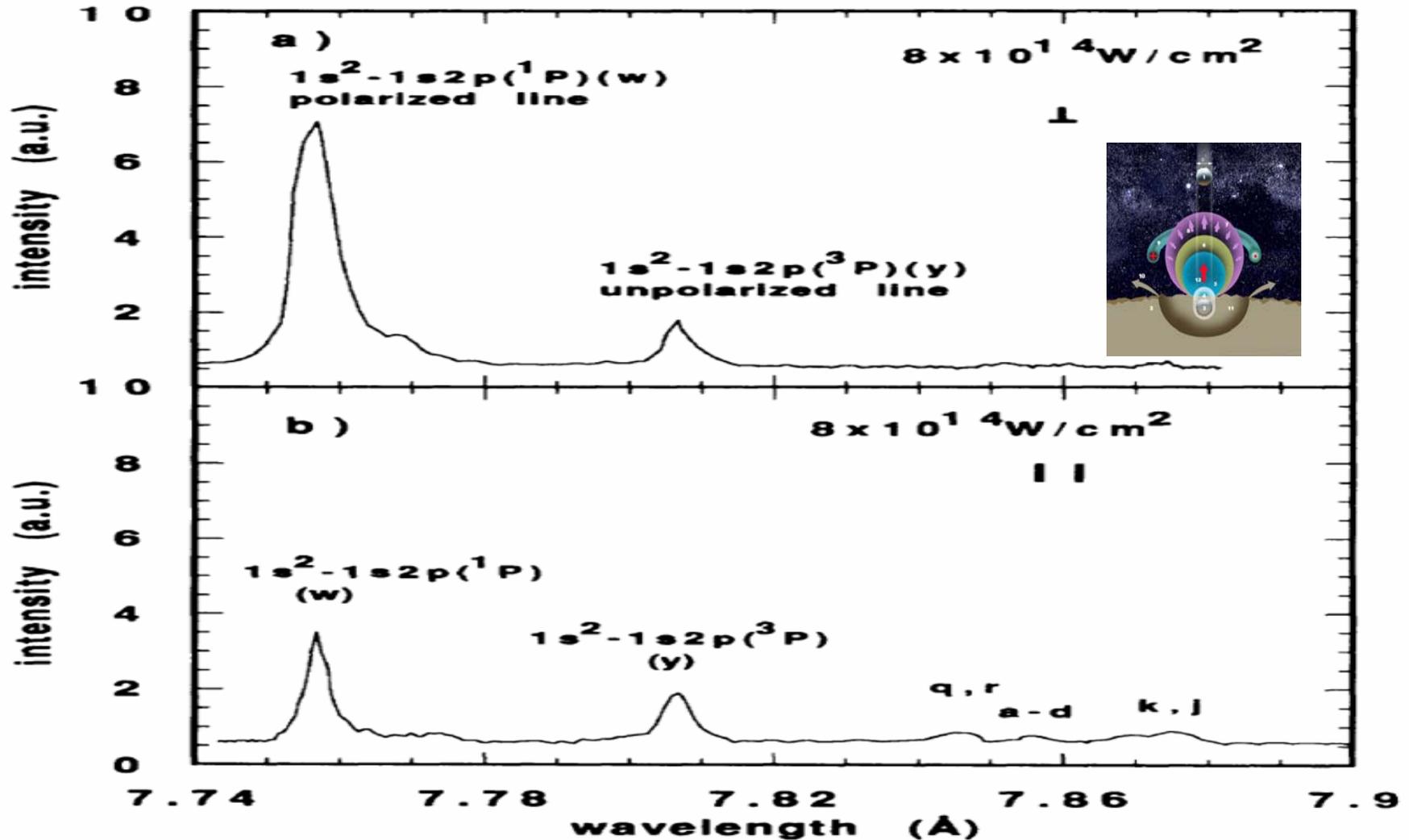
i-Pr₂Zn in cumene
 0.80 mmol

Scale up 2 times



Entry	Sample	5-Pyrimidyl alkanol 2		
		Yield (%)	Ee (%)	Config.
1	A	94	17	S
2	B	92	58	S
3	C	89	89	S
4	D	87	87	S

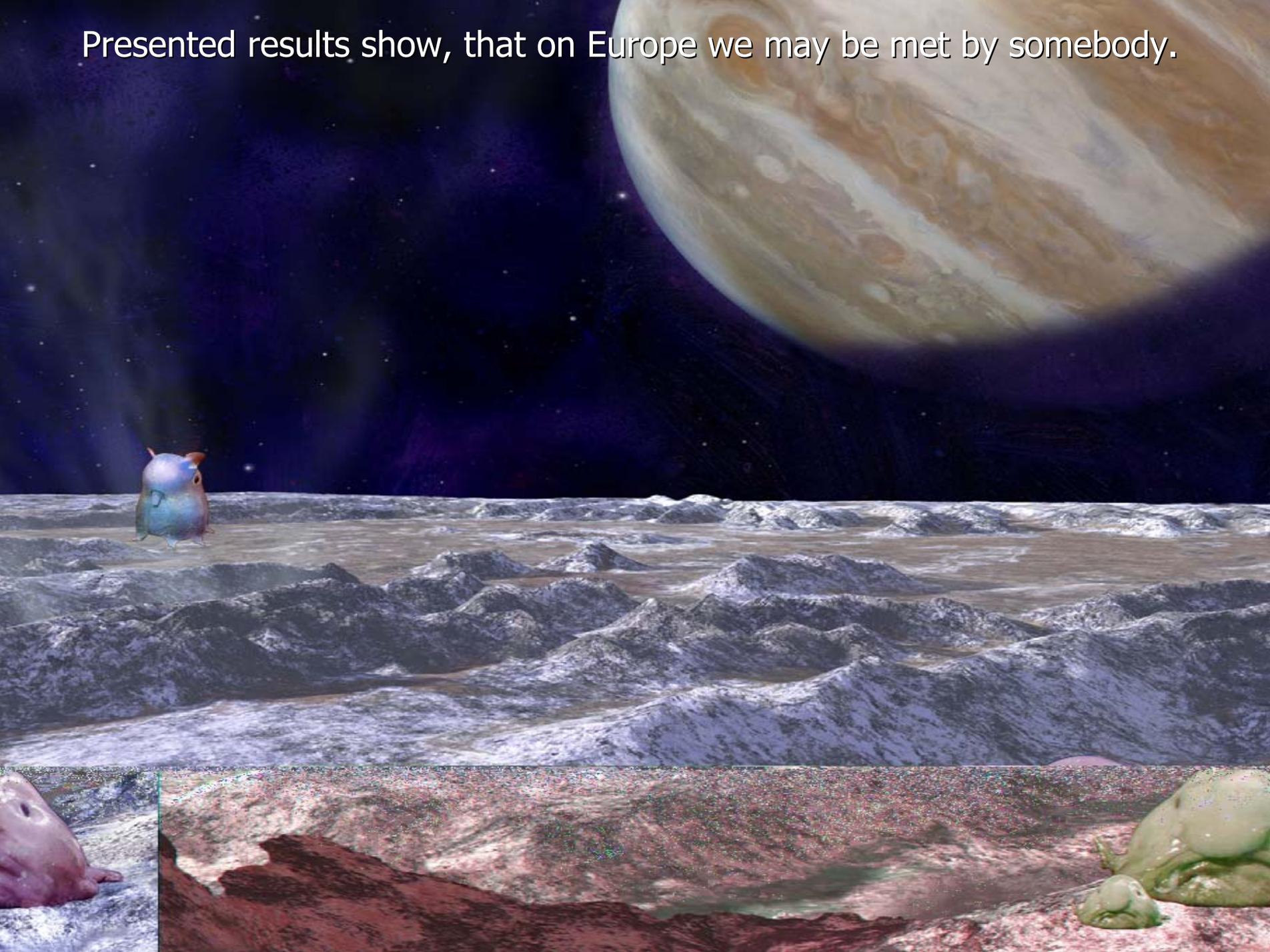
SIGNS OF SPONTANEOUS BREAKING OF THE MIRROR SYMMETRY

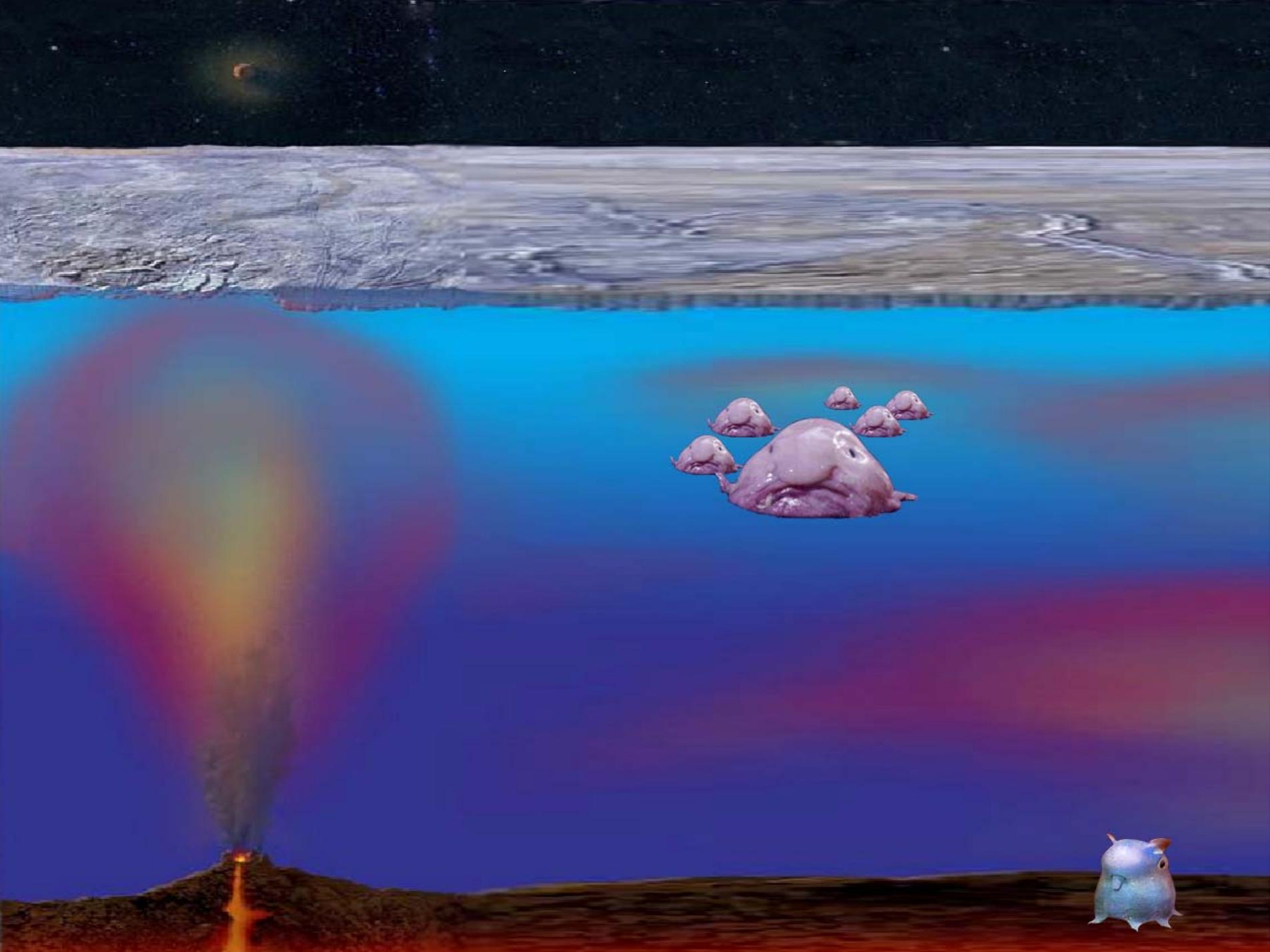


Helium-like and lithium-like aluminum lines from a laser-produced plasma. The polarization components are resolved. (T. Fujimoto, E.O. Baronova, and A. Iwamae)

- The meteorite impact has a possibility to inject the new-created complicated OC deep inside the space body surfaces, including subsurface water reservoirs, such as, for example, on Europe, Encelade and Titan.
- In this case the meteorite impact has no natural alternative in creation of the initial conditions for origin of extraterrestrial life.
- Such a possibility was confirmed by laboratory impact modeling experiment, in which the plasma torch was created inside the water.

Presented results show, that on Europe we may be met by somebody.





"Kenso Soai" <soai@rs.kagu.tus.ac.jp>

"Managadze George" <managa@bk.ru>, "Vadim Davankov"
<davank@ineos.ac.ru>

"Tsuneomi Kawasaki" <tkawa@rs.kagu.tus.ac.jp>

29 July 2008 15:40:43

Collaboration

Dear Vadim and George,
CC: Tsuneomi Kawasaki.

Attached please find the results of preliminary experiments.
Although the formation of S enantiomer was predominant,
examination using more amount of material will be necessary
to reach conclusions.

Best regards. Sincerely, Kenso

=====
Kenso Soai, Professor

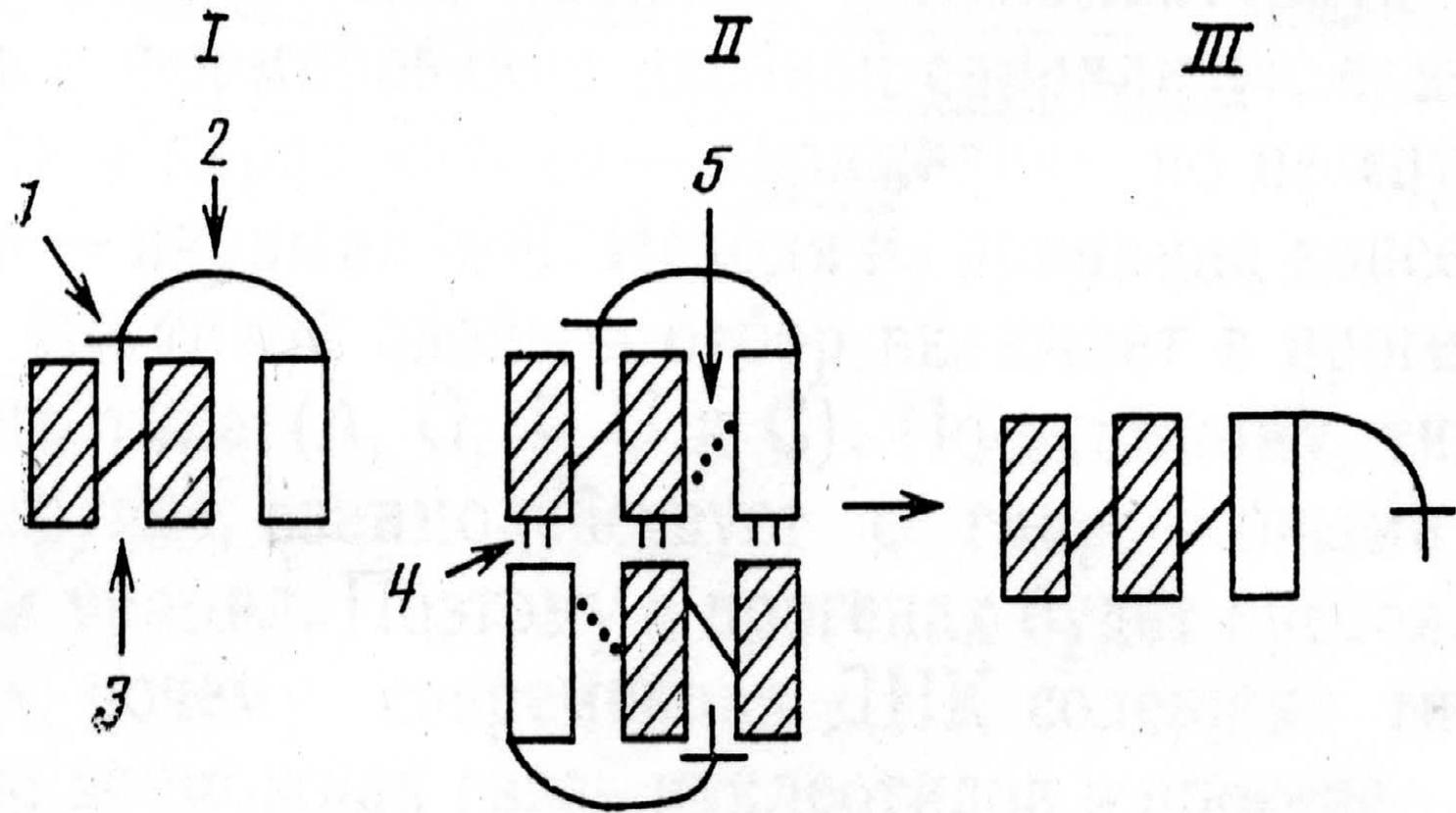
Department of Applied Chemistry, Faculty of Science

Tokyo University of Science Kagurazaka, Shinjuku-ku

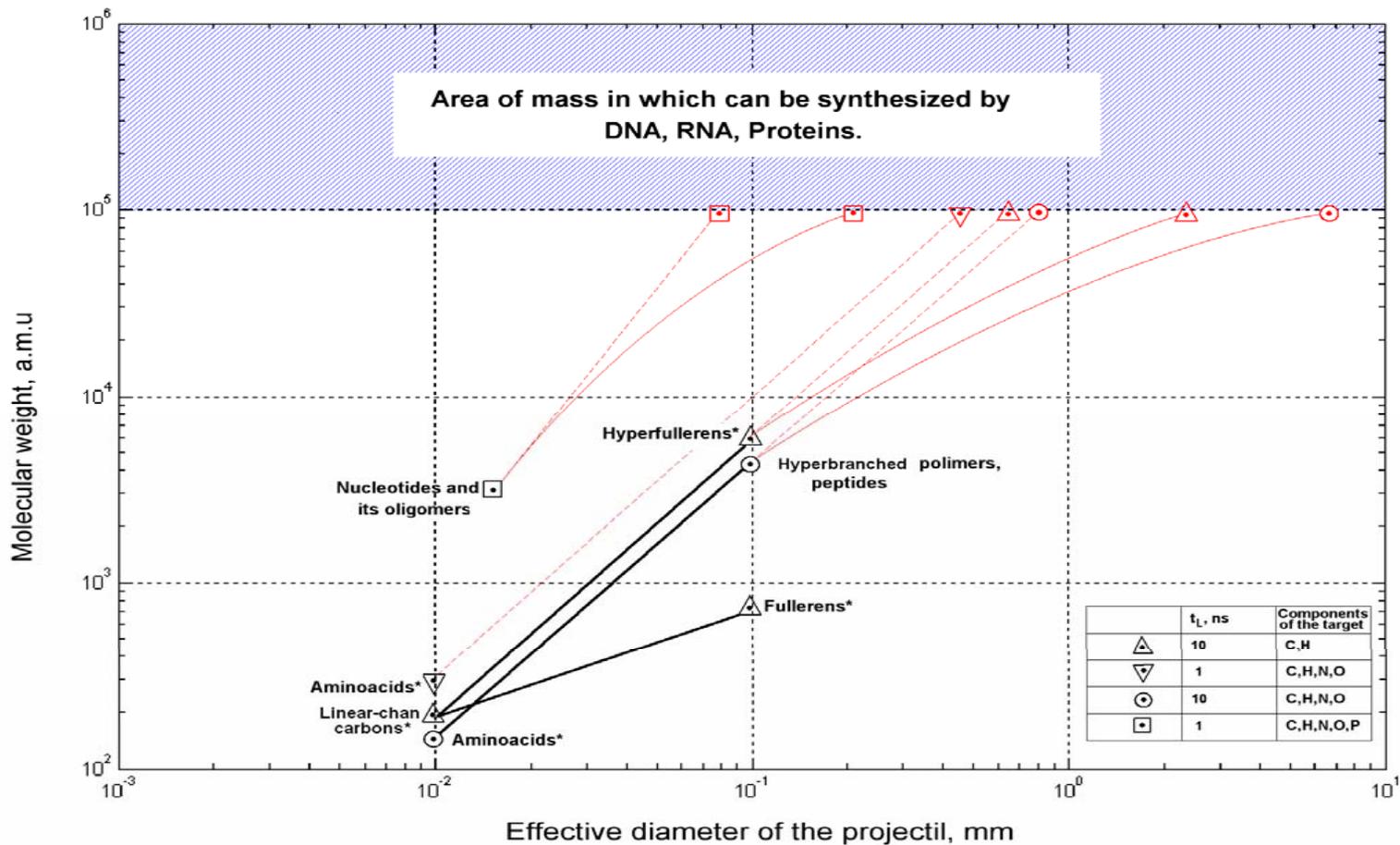
Tokyo, 162-8601 Japan Phone: +81-(0)3-5228-8261

