

01.04.21 –

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“18” 2008 16⁰⁰
501.001.31

... : 119991, -1, ,
, , .1, .62, , ...

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“ ” 2008 .

501.001.31

- , ...

Ti:Sapphire.

1

$10^{22} / \text{cm}^2$.

$(1,4 \times 10^{18} / \text{cm}^2 \cdot \text{cm}^2)$

$(M^2 \sim 2)$

30-100

4

1

,

,

1

,

10 %

,

,

.

$$(\sim 10^{11} - 10^{13} \text{ / } ^2)$$

).

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α -

α -

α -

α - ,

α -

:

1.

“

”

-

2.

$$10^{16} - 10^{18} \text{ / } ^2$$

.

3.



1. $\sim 10^{16}$ $10^{17} / \text{cm}^2$,
P-

s-

(),
()

13 .

2.

13 ,

$10^{17} / \text{cm}^2$:

()
().

3.

300

140

13 , $2.5 \cdot 10^{-7}$ $2 \cdot 10^{-3}$,
 $\sim 10^{18} / \text{cm}^2$.

4.

α -



0,2

$M^2=1.8$

Ti:Sapphire

$10^{18} / \text{cm}^2$

0,1 .

, ,

.

1. P- S-

() ,
 $10^{17} / ^2$.

2.

$10^{18} / ^2$

,

$2 \cdot 10^{-3}$.

3.

α -

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12-

« -2005» (, , 2005), 4-
“ ” (- , ,

2006),

ICONO-

2007 (, , 2007), 13-

“ ”

(- , , 2008).

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(, , 2003);

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” (, , 2003);

13-

(LPHYS'04) (, ,

2004); Frontiers of Nonlinear Physics (

, , 2004);

8-

AFOSR (- , , 2006);

“ 2007” (, , 2007); 5- 6-
“Complex Systems of Charged Particles and their Interaction with
Electromagnetic Radiation” (, , 2007/2008).

2

12

111 , 36 , 3
(159).

1.1

CPA – ,

1.2

1.3

($\sim 10^{16}$ / 2),

(10^{18} / 2).

($\sim 10^{17}$ / 2).

1.4

$10^{15}-10^{18} / \text{cm}^2$

2.1

10

50

0,2

10

2.2

13

$2,5 \times 10^{-7}$,

7

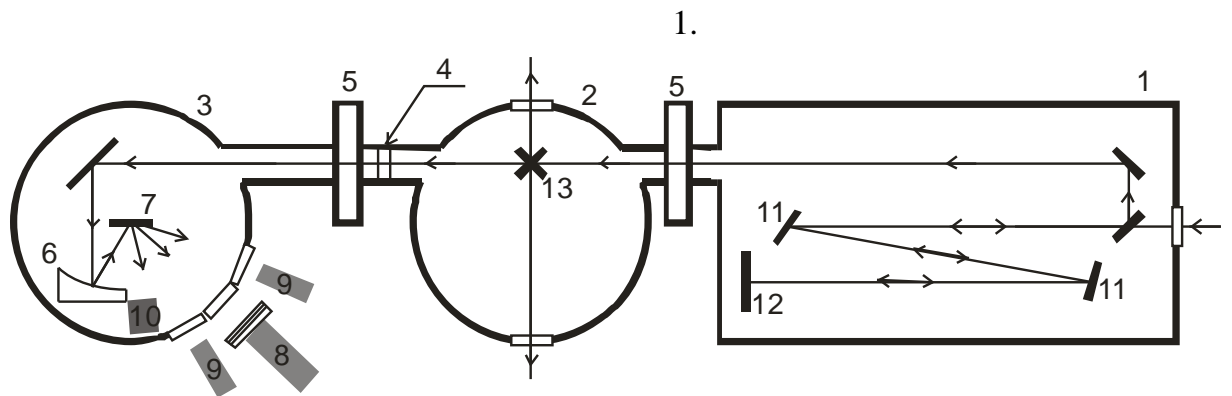
5×10^{-4} .

10^{-7}

10^{-5}

$M^2 = 1,8 \pm 0,3$.

2.3



.1

Ti:Sa.

(1- , 2- , 3- ,
4- , 5- , 6- ,
7- , 8,9- , 10- , 11- ,
12- , 13-)

1.

~50

2.

13

3,

7

6.

- 45 .