Fax: +81-(0)3-5261-4631(changed)

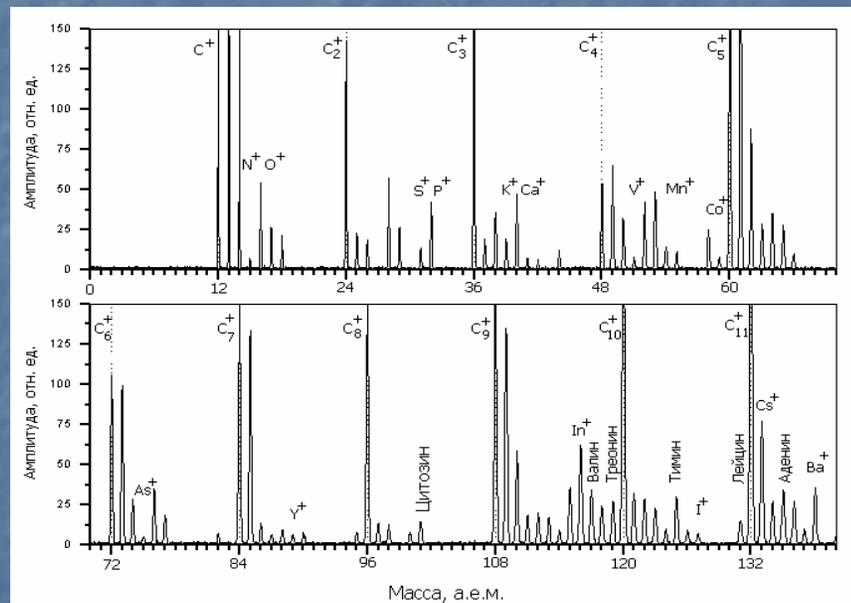
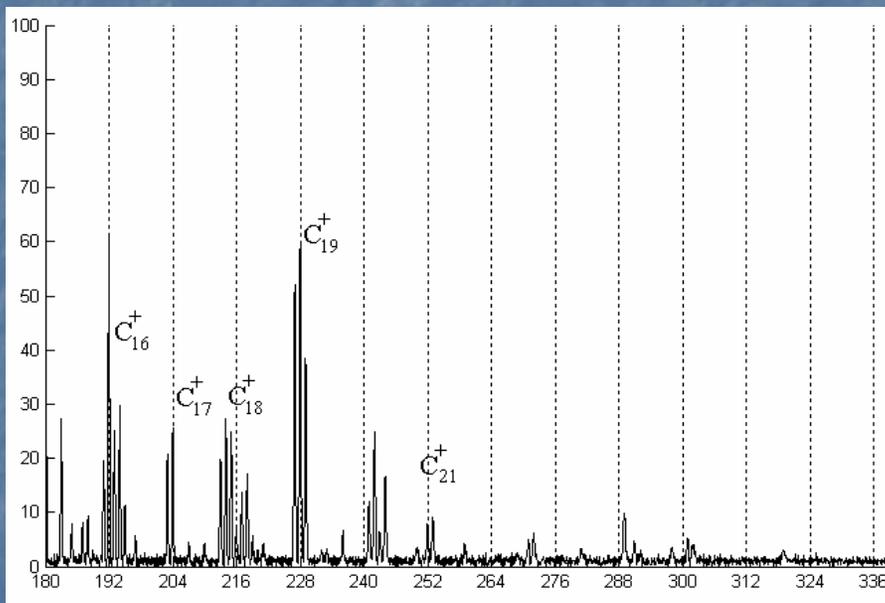
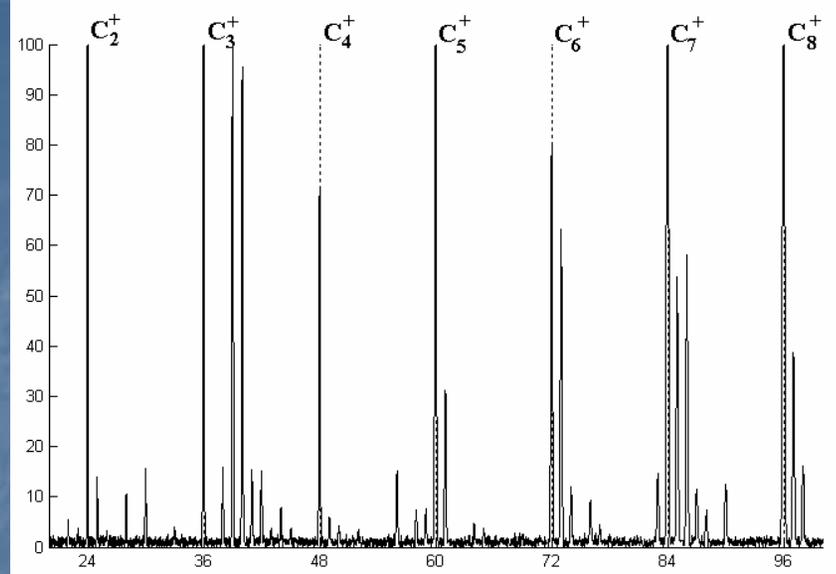
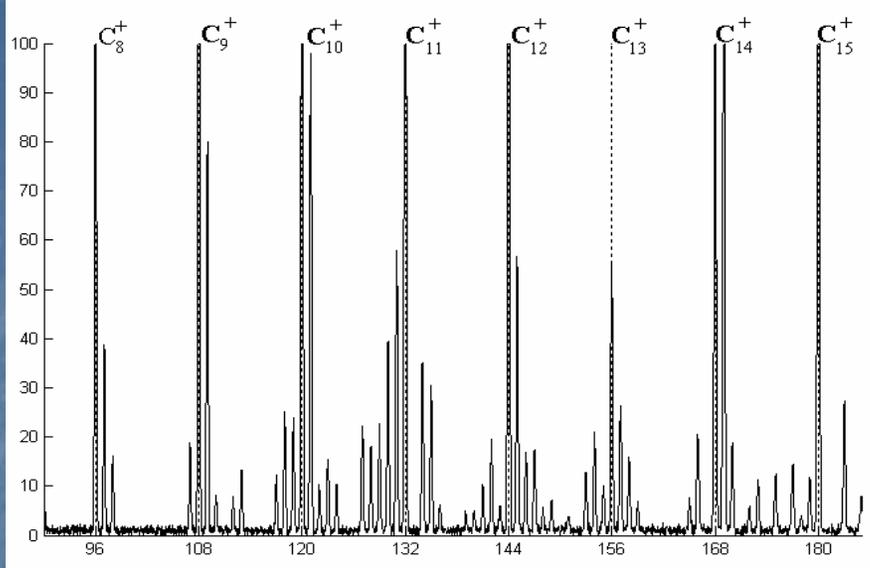
E-mail: soai@rs.kagu.tus.ac.jp URL: <http://www.rs.kagu.tus.ac.jp/soai/>
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Pro-gene arising.



Names and masses values of synthesized in a plasma torch OC depending on laser spot diameter (recounted on projectile effective diameter), duration of laser influence and the target composition. (*the identified compounds are noted).



Typical mass spectra of OC synthesized in a laser-generated plasma torch under the action on pure carbon and its mechanical mix of NH_4NO_3 for the spot diameter $\sim 50\mu m$ and pulse duration $\sim 1ns$.

In similar spectra were identified 11 amino acids and carbines.

The most important properties of living matter have appeared at pre-biological stage of the evolution of a life in the physical and chemical processes.



200-year-long attempts to understand how these unique properties of the matter were formed and to overcome a abyss between living and lifeless substance had a changeable success.

During this time :

- learned how in the laboratory analogues of nature phenomenon synthesize the number of key monomers of biopolymers; (F. Weller 1828, J. Leb 1906, A. Oparin 1924, S. Miller, H. Urey 1953, S. Fox 1977...)
- discovered the breaking of mirror symmetry of bioorganic world; (L. Pasteur 1884)
- showed impossibility to create macromolecules respondent requirements of biological level of complexity by simple statistical displacements of monomers. (M. Eigen 1970, V. Goldanskii, V. Avetisov 1986)

However, during this time :

- didn't find natural mechanism of synthesis of long polymeric macromolecular structures;
- didn't understand when, how and why had appeared homochirality and what had determined the «sign of chirality» of bioorganic world;
- didn't find out how in non-biological processes could had appeared first forms of living matter, with features of replication and translations.

Results of the newest research's have shown:

- ❑ water on the Earth was already present at a liquid phase 150-200 million years later, after formation of a planet,
- ❑ the life has arisen much earlier than assumed before-in time of the intensive meteoric bombardment of the Earth,
- ❑ the dense dust clouds were generated during formation of the impact craters and closed of sunlight.

- This results contradictory with the classical scenarios of a biotic synthesis of OC under influence of Sun energy on the Earth atmosphere.
- However, they stimulated new searches and help to discovery a new unknown earlier properties of medium and original mechanism contributory of origin of a life.

Properties of the medium should provide:

- **formation of the high-molecular polymeric OC;**
- **appearance of the replication and genetic code;**
- **mirror symmetry breaking during origin of the isomers;**
- **formation of survival zone for primary living matter.**

Special interest can present to finding identical physical mechanism providing synthesis of OC on the "warm" Earth and in "cold" Space condition's.

□ Our investigations showed that, one of this medium is plasma torch, arising during SHV-meteorite impact, and which was earlier well known.

□ However its unexpected properties in connection with high-molecular, polymeric OC synthesis and hypothetical breaking of mirror symmetry have, been discovered experimentally more recently.

□ Another medium is impact crater.

Presented results show, that on Europe we may be met
by somebody.

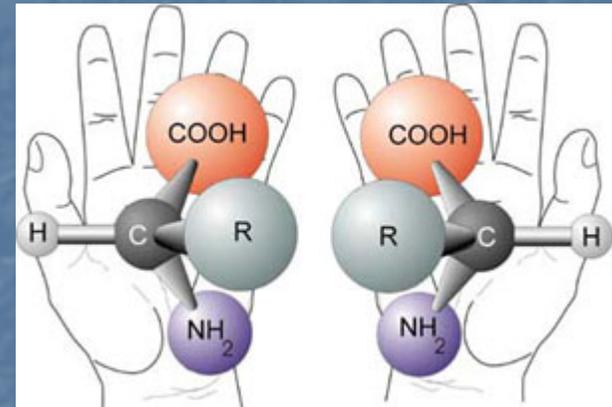
□ For investigation the unknowns properties of processes accompanied of SHV impact was using, system approach.

□ According this innovation, the main potential possibility of natural phenomenon was considering and analysis's in common with condition and processes required for origin of life.

□ This considering include problem from synthesis OC and symmetry breaking to arise of first living forms.

Problem of mirror symmetry breaking remains one of the most important ones. It is supposed that such breaking had happened at the stage of chemical evolution.

- All organisms living on the Earth are mostly applying in their vital activity only one of the two possible mirror isomers of OC, in particular L-isomers of amino acids.
- Their solution can turn the plane of optical polarization to the left (L).
- Two reasons were considered for the symmetry breaking: influence of physical fields or spontaneous processes.



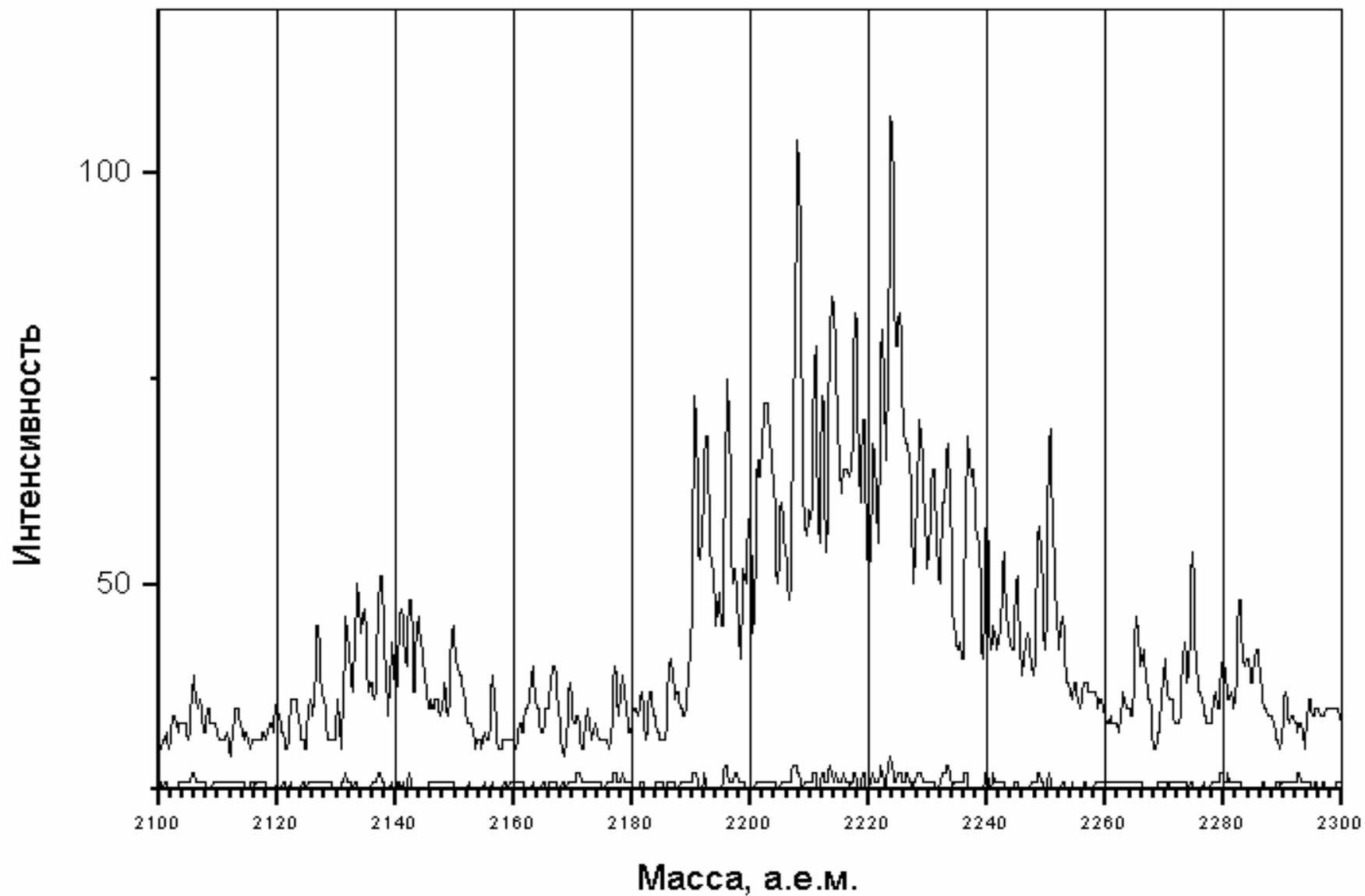
Mirror symmetry breaking in OC of meteorite origin

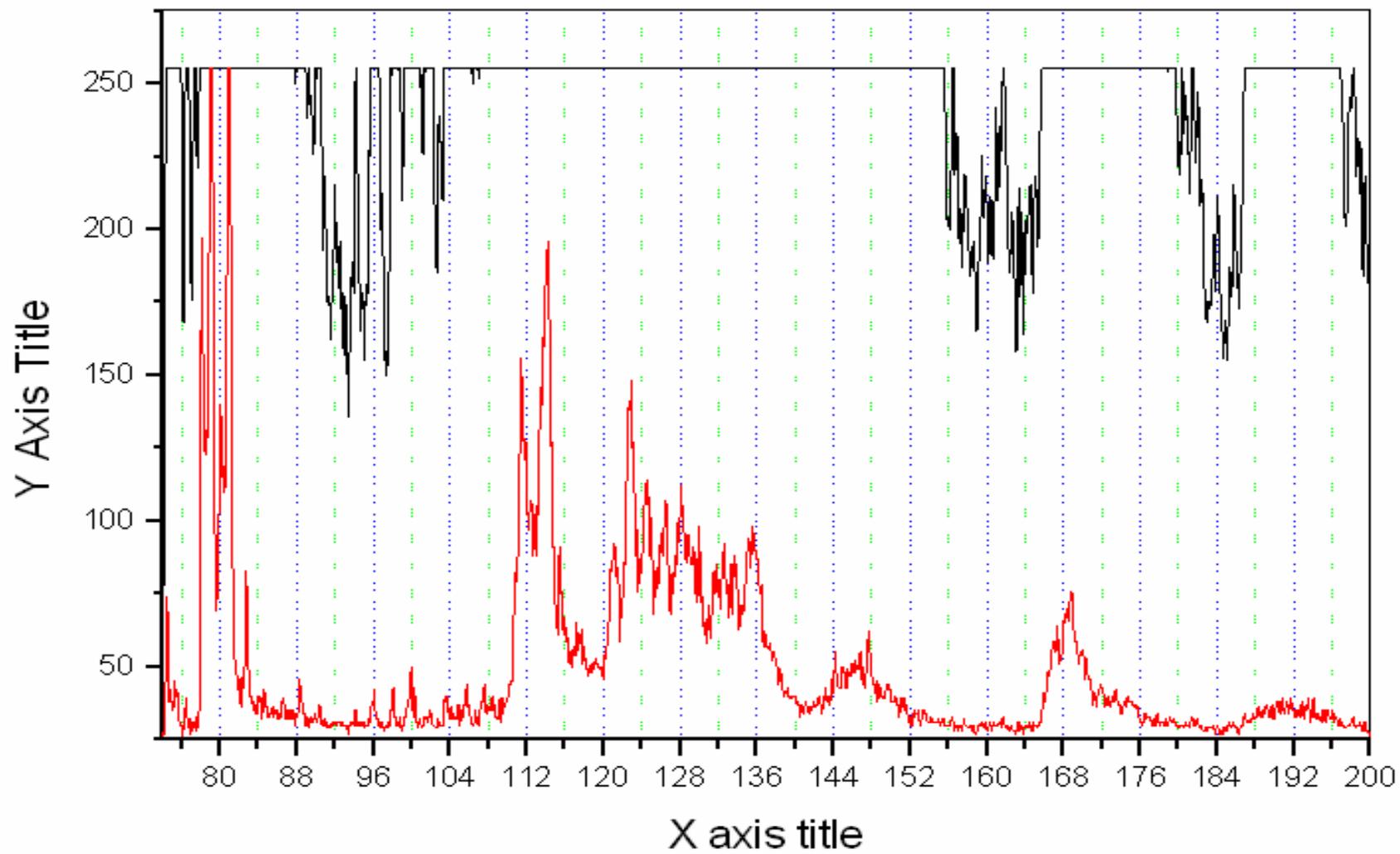


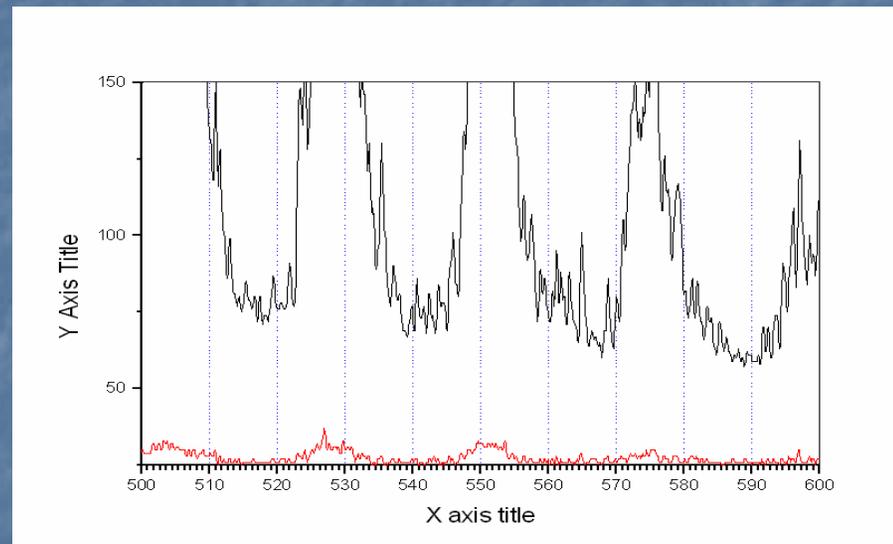
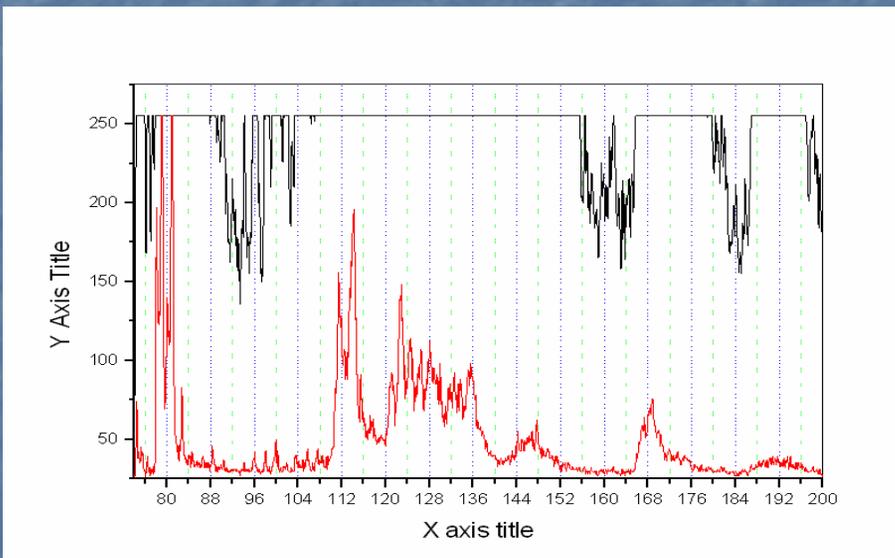
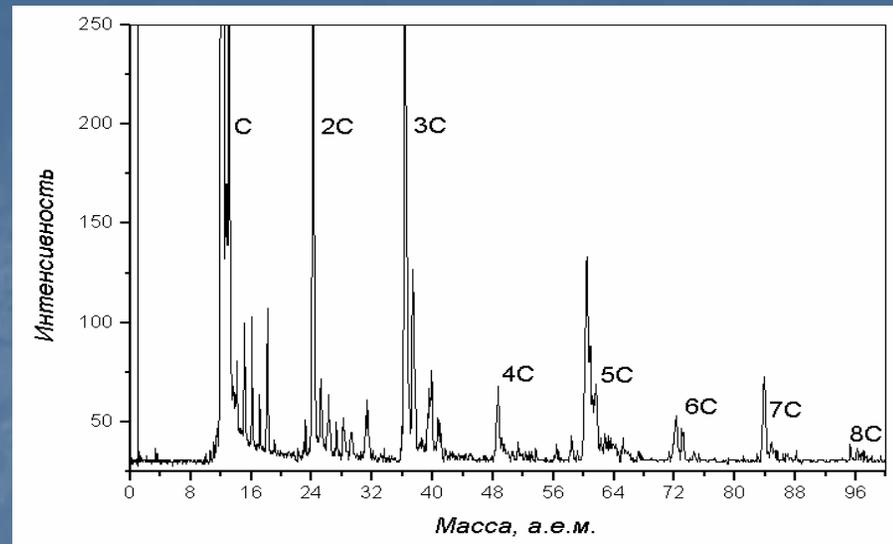
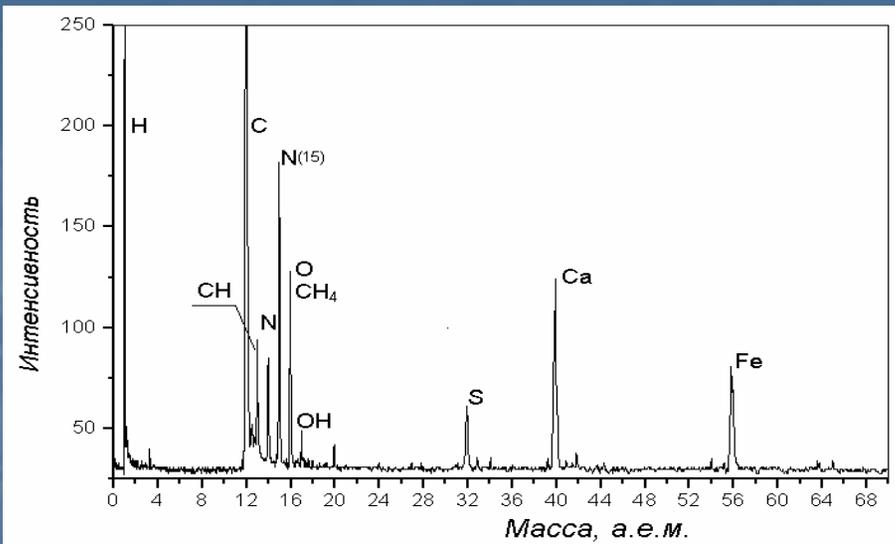
□ Fragment of Marchison meteorite

□ The study of alanine amino acid, contained in the Marchison meteorite has showed that the L-enantiomer in its chemical content – the same as on Earth - was prevailing; it

□ Therefore, it is possible that synthesis of amino-acids in space and on Earth by the common mechanism was provided.

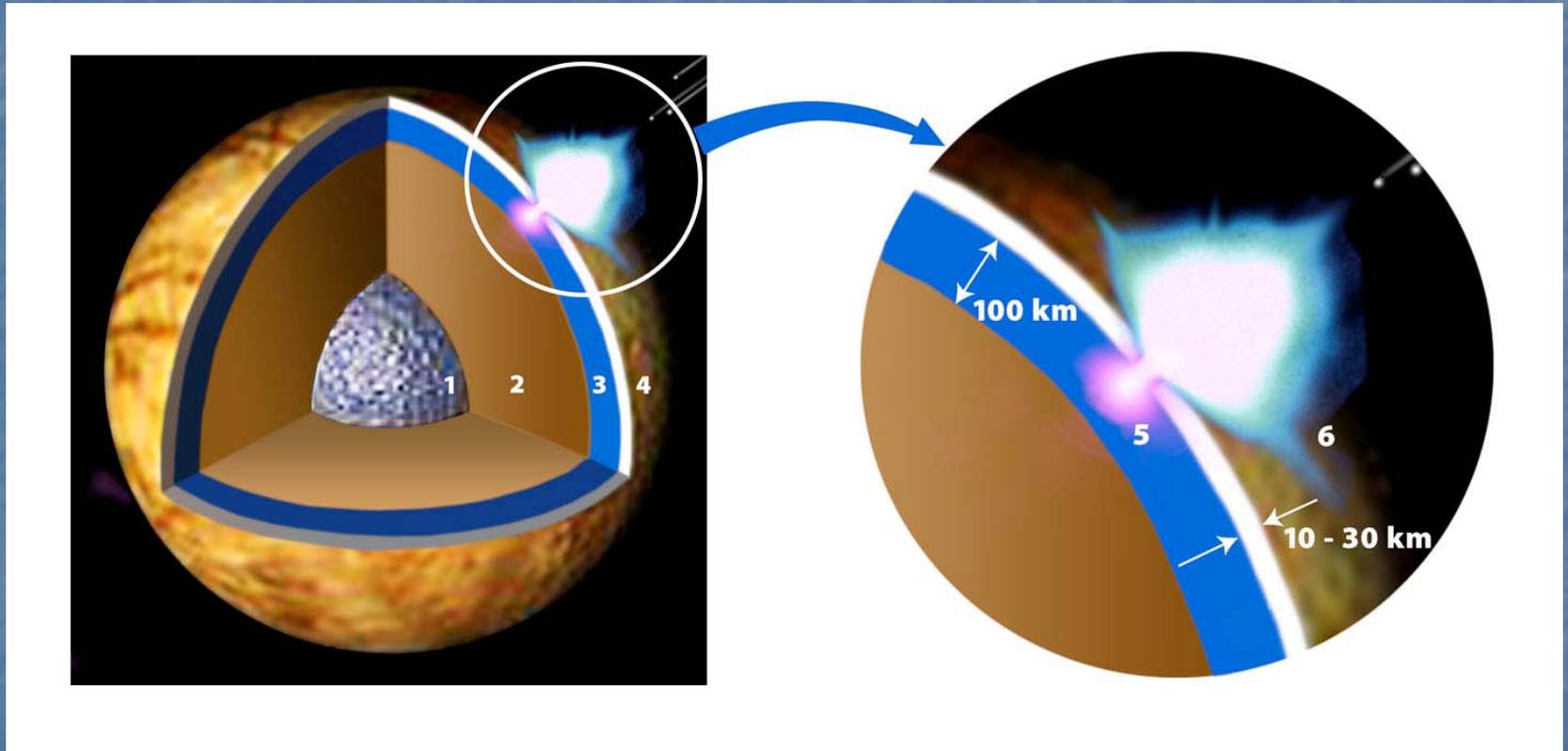




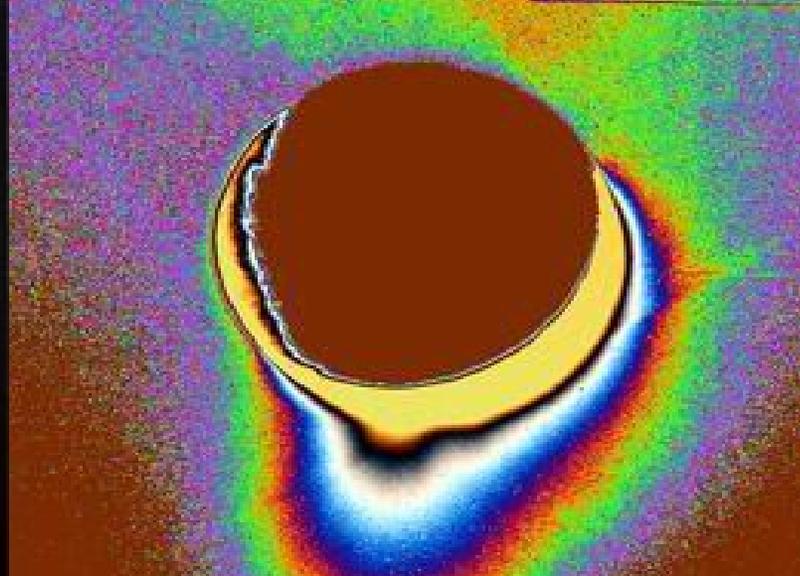


Mass spectra showing important features of development of a plasma torch and characteristics of synthesized OC.

□ These results allowed to propose SHVI configuration when a meteorite penetrates into a subsurface water reservoir.



□ This mechanism can result in the origin of extraterrestrial life.



Enceladus "Cold geyser" Model

H₂O vapor plus ice particles

H₂O Ice T = ~77 K

Vent to surface

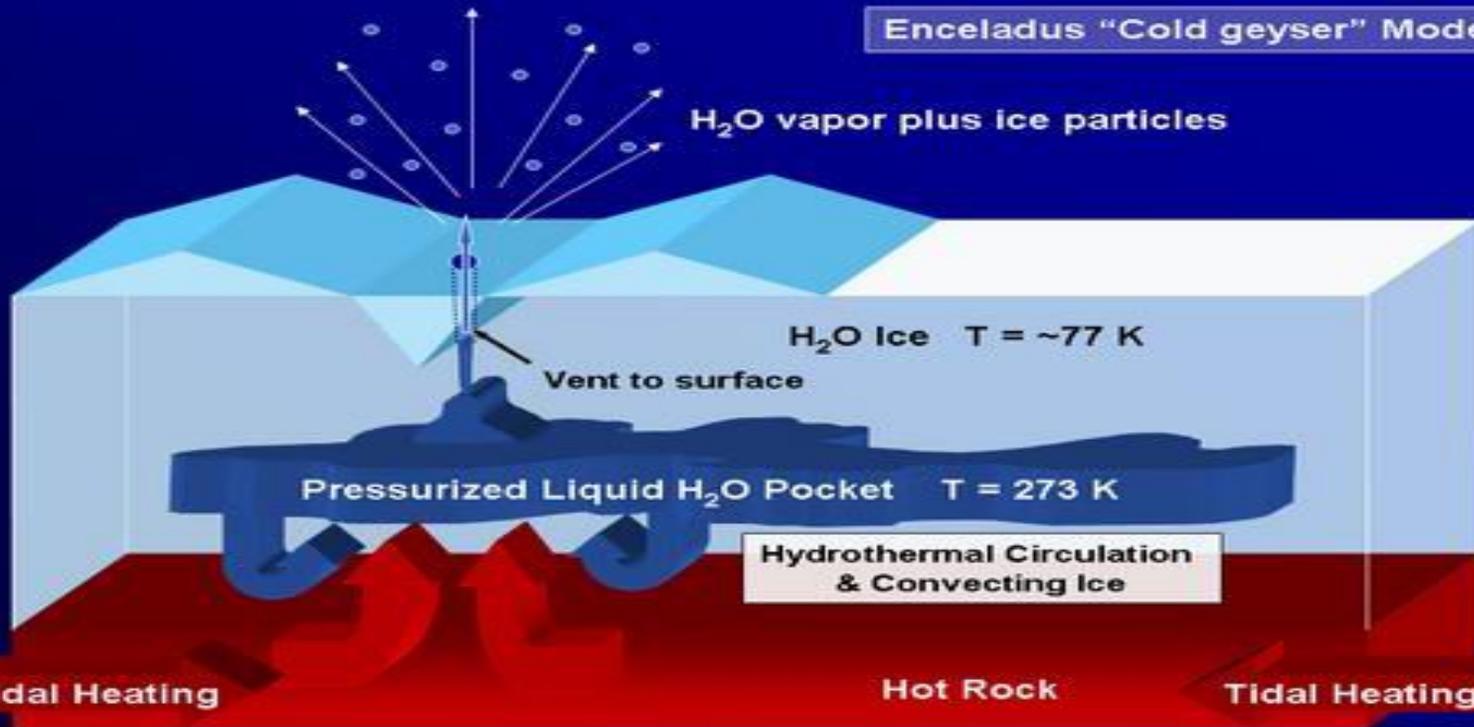
Pressurized Liquid H₂O Pocket T = 273 K

Hydrothermal Circulation & Convecting Ice

Tidal Heating

Hot Rock

Tidal Heating



Laser action



Optical window

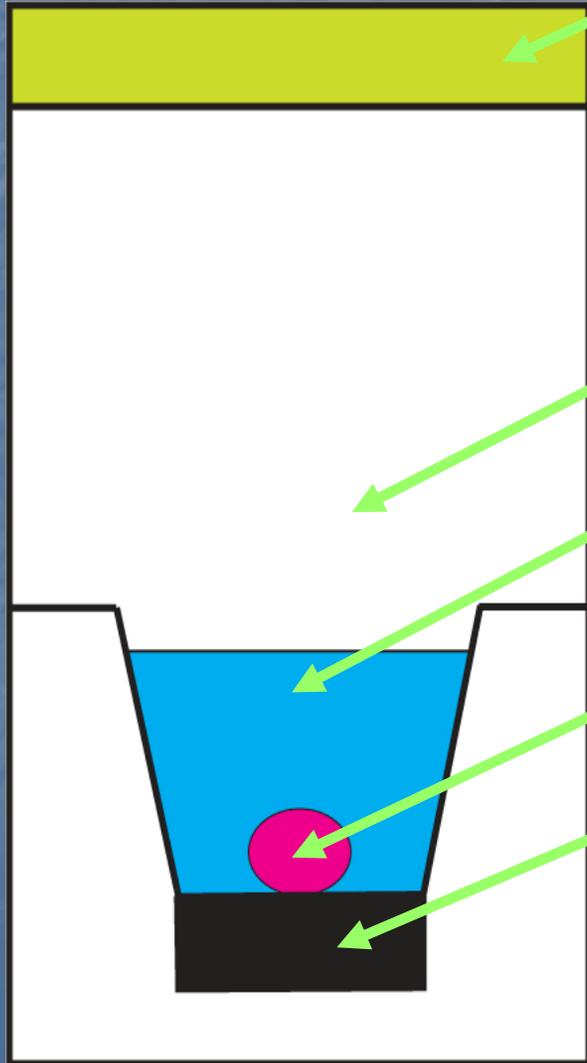
Hermetic container

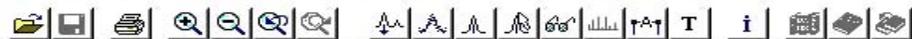
Air in 1 atmosphere

Aqueous solution of
 NH_4NO_3

Underwater plasma torch

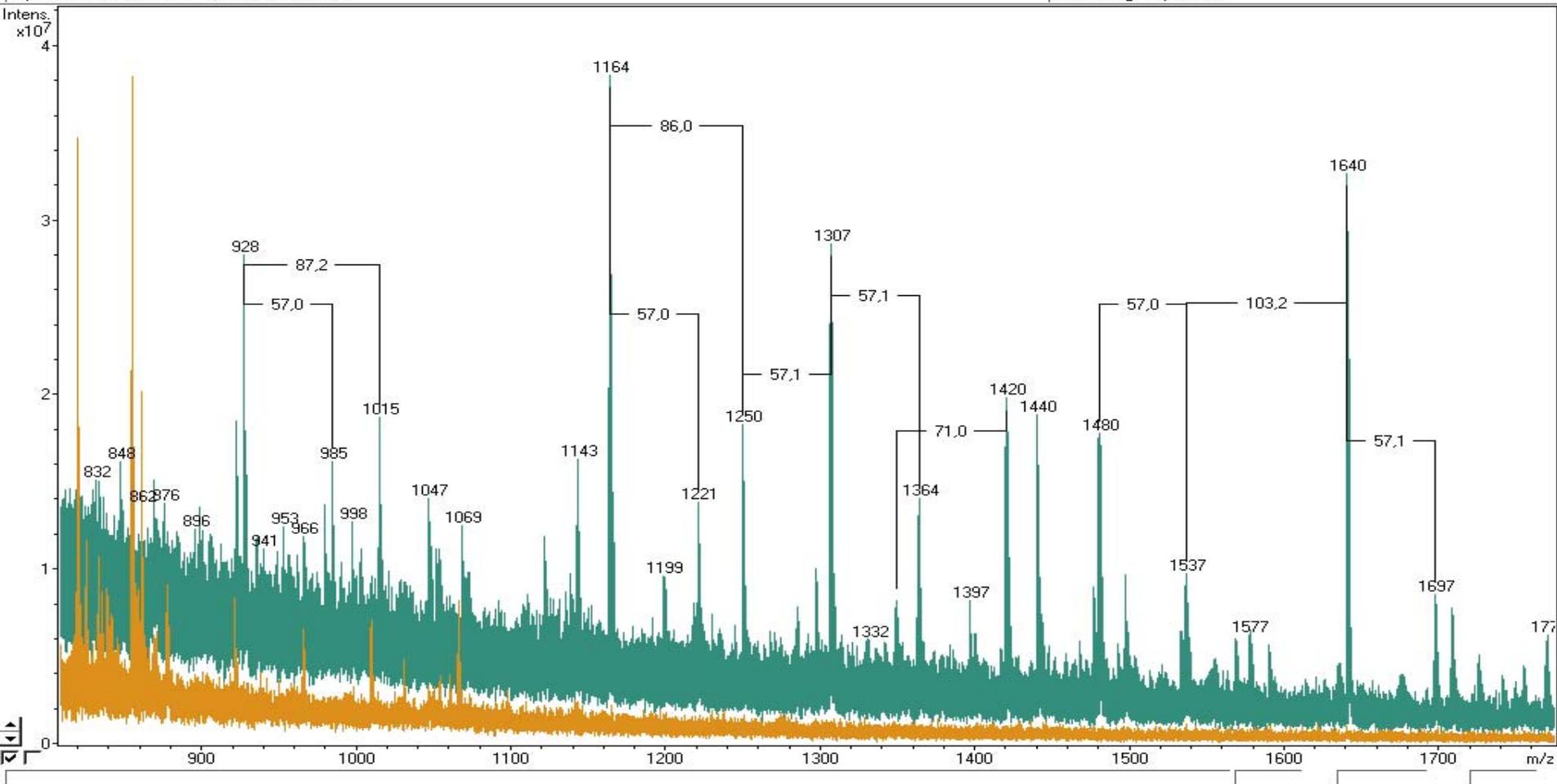
Carbon target



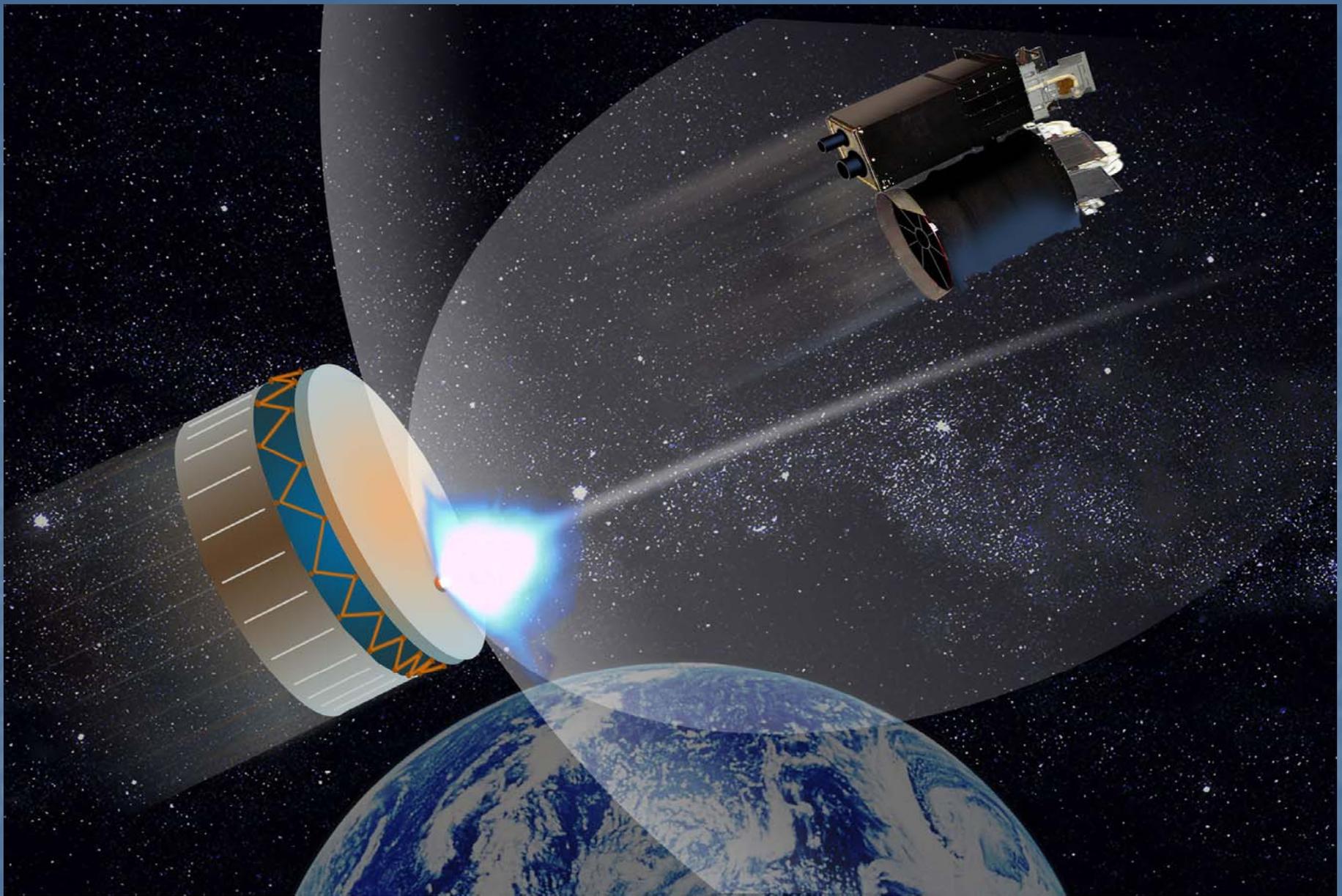


experiment; desalted on C18||DHB/CHCA||RZ

Time-of-Flight Spectrum



Mass peaks of OC formed in a sub water plasma torch generated under the influence of laser radiation on a target made from carbon and water solution of NH_4NO_3 , with an possibility of synthesis of Gly, Ala, Ser and Cys.



The experiment COUNTER IMACT and long distance impact mass-spectrometer.



The conclusion :

- Earlier unknown property of SHVI plasma torch, provides abiogenic synthesis of high-molecular OC on the early Earth, at a prebiological stage of evolution under the influence of meteoric bombardment and origin of simple OC in interstellar gas-dust clouds during SHV-colliding of a dust particles in identical physical mechanisms are found and confirmed experimentally.
- Detected experimentally increase of OC masses with the enlarging of plasma formation area shows, that SHVI of a meteorites with diameter bigger than 1 cm, can provide synthesis of OC with masses and properties comparable with RNA, DNA, proteins.

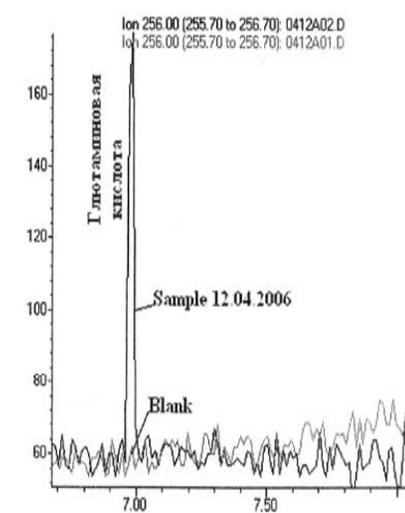
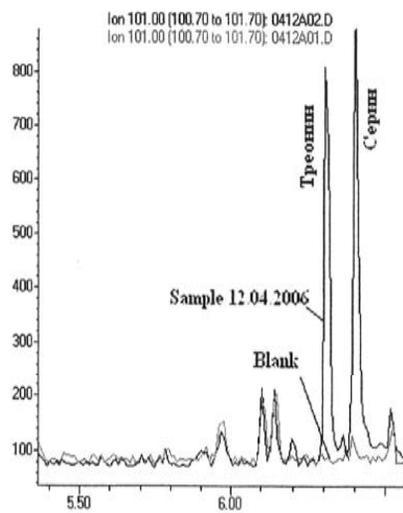
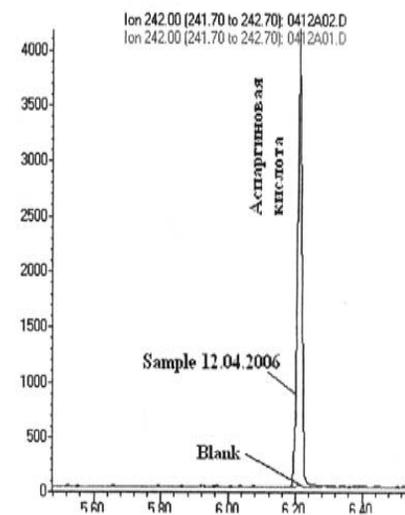
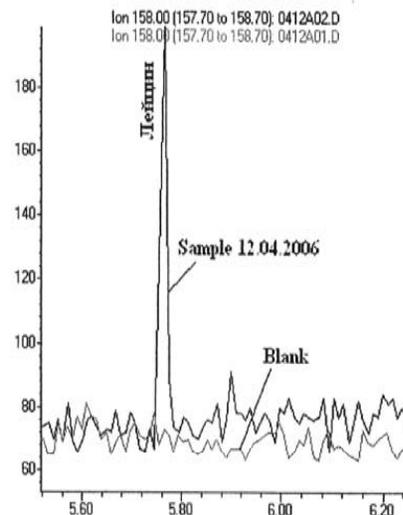
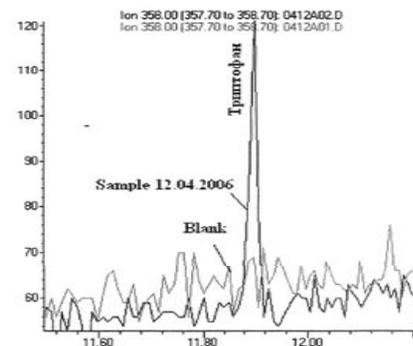
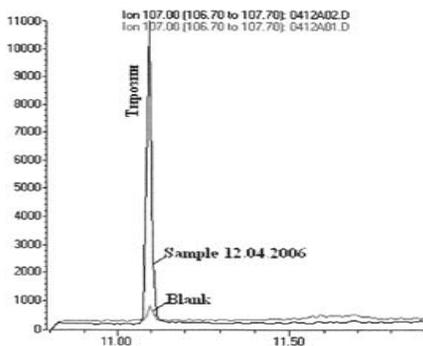
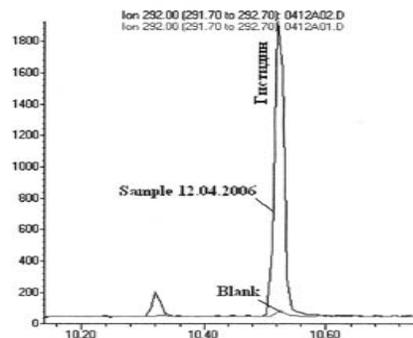
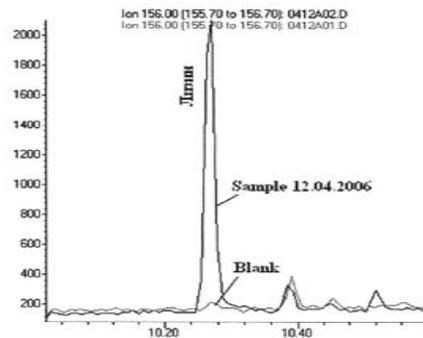
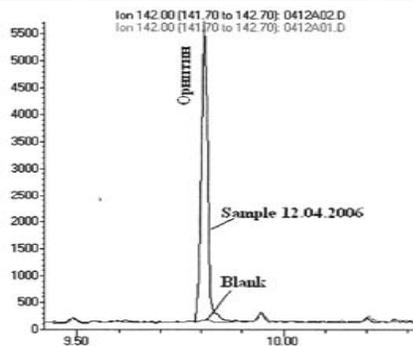
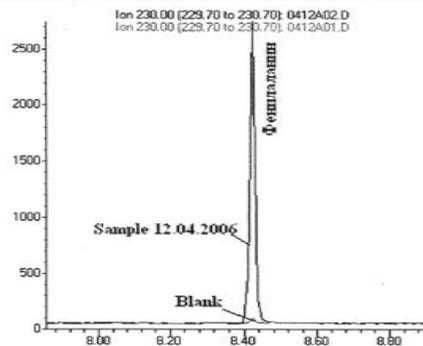
- Presence in the plasma torch of unbalanced electric and magnetic fields and also plasma instabilities capable to generate circular-polarized emission, allows to count this medium as local chiral physical fields providing, hypothetically, at list insignificant initial infringement of symmetry of synthesized isomers, which in the further could define a "sign" of symmetry of the bioorganic world.
- High-molecular OC synthesized in a plasma torch can be introduced in the subsurface water reservoirs by penetrating impact of the meteorites on the planets and its satellites with ultra low superficial temperatures. Such process with high probability can initiate the beginning of prebiological stage of evolution.

In the new approach the following
sequence is considered:
phenomenon-event-medium

- phenomenon - formation of planets and meteoric bodies,
- event - SHVI of meteorites,
- medium -impact generated plasma torch.



The life is obliged to emerge.



Результаты анализа пробы методом ГХ-МС в режиме выделенных ионов на приборе HP5972 «Agilent». Образец перерастворили в 500 мкл 0.1 М HCl. Образцы снимались в следующей последовательности: 1 - вода/реагент (Blank) 2-образец (Sample 12.04.2006)

В результате анализа образца было найдено 11 аминокислот: **лейцин, аспарагиновая кислота, треонин, серин, глютаминовая кислота, фенилаланин, орнитин, лизин, гистидин, тирозин и триптофан**. Соотношение сигнал/шум (S/N) > 3.

Table 2. Amino acids identified by gas chromatography

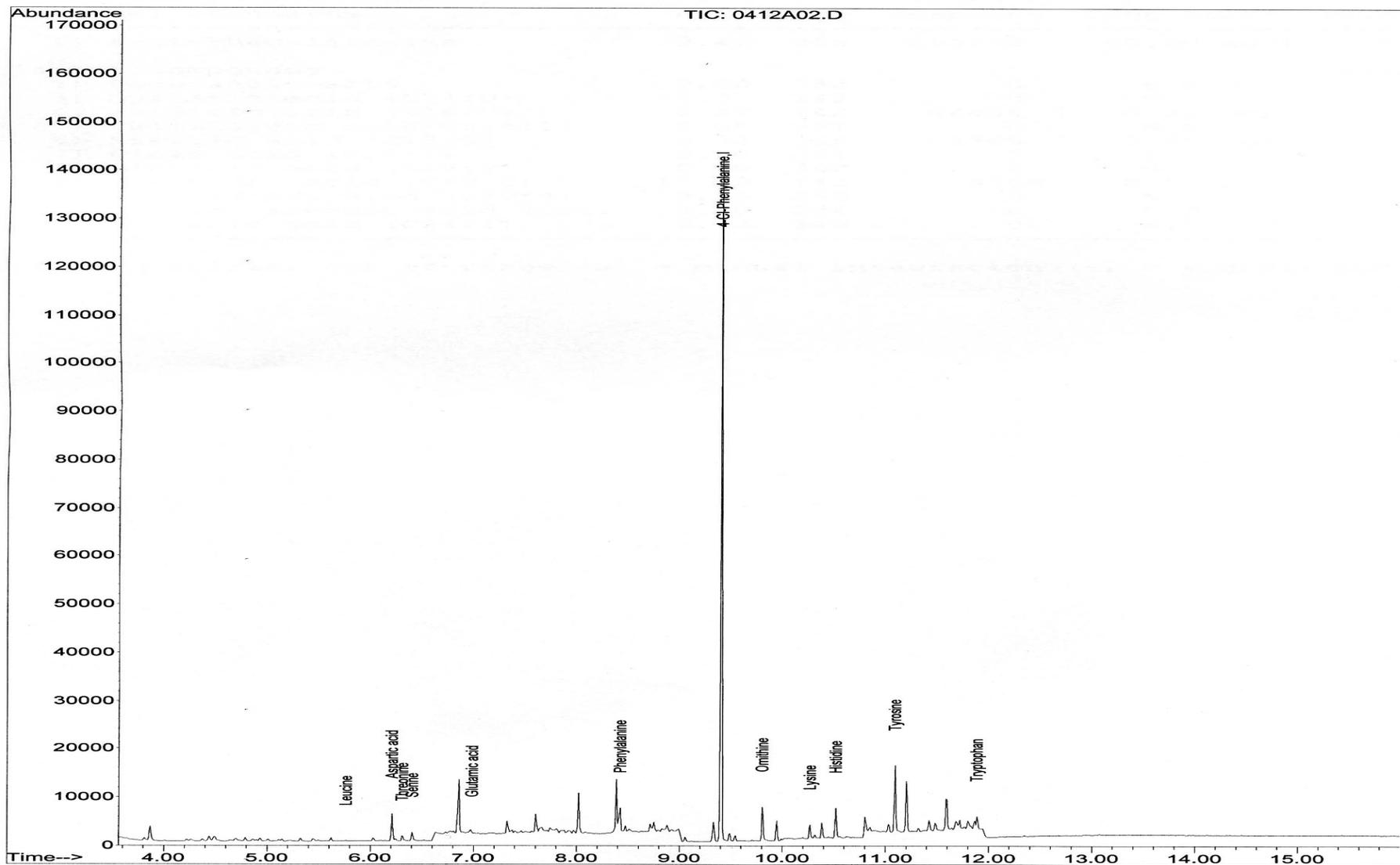
Amino acid	Water/reagent	Signal/Noise	Aliquot	Signal/Noise
Alanine				
Glycine			360	0,6
Valine				
Gamma aminobutyric acid				
Leucine			1296	4,9
Isoleucine				
Asparagine acid			39018	318,4
Threonine			9138	13,7
Serine	420	0,5	9288	15,4
Proline				
Asparagine	1039	0,3	1591	0,3
Glutamine acid			1808	6,2
Methionine				
Hydroxyproline				
Phenylalanine	559	4,1	26577	172,8
Cysteine				
Glutamine				
Ornithine			62834	125,0
Lysine	469	7,6	22596	65,7
Histidine	386	3,7	20545	208,9
Tyrosine	4942	2,5	122675	100,4
Cystine				
Tryptophan			712	6,0

asparagine acid, threonine, serine, glutamine acid, phenylalanine, ornithine, lysine, histidine and tyrosine.

Data Path : \\5972\c\HPCHEM\1\DATA\0412\
Data File : 0412A02.D
Acq On : 12 Apr 2006 17:42
Operator : Sobolevsky
Sample : sample of kosmos
Misc :
ALS Vial : 57 Sample Multiplier: 1

Atypicus 2

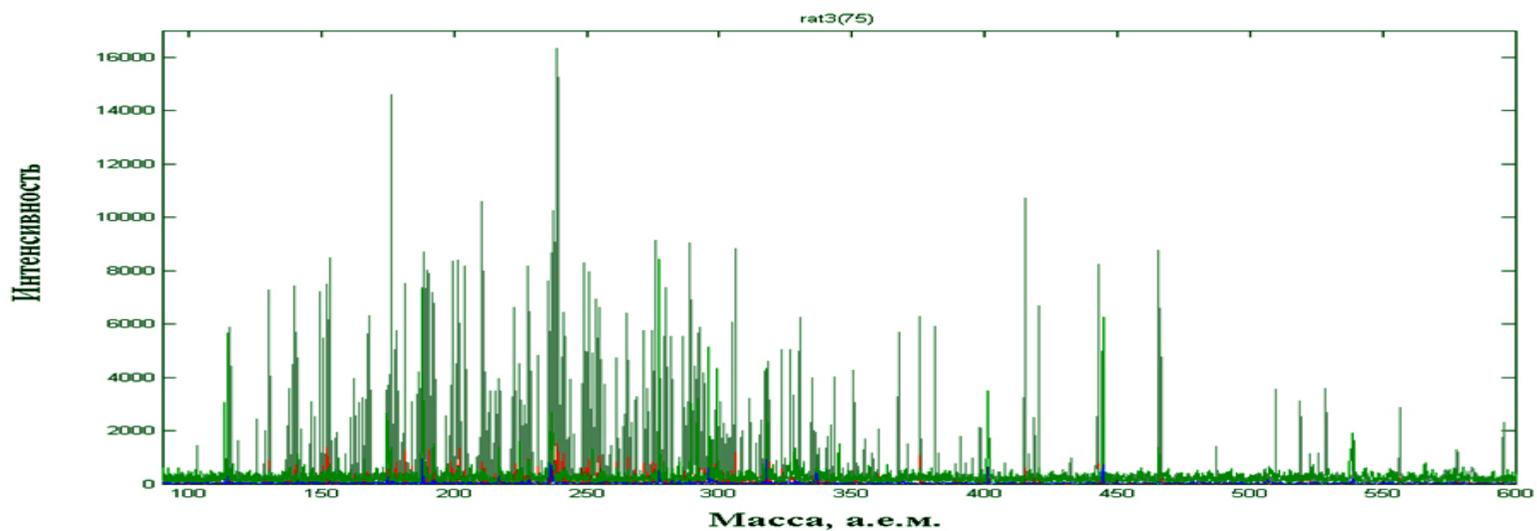
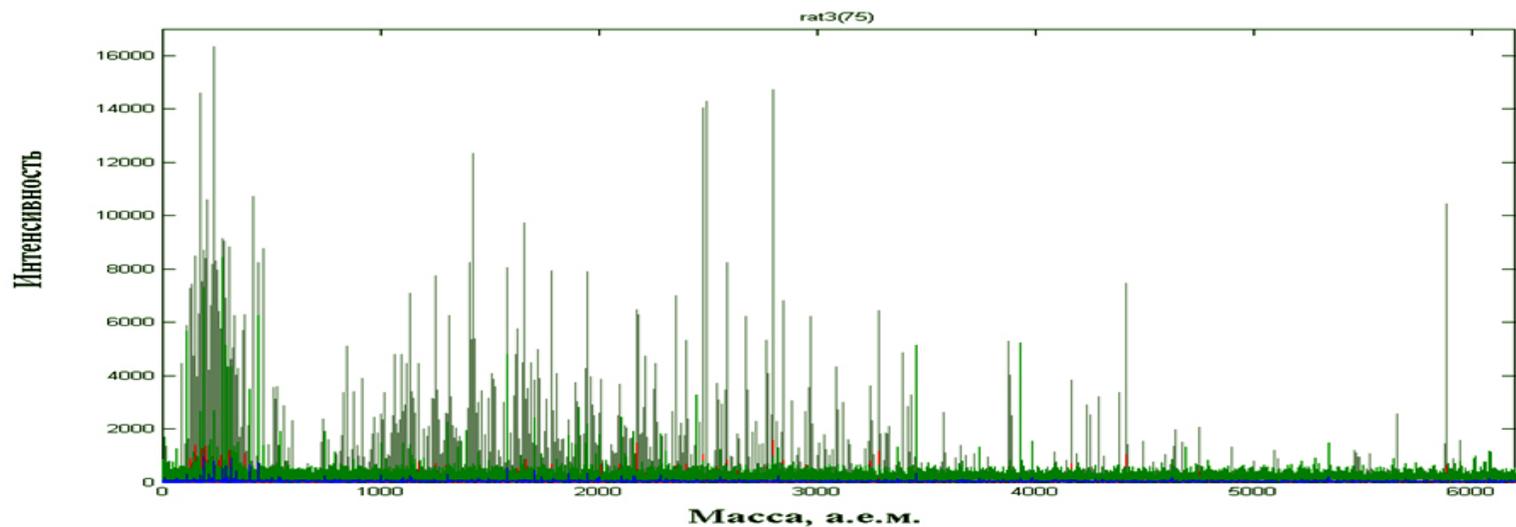
Quant Time: Apr 20 13:22:08 2006
Quant Method : D:\DATA\AAFA\AAFASIM.M
Quant Title : AA FA
QLast Update : Sun Feb 26 18:52:33 2006
Response via : Initial Calibration



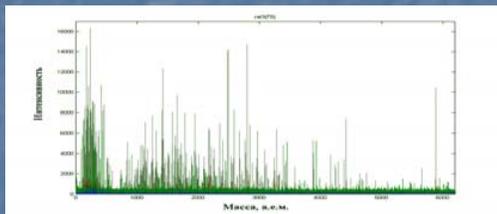
Идентифицированные аминокислоты

Название	Масса, а.е.м.	Контроль		Измерения		Обнаружено
		Вода/ реагент	Сигнал/ шум	Аликвота	Сигнал/ шум	
Аланин	89					
Глицин	75			360	0,6	-
Валин	117					
ГАМК	103					
Лейцин	131			1296	4,9	+
Изолейцин	131					
Аспарагиновая к-та	133			39018	318,4	+
Треонин	119			9138	13,7	+
Серин	105	420	0,5	9288	15,4	+
Пролин	115					
Аспарагин	132	1039	0,3	1591	0,3	-
Глютаминовая к-та	147			1808	6,2	+
Метионин	149					
Фенилаланин	165	559	4,1	26577	172,8	+
Цистеин	121					
Глютамин	146					
Орнитин	132			62834	125,0	+
Лизин	146	469	7,6	22596	65,7	+
Гистидин	155	386	3,7	20545	208,9	+
Тирозин	181	4942	2,5	122675	100,4	+
Цистин	268					
Триптофан	204			712	6,0	+

Название	Масса, а.е.м.	Контроль		Измерения		Обнаружено
		Вода/реагент	Сигнал/шум	Аликвота	Сигнал/шум	
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Триптофан	204			712	6,0	+



The spectrum and its fragment of a mixture of carbon and $(\text{NH}_4)_2\text{HPO}_4$ for a spot diameter of ~ 100 μm .



For molecular clouds:

We assume:

H и He gas $\sim 99\%$ (G)

Dust $\sim 1\%$ (possibly up to 5%) (D)

Estimate for particles with $\emptyset \sim 10^{-6}$ cm:

$$n_G / n_D \sim 10^8 - 10^9 \quad (*)$$

The most effective mechanism of H_2 formation: attachment to the dust particle

$$t_A \sim 1 / v_G \cdot n_D \cdot \sigma_D \sim 10^{15} \text{ s at } v_G \sim 10^5 \text{ cm/s}$$

Collision time for dust particles at $v_D \sim 10^7$ cm/s ($\sim 10\%$ of particles)

$$t_D \sim 1 / v_D \cdot n_D \cdot 2\sigma_D = 5 \cdot 10^{13} \text{ s}$$

Therefore, $\sim 10^4$ molecules are formed in one collision between the dust particles.

In the same time due to attachment on the dust particle $N_H \sim 5 \cdot 10^7$ molecules will be formed.

I.e., the process of H_2 formation will be $\sim 5 \cdot 10^3$ times more effective. But this is valid only for H_2 .

If we compare the efficiency of formation for organics molecules or for molecules based on C, N, O, S, then impact processes will turn to be comparable or even more effective.

It is related to the fact that the C, N, O, S prevalence is $\sim 10^{-4}$ times less than that of hydrogen.

$$\text{Then } N_D > N_G$$

Yield of molecular ions for dust particles impact at $V = 80$ km/s

We assume:

Molecular yield $\sim 10^{-2} - 10^{-3}$

The degree of ionization $\sim 10^{-2}$

Total yield of molecular ions $N_M \sim n_i \cdot 10^{-3} \cdot 10^{-2}$

Dust particle with $\emptyset \sim 10^{-6}$ cm and weight $3 \cdot 10^{-18}$ g ($\rho \sim 3$) will evaporate $\sim 3 \cdot 10^{-17}$ g of the matter in the form of plasma

The weight of synthesized molecules and molecular ions: $3 \cdot 10^{-19} - 3 \cdot 10^{-20}$ g

The number of synthesized molecules and molecular ions:

$$N_M \sim 10^3 - 10^4$$

for molecule mass $\sim 20-30$ a.m u.

Check: From laboratory dust-impact experiment ($V \sim 65$ km/s)

$$Q = c \cdot m \cdot v^\beta = 8,5 \cdot 10^{-3} \cdot 3 \cdot 10^{-21} \text{ kg } (80 \text{ km/s})^{4,74}$$

$$Q \sim 2,6 \cdot 10^{-14} \text{ Coulomb}$$

$$N_i \sim 10^5$$

The total amount of the matter will be

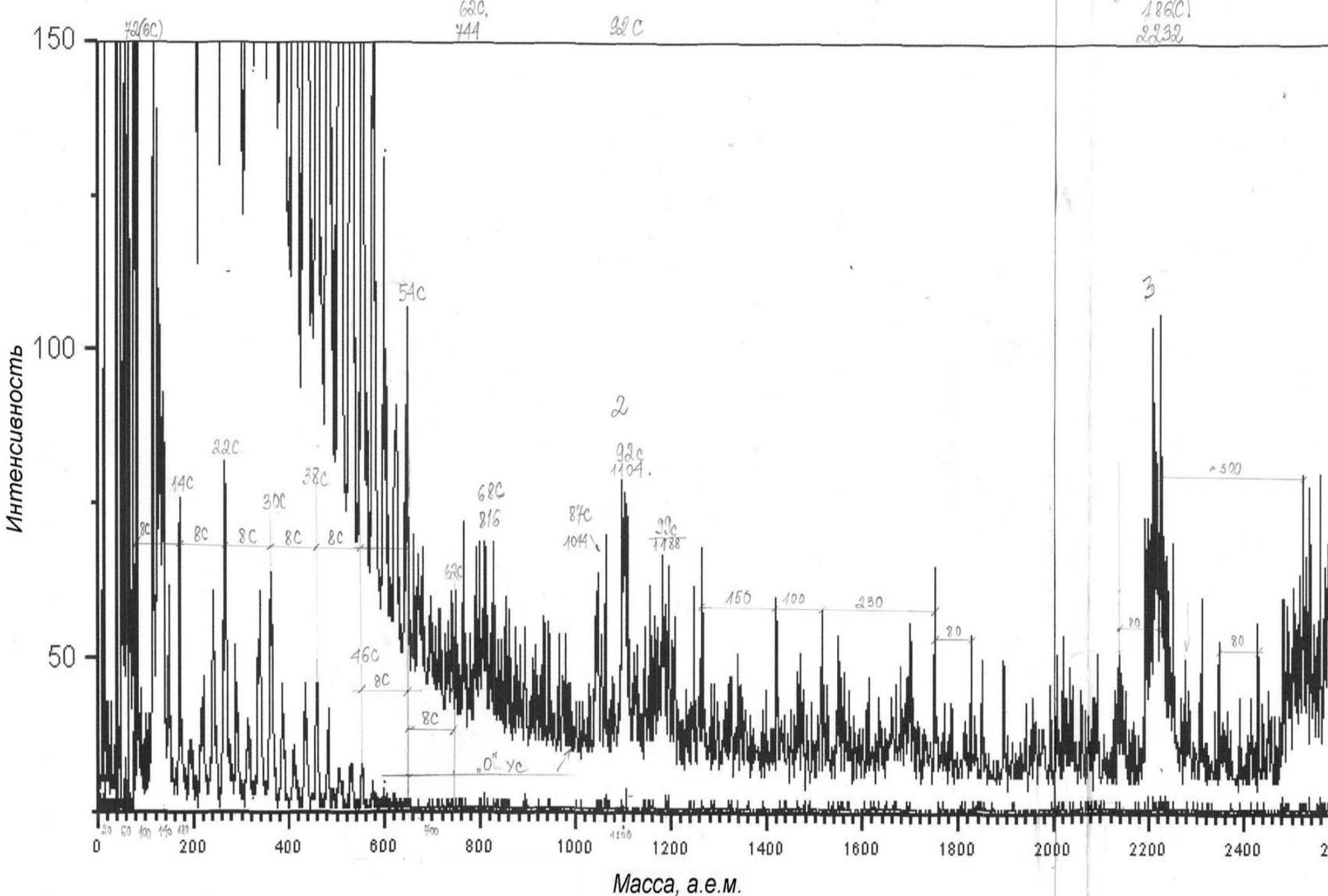
$$\Sigma N_{i+N} \sim 10^7$$

$$\text{and } N_M \sim 10^7 \cdot 10^{-3} \sim 10^4 \text{ molecules}$$

i.e., we have an agreement by the order of magnitude

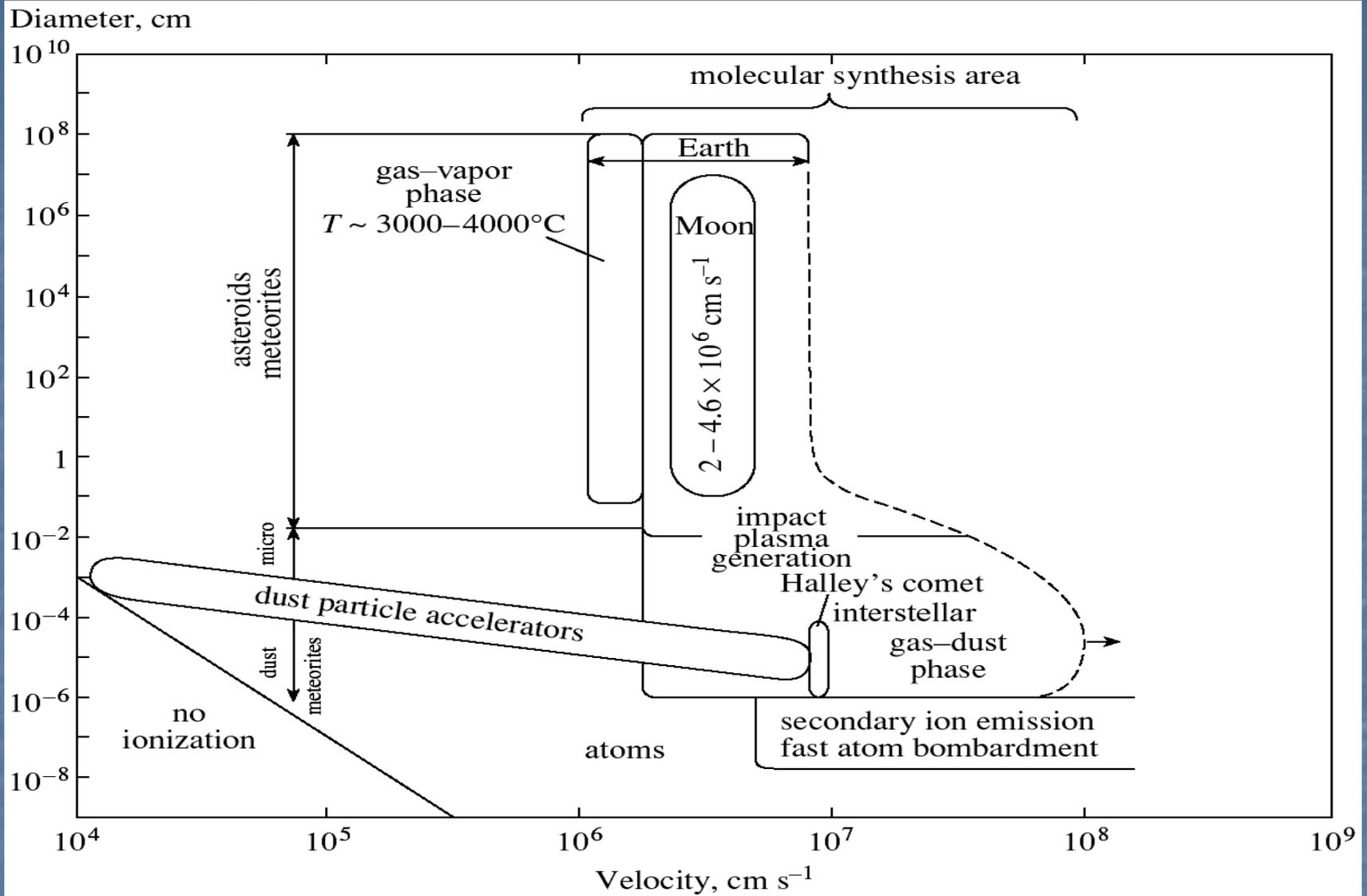
The offered hypothesis on the following experimental results is based:

- found out in a torch asymmetric, no equilibrium electromagnetic fields the requirements local chirality's one is satisfied
- plasma instability generation in a torch occurrence of the circular-polarized radiation are capable to provide
- presumable breaking of symmetry in a place and on time with process of isomers synthesis is coinciding
- at amino acids of a biological and space origin same "sign" of chirality's is observed

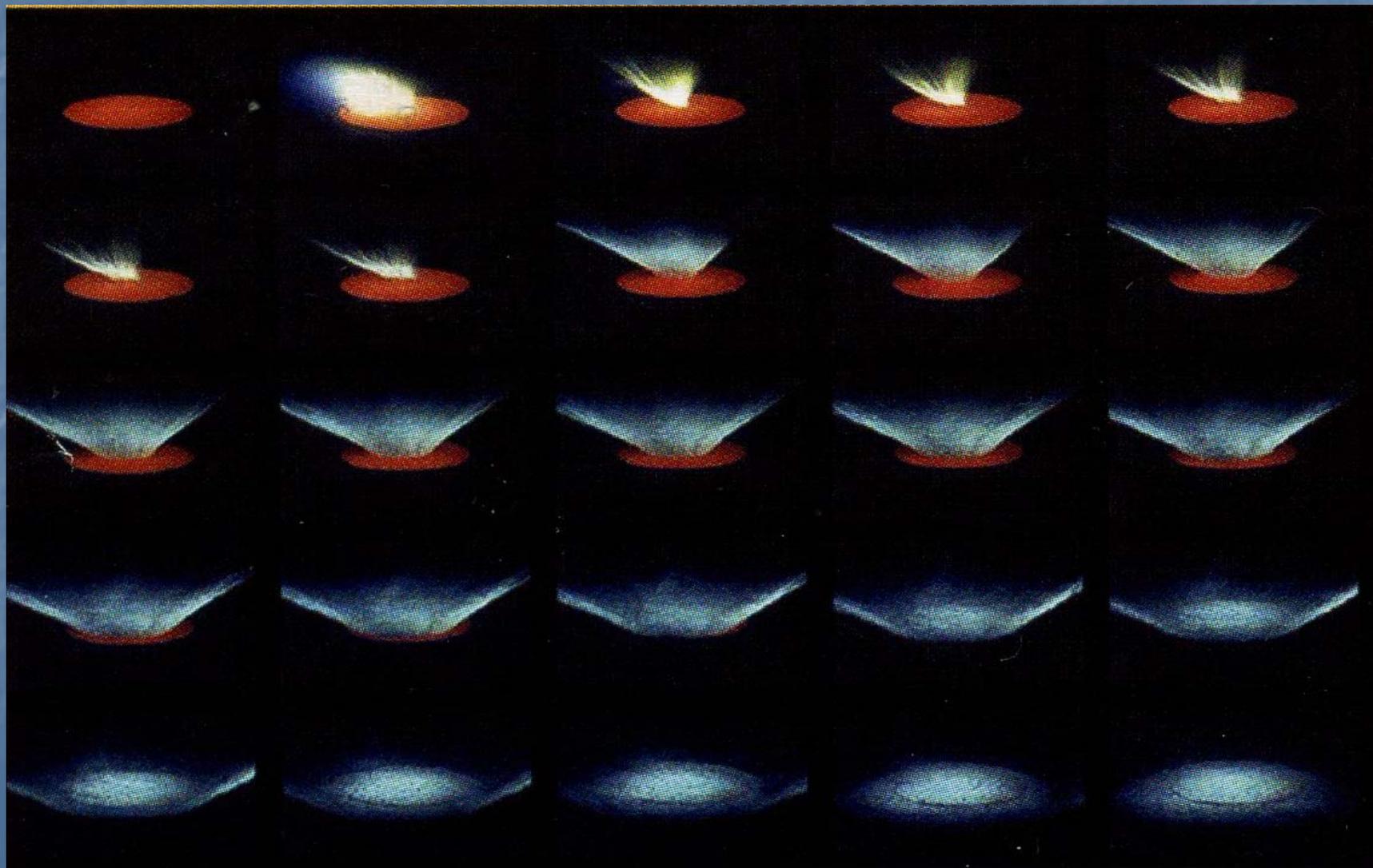


Mass	Atomic ions	Molecule based on			Name
		C	N	O	
12	C	–			
13	C	CH			
14	N	CH ₂			
15	–	CH ₃	NH		
16	O	CH ₄	NH ₂		methane
17	–	–	NH ₃	OH	ammonia
18	–	–	NH ₄	H ₂ O	
19	F	–		H ₃ O	
24	Mg	C ₂			
25	Mg	C ₂ H			
26	Mg	C ₂ H ₂	CN?		acetylene
27	Al	C ₂ H ₃	HCN?		
28	Si	–	N ₂		
29	Si	–	CH ₂ NH		carbamide
30	Si	CH ₂ O		NO	formaldehyde
34	S	–	–	H ₂ O ₂	
36		C ₃			
37	Cl	C ₃ H			
38	–	C ₃ H ₂			
39	K	C ₃ H ₄			
40	Ca	C ₃ H ₄	C ₂ H ₂ N?		allene
41	K	–	C ₂ H ₃ N		
42	–			C ₂ H ₂ O	ketene
43	–		NHCO		
44	Ca	C ₂ H ₄ O	HNCHO		acetaldehyde
46	Ti	C ₂ H ₆ O	NO ₂	CH ₂ O ₂	ethanol/formic acid
48	Ti	C ₄			
49	Ti	C ₄ H			
50	V	C ₄ H ₂			
51	V	C ₄ H ₃			
60		C ₅			detected
72		C ₆			also
84		C ₇			C _n H _m
96		C ₈			n up to 10
108		C ₉			m up to 14
120		C ₁₀			

The mass peaks of the experimentally detected polyatomic ions and their interpretation



The overall picture of impact plasma generation in various processes in nature and in a laboratory as a function of the body size and velocity



Yield of molecular ions for dust particles impact at $V = 80$ km/s

We assume:

Molecular yield $\sim 10^{-2} - 10^{-3}$

The degree of ionization $\sim 10^{-2}$

Total yield of molecular ions **$NM \sim n_i \cdot 10^{-3} \cdot 10^{-2}$**

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The number of synthesized molecules and molecular ions:

$$NM \sim 10^3 - 10^4$$

for molecule mass $\sim 20-30$ a.m.u.

Check: From laboratory dust-impact experiment ($V \sim 65$ km/s)

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$$Q \sim 2,6 \cdot 10^{-14} \text{ Coulomb}$$

$$N_i \sim 10^5$$

The total amount of the matter will be

$$\Sigma N_i + N \sim 10^7$$

$$\text{and } NM \sim 10^7 \cdot 10^{-3} \sim 10^4 \text{ molecules}$$

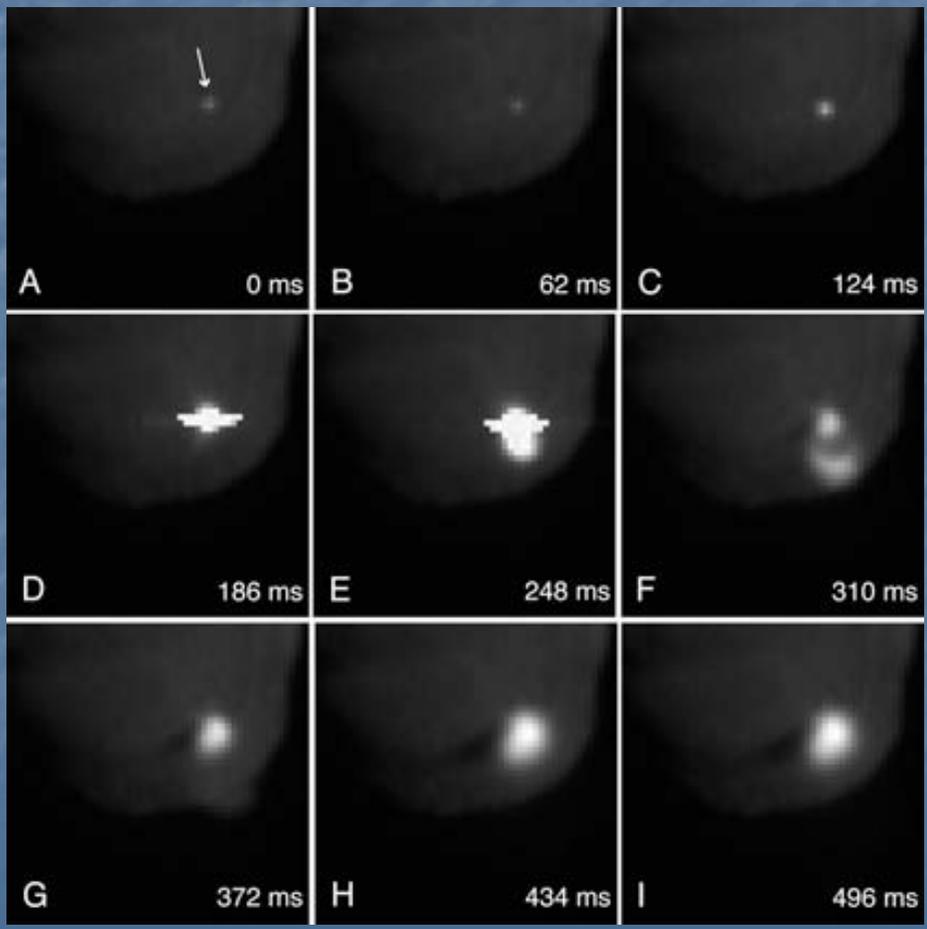
i.e., we have an agreement by the order of magnitude



Dependence of mass of OC synthesized in a plasma torch from effective diameter projectile, duration of laser action and the target composition.
 *the identified substance are noted.

Название	Масса, а.е.м.		Контроль		Измерения	
	Обнаружено	Вода/реагент	Сигнал/шум	Аликвота	Сигнал/шум	
Аланин	89					
Глицин	75		360	0,6	-	
Валин	117					
ГАМК	103					
Лейцин	131		1296	4,9	+	
Изолейцин	131					
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Тирозин	181	4942	2,5	122675	100,4	+
Цистин	268					
Триптофан	204			712	6,0	+

- At the stage of formation, surface of planets experience intensive meteorite bombardment
- Meteorites and asteroids are accelerated in gravitational field of the planet to the velocities of ~ 100 km/s





The most important properties of an alive matter have appeared at a chemical or pre-biological stage of the evolution of a life.

85 year long attempt to understand why, how and in what conditions these unique properties of the matter were formed is hard to call successful.

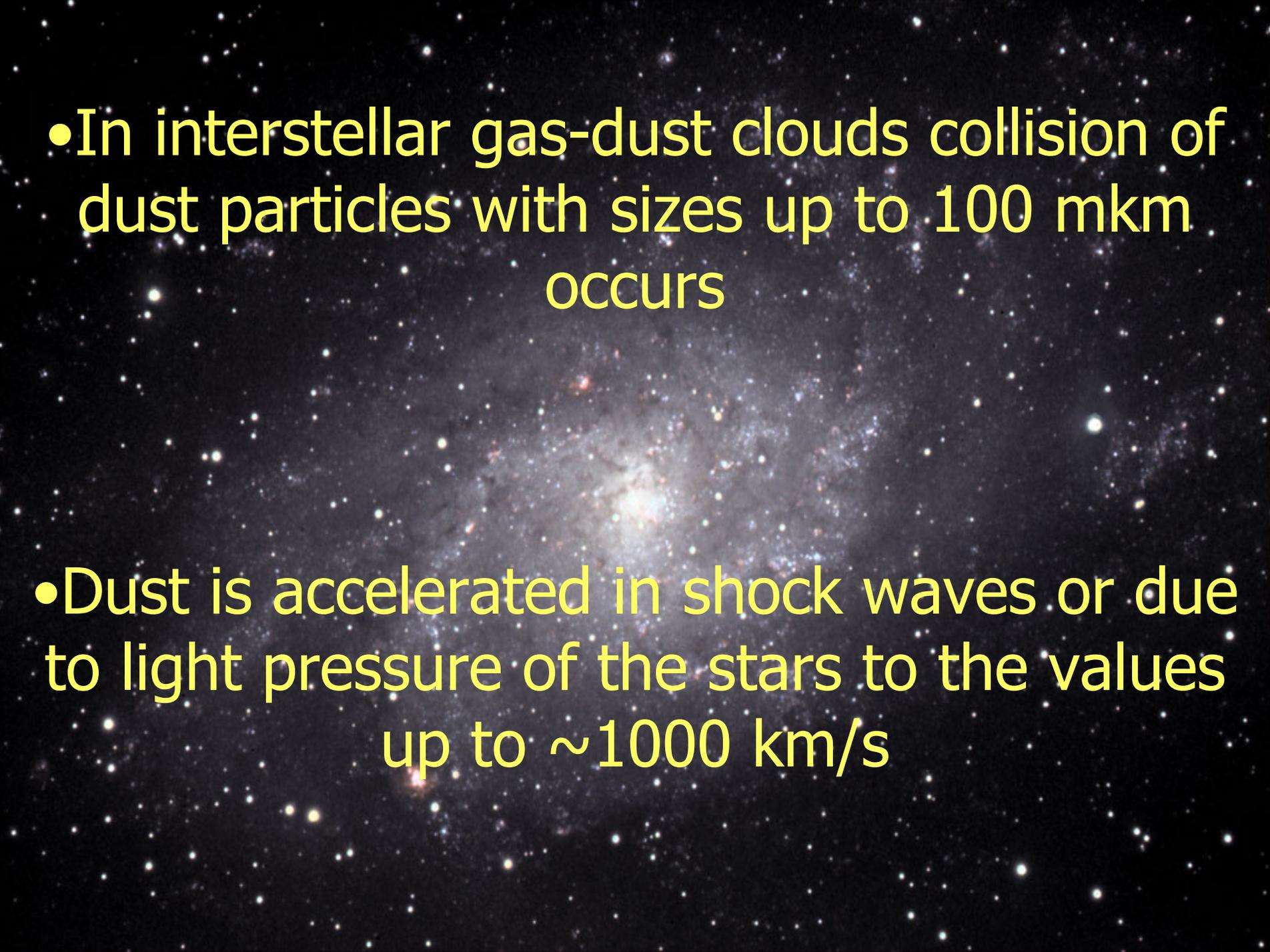
- At the beginning of a new century natures mediums or mechanisms of synthesis which were not considered and studied for a reconstruction of processes of a chemical stage of evolution practically have not remained.
- Therefore, the experimental discovery of an early unknown unique property of the plasma torch, providing synthesis of high-molecular polymeric OC, is necessary to consider as exclusive great success.
- Surprisingly how such important feature of impact plasma had escaped from the attention of many researchers.





- At the stage of formation, surface of planets experience intensive meteorite bombardment

Meteorites and asteroids are accelerated in gravitational field of the planet to the velocities of ~ 100 km/s

The background of the slide is a deep space photograph. It features a dense field of stars of various colors (white, yellow, red, blue) scattered across a dark, black sky. In the center of the image, there is a bright, multi-colored galaxy, likely the Andromeda Galaxy, showing a mix of blue, white, and red hues. The overall appearance is that of a vast, star-filled universe.

- In interstellar gas-dust clouds collision of dust particles with sizes up to 100 μm occurs

- Dust is accelerated in shock waves or due to light pressure of the stars to the values up to $\sim 1000 \text{ km/s}$







Past and future of impact and laser mass-spectrometry in Space.

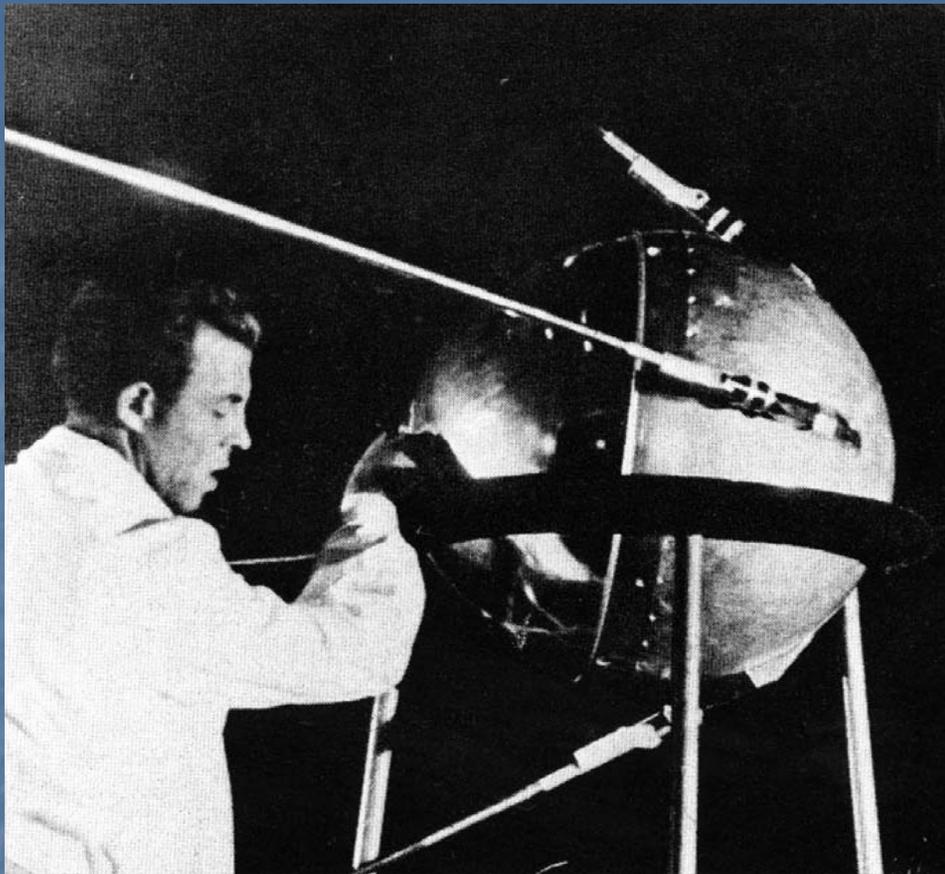
G. Managadze, Prof., PhD

Space Research Institute (IKI), Russian Academy of Sciences

Profsouznaya 84/32, GSP7, Moscow 117997, Russia

managa@iki.rssi.ru +7 (495) 333-42-02

fax 333-12-48 for 504 lab.



СПУТНИК at its 50th anniversary, to the joy of its creators, became a symbol of the most important achievement of the humanity.

This is in consonance with the words of Neil Armstrong when he made his first step on the Moon.



СПУТНИК-for the scientists meant long-awaited breakthrough in space. It allowed to:

- research Universe above the atmosphere;
- directly touch space bodies;
- use unlimited and high-vacuum space for large-scale physical experiments.

Significance of these tasks turned **СПУТНИК** into property of all humanity.

- These researches also provided access to the material evidences of the history of our planet's formation, written in the stone annals of the Moon and other space bodies. These material evidences were completely destroyed on the Earth.
- All above mentioned called for development and creation of new generation of space mass spectrometer's. Some of this instruments became well knows.

- At the 10th anniversary of **СПУТНИК** was born a new scientific direction of researches. It's aim was to study the properties of the medium by directed and active influence of an electron beams, plasma jets and radio-emissions on the magnetosphere of Earth.
- Development of these researches had defined scientific interest of many scientists for many decades.

- Active experiments such as Araks, ECHO, Porcupine, have been connected with the names of Hess, Sagdeev, Winkler, Lust, Hearendel, McEntiere, Kellogg, Cambou, Pella, Kawasima. They have made basis for the future quality leap in the researches of this type.
- Therefore, already in 80ties active experiments were started to use for the investigation of planets and small bodies of Solar System, including nucleus of comets.
- Cold war couldn't stop the formation of international united society for the investigation of this new direction. Its members knew each other well, and were like-minded friends that could help to solve not only scientific problems

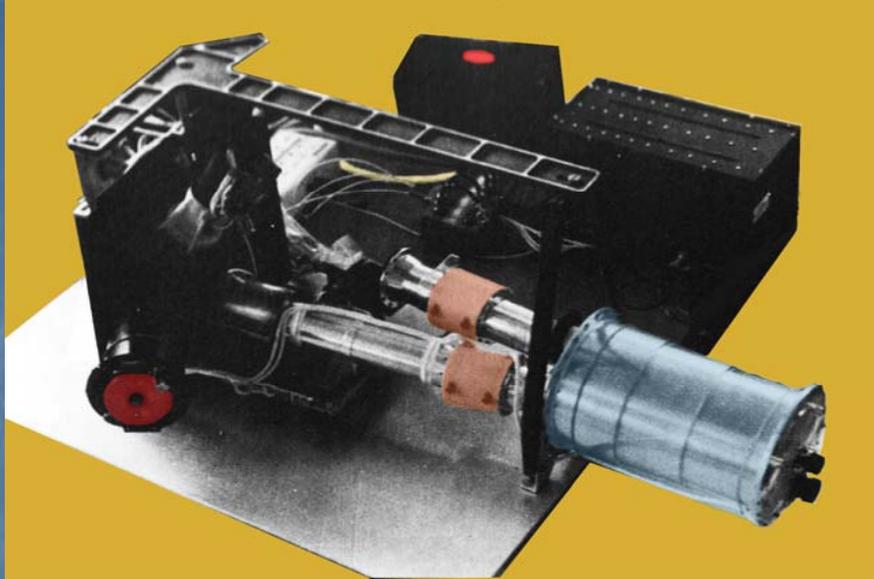
- Official history and scientific results of the missions as VEGA or Phobos are well known. However, there were some not widely-known episodes that had played crucial role or led to dramatic consequences.
- Fruitful scientific cooperation gave birth of whole generation of a new on-board mass spectrometers and also provided generation of new ideas in the scientific fields that were not directly connected with space researches.
- VEGA and Phobos projects became first open projects in USSR, in which foreigners could participate from the very first days of project realization.

Each of Space Missions, Spacecraft or Instruments, as well as people, have different fates-from fortunately to dramatic.

An example of lucky instrument is PUMA.

But, unfortunately, the fate of well-known at the development study long distance laser MS LIMA-D was dramatic, because spacecraft hadn't reach the target.

However, as will be shown later, the general ideas and technical solutions of LIMA-D instrument will be used on all amounts during creation of long distance impact MS



Genealogy of instrument's. Appearance and creation.

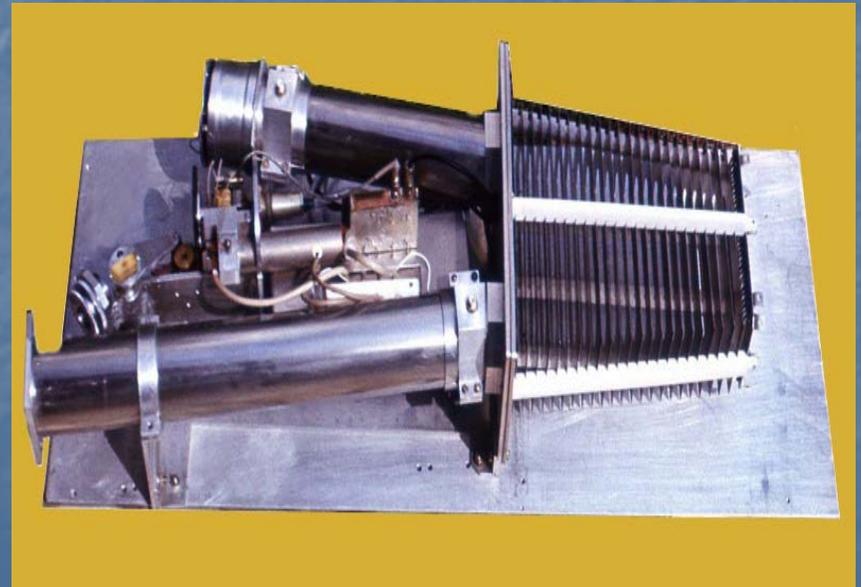
At beginnings were developed dust-impact MS PUMA.

LIMA-laser ablation MS were created for laboratory testing of PUMA .

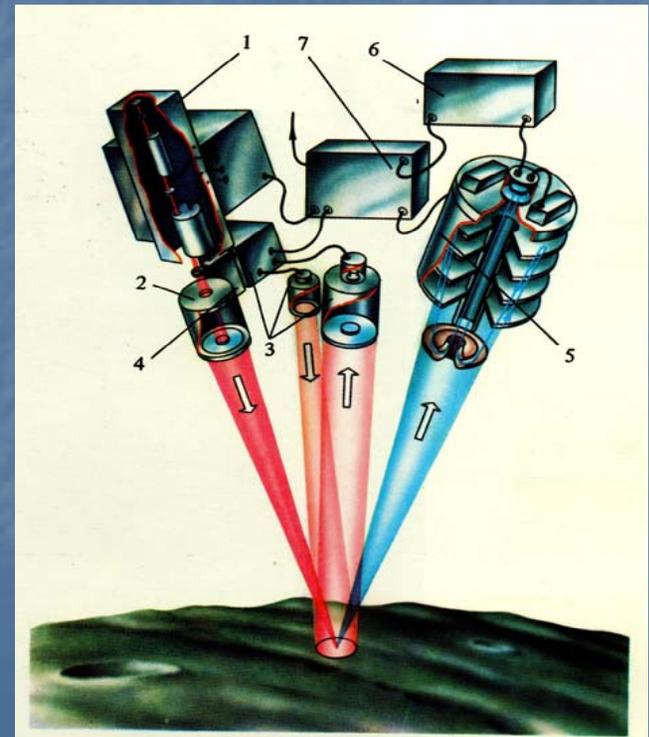
LIMA was also planned for the mass and isotopic composition measurements of Phobos regolith.

It was planned to deliver the sample to the spacecraft by harpoons in the framework at first version of closed Soviet project Phobos.

However, project authorities were concerned with reliability of harpoons and LIMA was removed from board.



This had stimulated development of laser long distance MS LIMA-D which was capable to make same measurements from 80-meter distance.



- PUMA's success before launch partly had been provided by LIMA. In particular, when PUMA was practically ready, laboratory of investigations modeling impact plasma torch with the help of LIMA's laser, had shown, that high density plasma, produced from big dust particles can shield electric field which accelerates ions and completely ruin such important measurements.
- Fortunately, a simple solution was found that allowed to optimize almost ready instrument. This was made very quickly and gave possibility to obtain expected results.

- ❑ The fly-bys of VEGA-1 and VEGA-2 spacecraft near Halley comet in March 1986 PUMA experiments first in the world gives data of elemental and mineralogical composition of cometary's dust particles.
- ❑ During these measurements organic component in dust particles were discovered.
- ❑ At next twenty years these data remained unique up to return of cometary's dust to the Earth in 2006 by Stardust spacecraft.

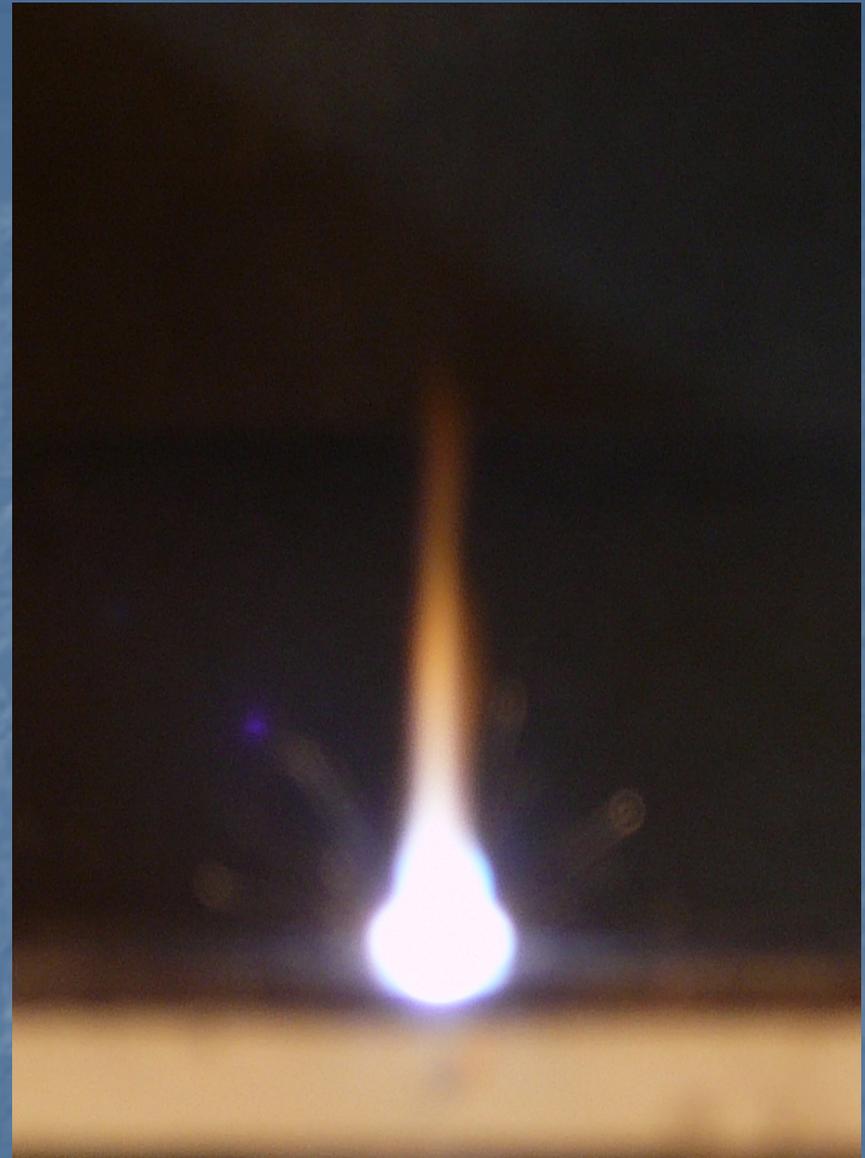
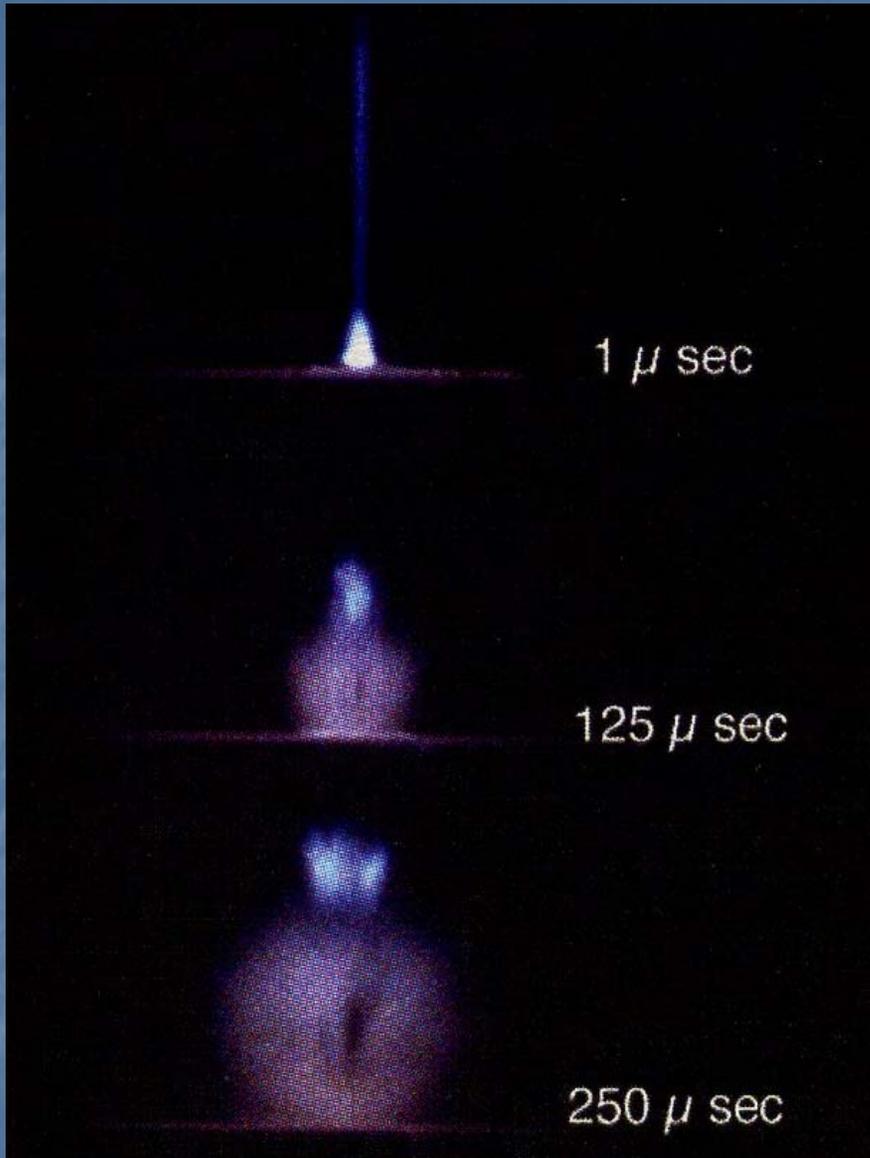
- The knowledge accumulated during study of earlier unknown properties of plasma torches of impact and laser origin in the frame of VEGA mission and experience by created LIMA-D instrument for PHOBOS mission turned out to be crucial later.
- In particular obtained experience was used after 15 years:
 - during the development of a new concept of life prehistory and
 - for beginning the creation of new generation of long distance impact TOF MS.

- Our recent experimental investigations showed that
- the plasma torch arising during SHV-colliding of fragments of the matter is the most suitable among known mediums for high-molecular, polymeric OC synthesis and
- hypothetical breaking of mirror symmetry.

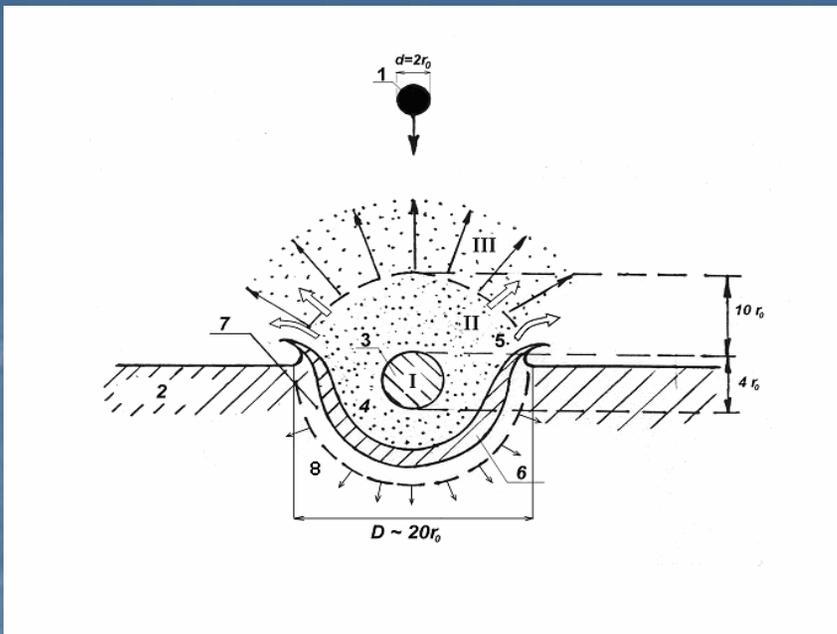
□ If the velocity of meteorite is higher than $\sim 15\text{-}20$ km/s, it's body and part of the Earth surface form high-temperature, completely ionized and atomized plasma torch and the impact crater.



□ This phenomenon is called Super High Velocity Impact (SHVI).



The plasma torches generated under the influence of SHVI (left) and the laser radiation (right) are identical.

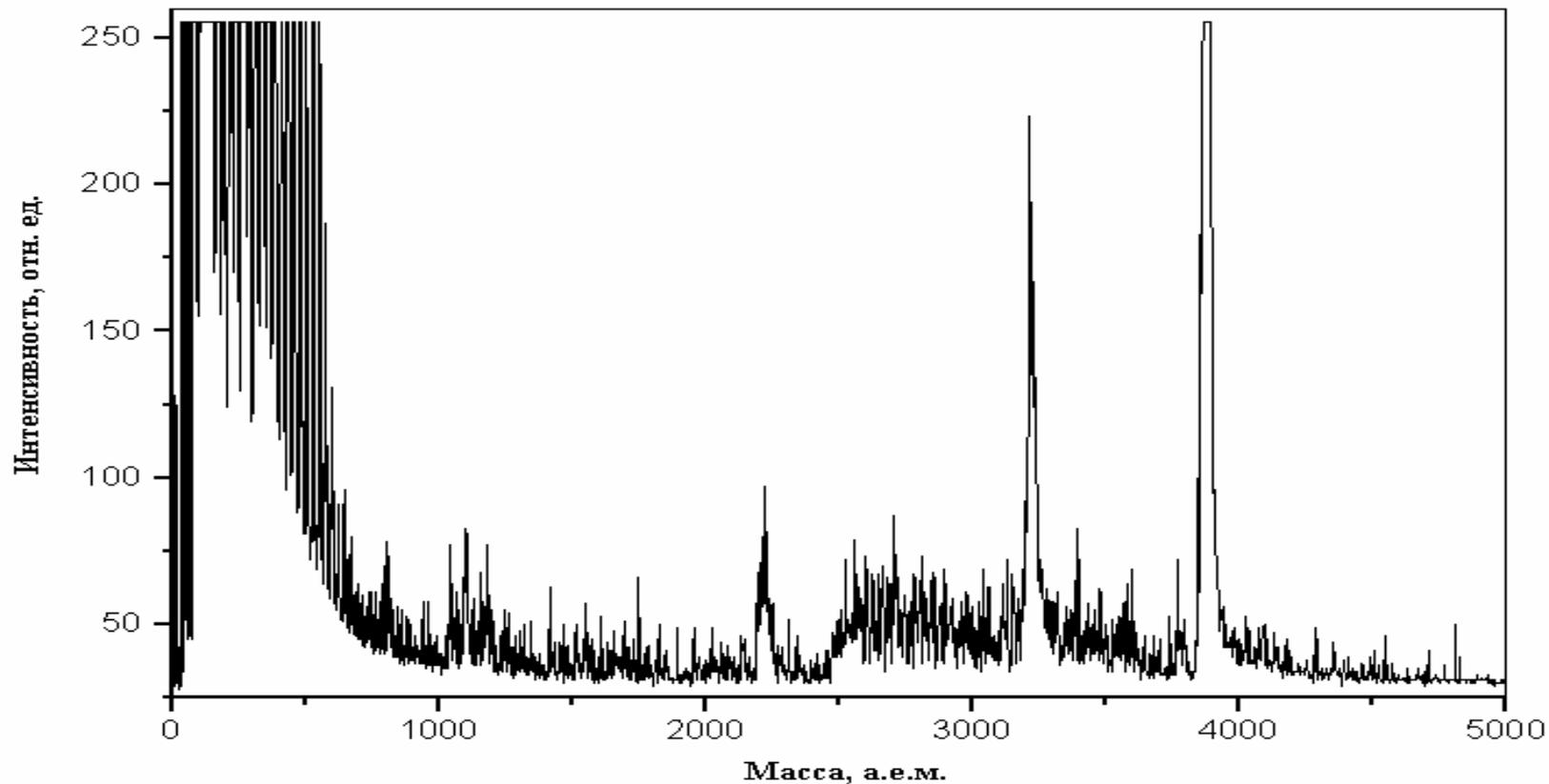


During adiabatic expansion, in a mode of "free" fly, the medium of plasma torch has the following unique properties:

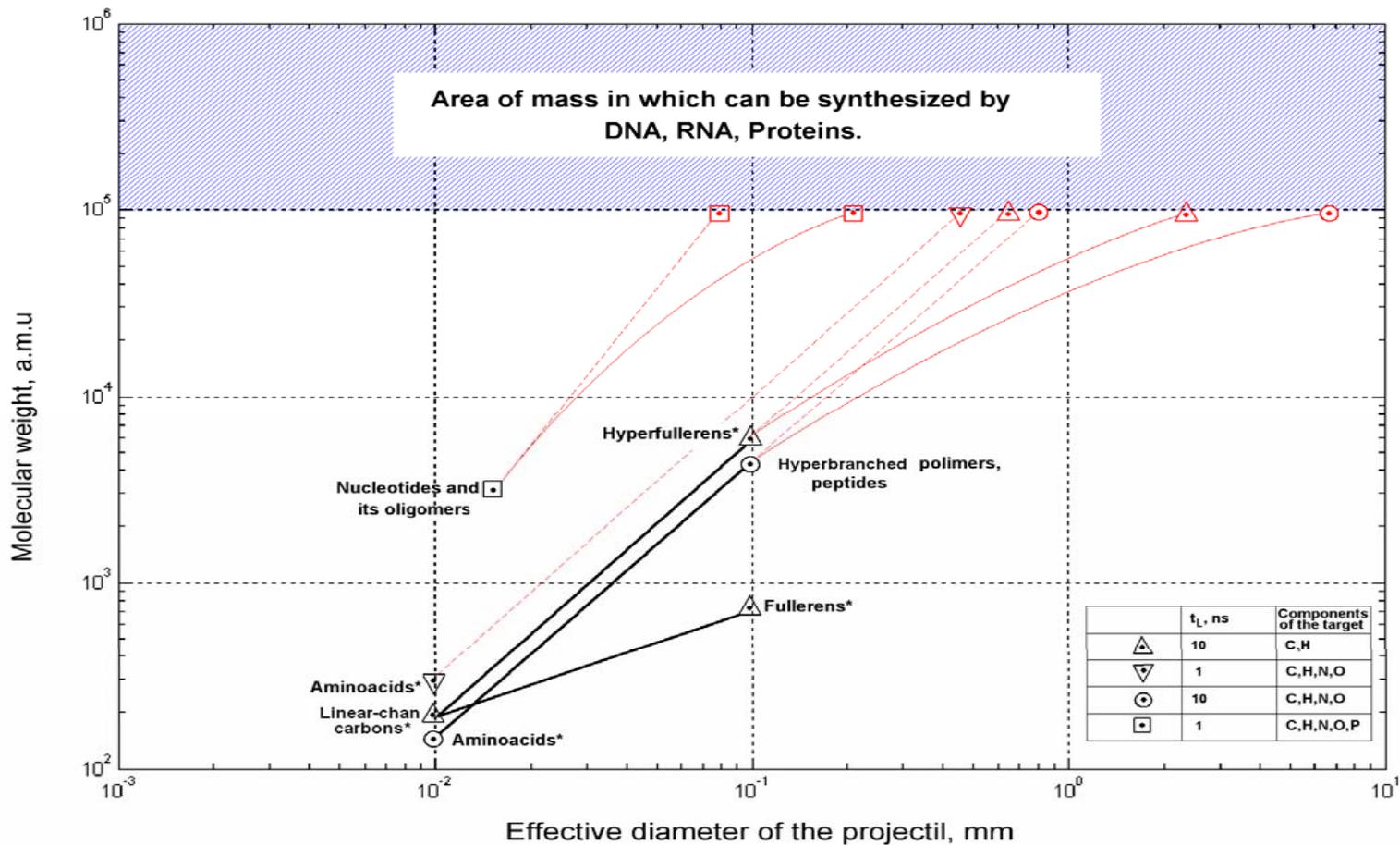
- association of the elements in a new compounds in plasma-chemical processes;
- maintenance of irreversible character of the reactions with fast remove of an intermediate products from the area of the reactions;
- involving of these products in the subsequent processes leading to their complication;
- fast self-assembly and ordering of OC due to the processes of plasma catalysis;
- hypothetically, breaking of mirror symmetry.

The most important, new properties of SHVI and of plasma torch include:

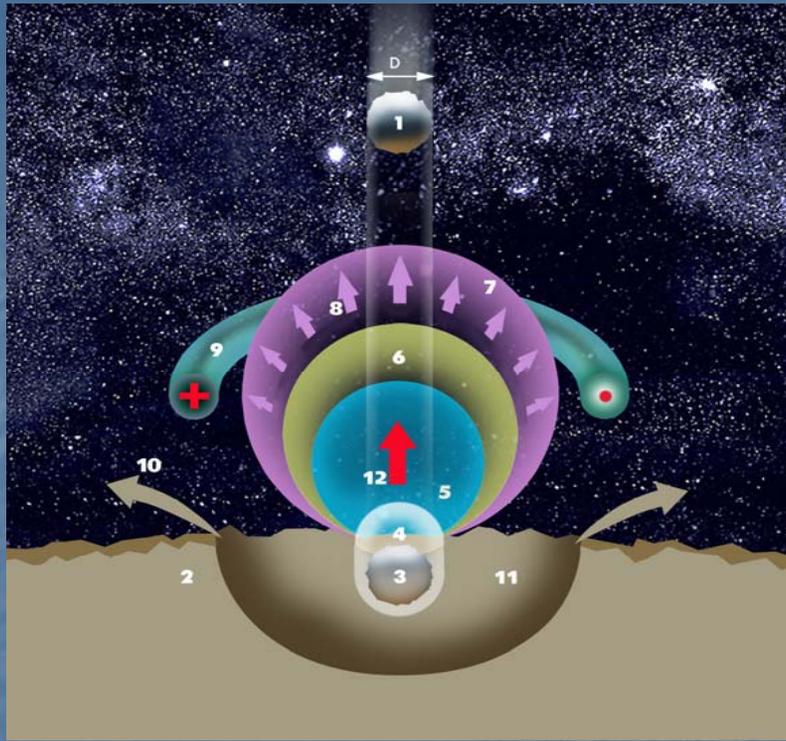
- Power density in the impact exceeds solar in $\sim 10^{13}$ - 10^{14} times.
- The initial density of a substance is higher than atmospheric in $\sim 10^6$ times.
- Chemical reactions in the torch proceed in $\sim 10^8$ times faster than in laboratory condition.
- The temperature of the plasma during “free” expansion decreases quickly from $\sim 10^5$ - 10^6 °C to the temperature of an environment.
- Possibility to realize the unlimited attempts to form “right” OC through changing of the initial conditions of synthesis in an enormous range of their characteristics.
- Possibility of injecting the synthesized OC into a subsurface water reservoirs.



Spectrum of carbon and $^{15}\text{NH}_4^{15}\text{NO}_3$, mix received at laser radiation spot diameter 1,5-2мм. The mass peaks 2250, 3250, 3900 a.m.u. was interpreted as dendritic type, hyperbranched polymer OC, mass peaks in regions 1000-2000 and 2500-3100 a.m.u.- as peptides. (A full spectrum).

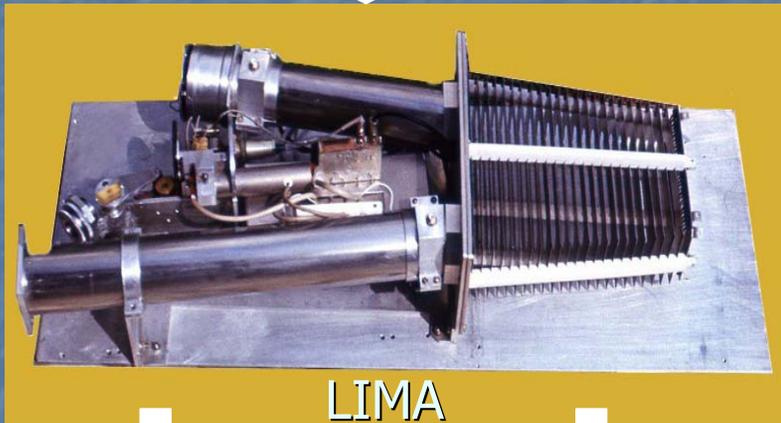
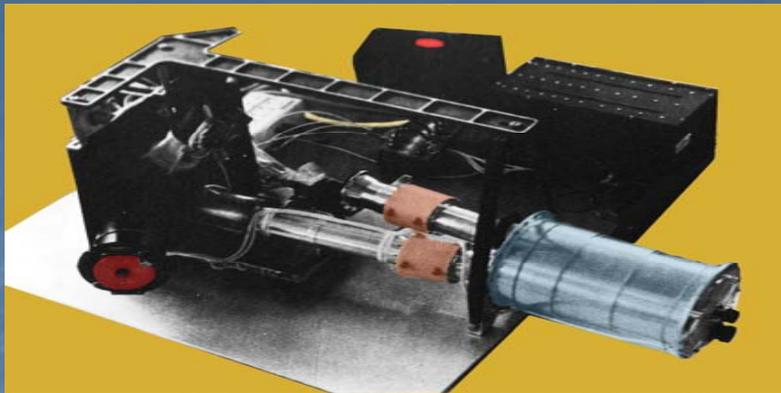


Names and masses values of synthesized in a plasma torch OC depending on laser spot diameter (recounted on projectile effective diameter), duration of laser influence and the target composition. (*the identified compounds are noted).

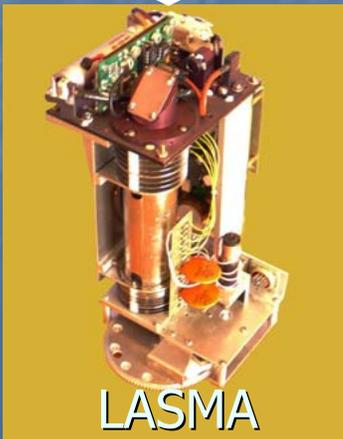


Proposed hypothesis
of symmetry breaking
is based on the
following experimental
results:

- no equilibrium electromagnetic fields meet the requirements of local chirality fields;
- plasma instabilities may generate circular-polarized radiation;
- process of symmetry breaking and isomers synthesis coincide in time and space;
- amino acids of biological and space origin have same-L-“sign” of chirality.



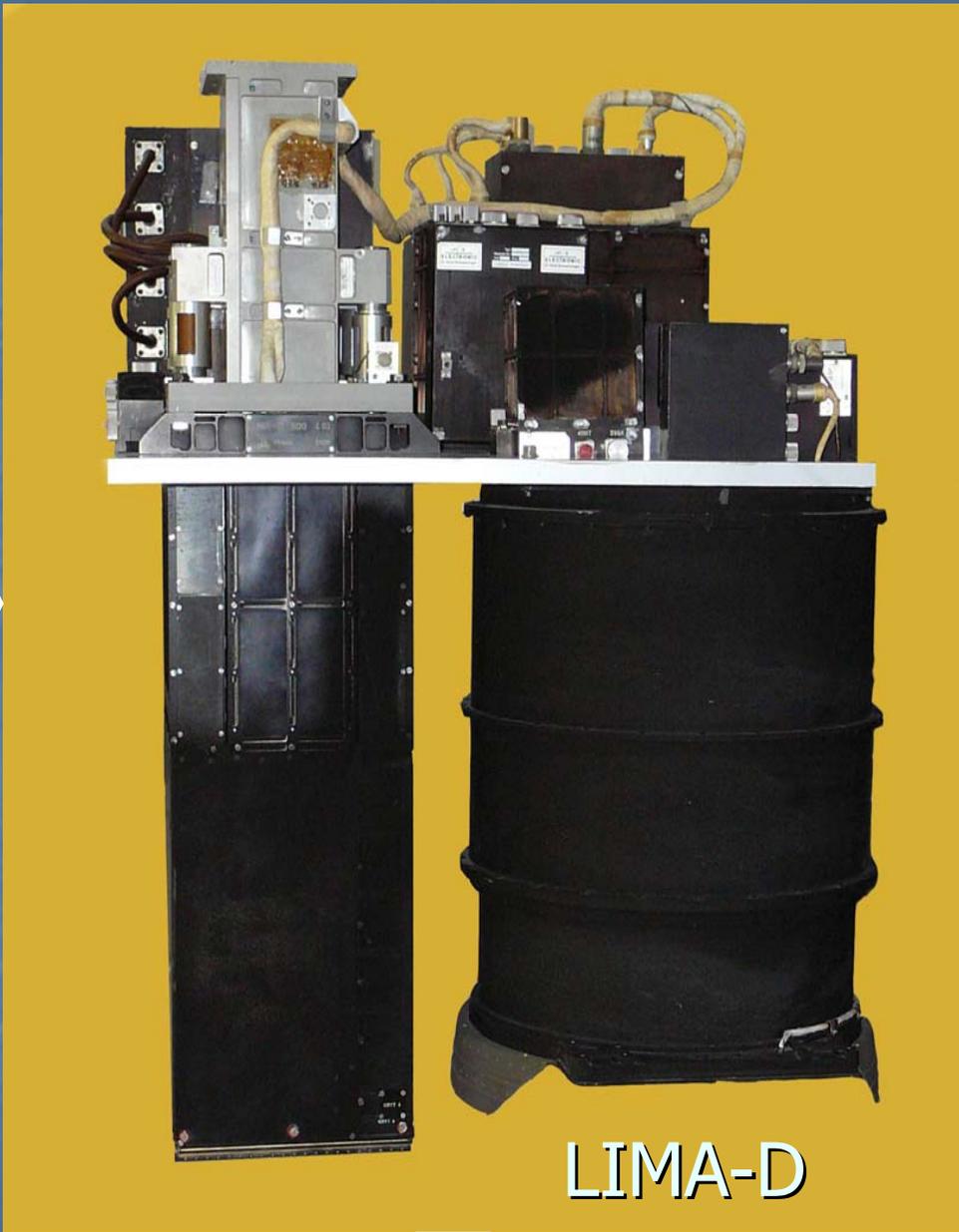
LIMA



LASMA

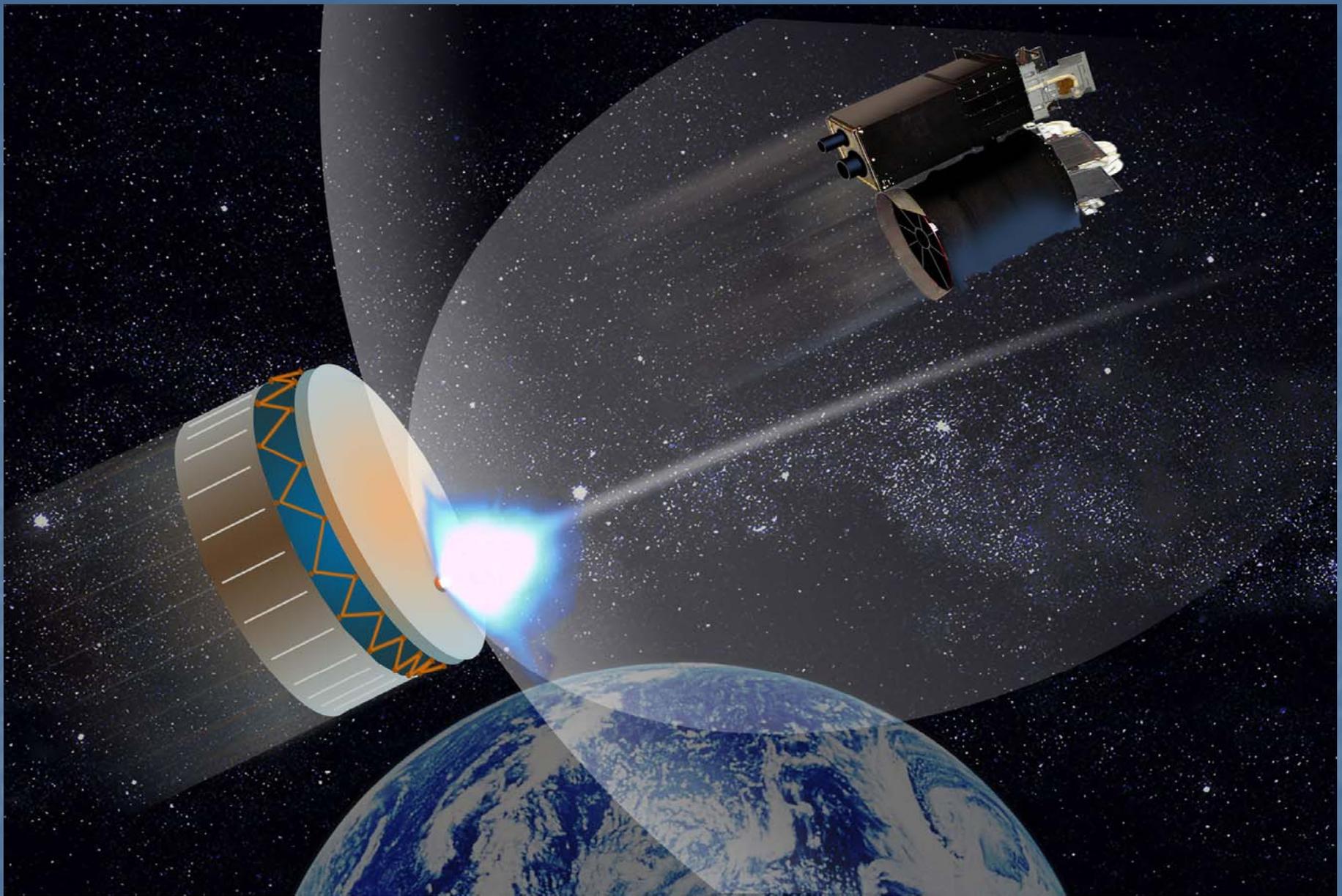


MTOF



LIMA-D





The experiment COUNTER IMACT and long distains impact mass-spectrometer.

Conclusion

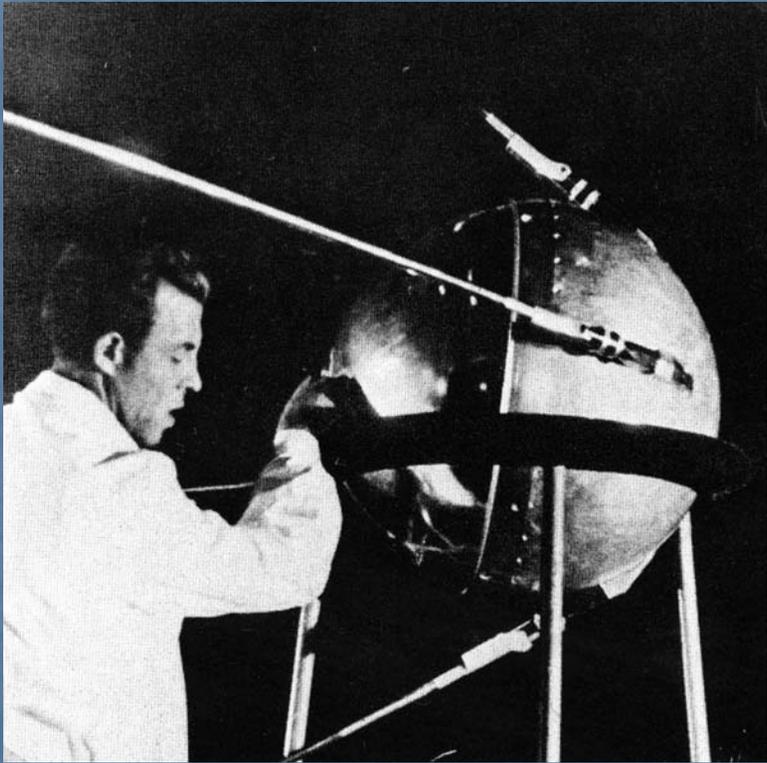
The presented concept of SHVI-active experiment in magnetosphere allows:

- to reproduce processes of SHVI for their deeper study by methods of impact MS.
- to investigate plasma torch new properties related to the synthesis of complicated OC
- and which is most important today, to conduct these experiments at the orbits that 50 years ago had been pioneered by

СПУТНИК



- Sputnik at its 50th anniversary, to the joy of its creators, became a symbol of the most important achievement of the humanity.
- This is in consonance with the words of Neil Armstrong when he made his first step on the Moon.



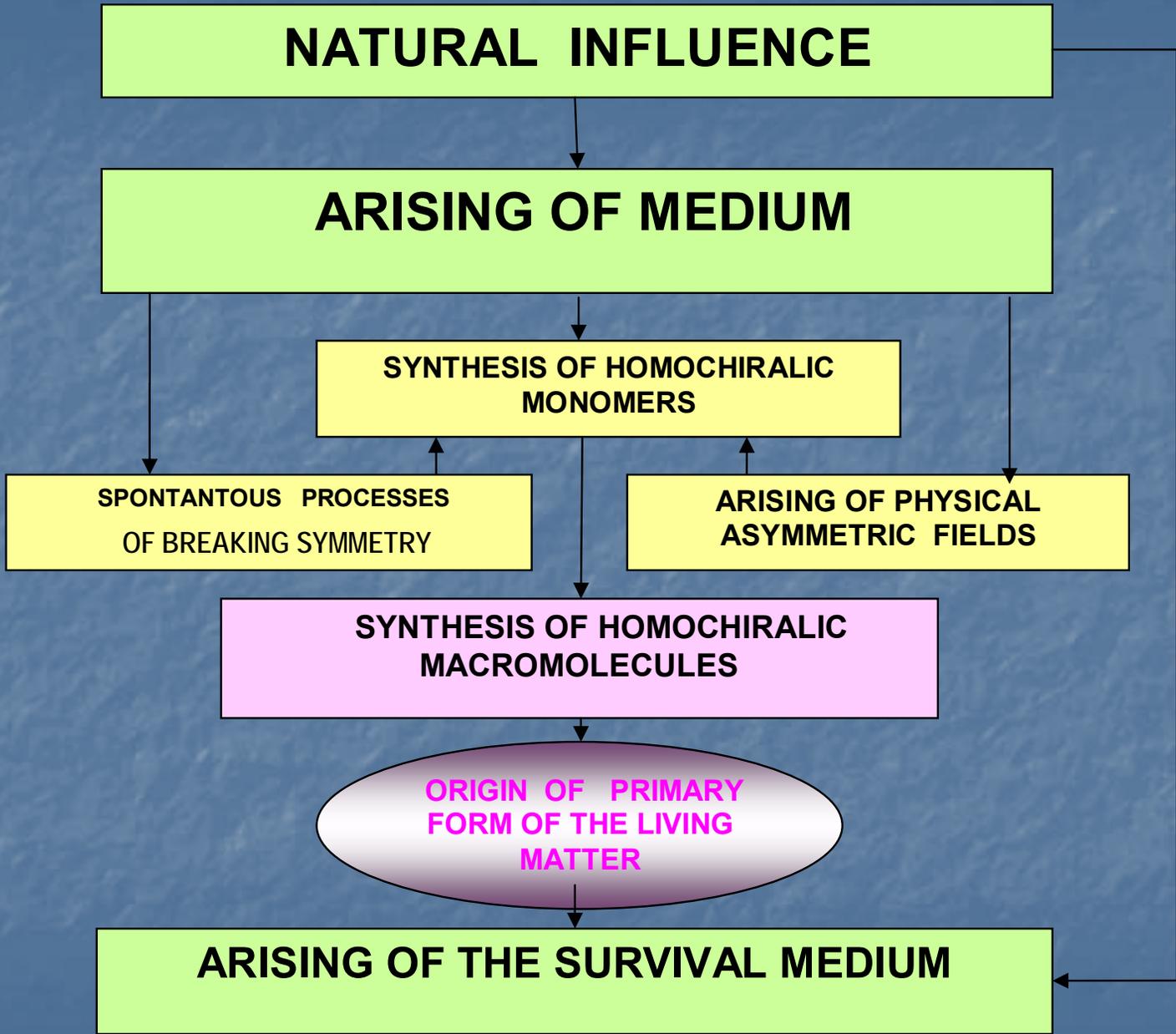
In that time it was forbidden to talk about them, although due to the efforts of Roald Sagdeev both Vega and Phobos from the very beginning were open project, which was not common for space researches in USSR.



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NATURAL INFLUENCE

ARISING OF MEDIUM

**SYNTHESIS OF HOMOCHIRALIC
MONOMERS**

**SPONTANTOUS PROCESSES
OF BREAKING SYMMETRY**

**ARISING OF PHYSICAL
ASYMMETRIC FIELDS**

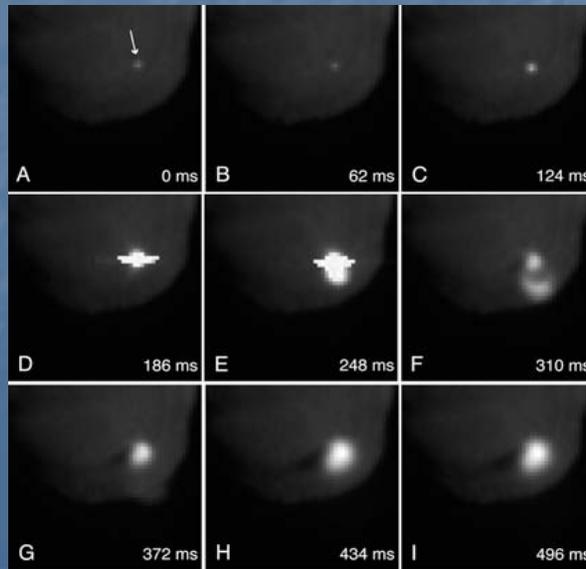
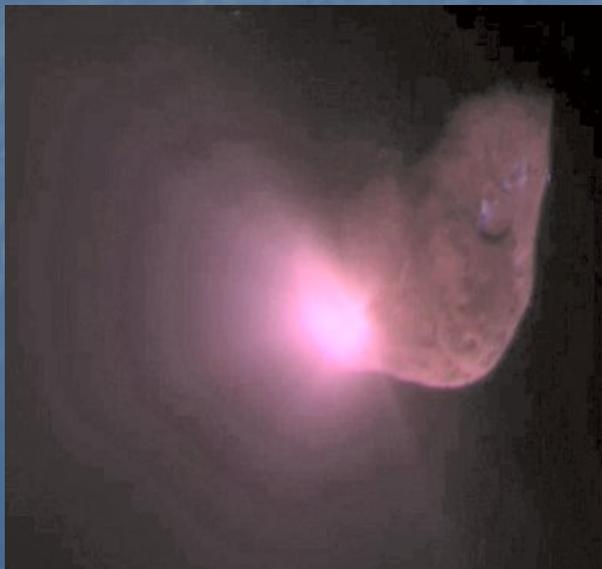
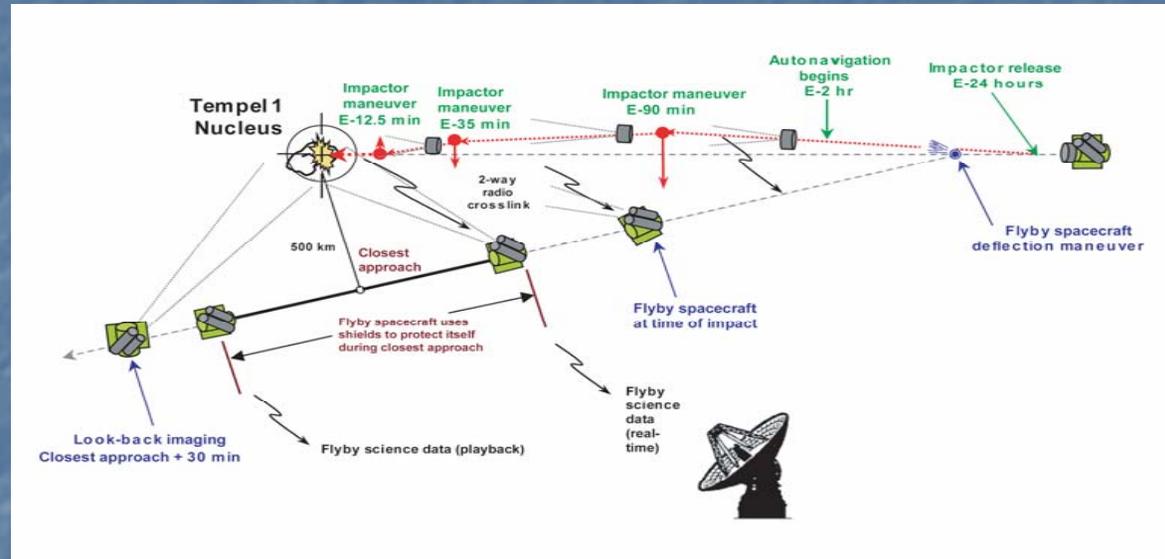
**SYNTHESIS OF HOMOCHIRALIC
MACROMOLECULES**

**ORIGIN OF PRIMARY
FORM OF THE LIVING
MATTER**

ARISING OF THE SURVIVAL MEDIUM



DEEP-(Dream Experiment with Excellent Perspectives of)-impact.





SHV colliding of
the fragments of
matter had
provided synthesis
and accumulation of
OC on early Earth



and its formation
in the interstellar
gas-dust clouds
during the particles
collisions, in identical
physical processes.



10 February, 2009

Session 3: Europa environment

Chair: G. Managadze

**17:00-17:30 G. De Angelis, J. E. Nealy, F. F. Badavi, B.M. Anderson,,
M. S Clowdsley, J.W. Wilson**

**Models of the radiation environment in the Jupiter system: the
case of Europa**

**17:30-17:50 Petrukovich A.A.
Plasma environment of Europa**

**17:50-18:10 I.I. Alexeev, E. S. Belenkaya
Jovian magnetosphere: Magnetospheric magnetic field at orbit
Europa and using magnetometer data to study of the Europa
interior**

**18:10-18:15 Belenkaya E.S., Alexeev I.I. (POSTER PRESENTATION)
Solar Wind - Jovian Magnetosphere Coupling**

**18:15-18:35 V. I. Shematovich and R.E. Johnson
Near-surface atmosphere of Europa**

**18:35-18:40 A.A. Berezhnoy (POSTER PRESENTATION)
Impact-Produced Exosphere of Europa**