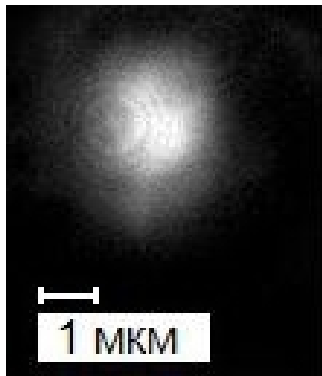
2.4 2.5

(

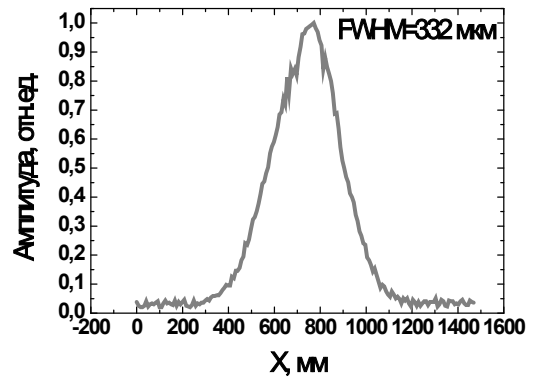
0,05 - 1

),

2.



()



()

. 2

()

()

D_f

:

$$D_f = \frac{f_{mirror}}{f} \cdot D_i \approx 3,5 \pm 0,1$$

f_{mirror} -

, D_i -

$J=10$

$\tau=50$

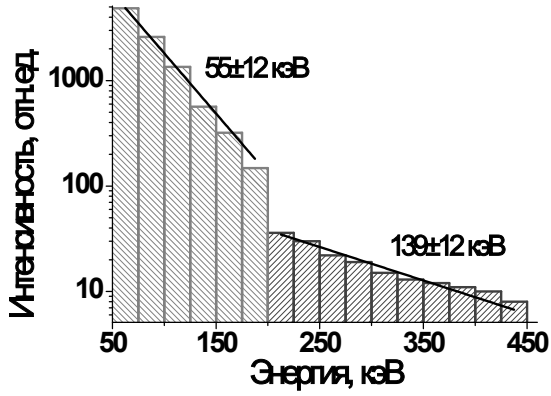
:

$$I = R \cdot \gamma \cdot \frac{4 \cdot J}{\pi \cdot d^2 \cdot \tau} \approx 10^{18} \text{ / } ^2.$$

($\gamma=0,56$),

$R=0,8$.

2.6



($E_p=140$, . 3).

. 3

0,05-0,46

$$E_p = m_e c^2 (\sqrt{1 + a_0^2} - 1), \text{ Дж}$$

$$\sim 10^{18} / \text{м}^2.$$

3.3.1 3.3.2

2

$$2,5 \times 10^{-2} - 2,5 \times 10^{-7}.$$

45°.

$$2 \times 10^{17} / \text{м}^2$$

1 10

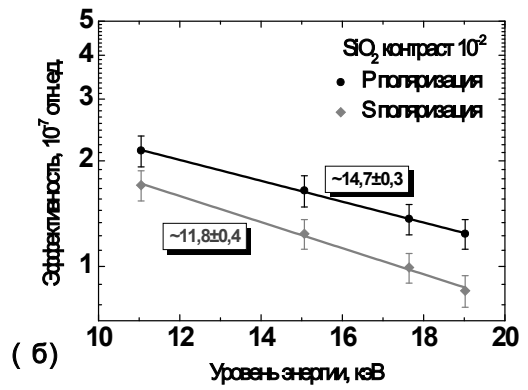
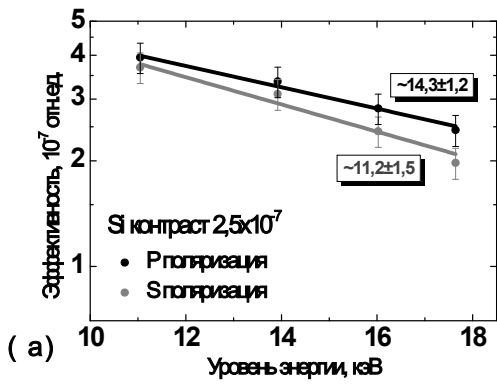
(. 4).

$$5 \times 10^{16} / \text{м}^2$$

3.3.3

$$10^{15} - 10^{17} / \text{м}^2,$$

$$2,5 \times 10^{-2} - 2,5 \times 10^{-7}.$$



. 4

$P-$ $S-$ Si SiO_2
 10^{-2} $2,5 \times 10^{-7}$
 $10^{15}-10^{16}$ / 2 $P-$
 $2,5 \cdot 10^{-7}$ E
 I

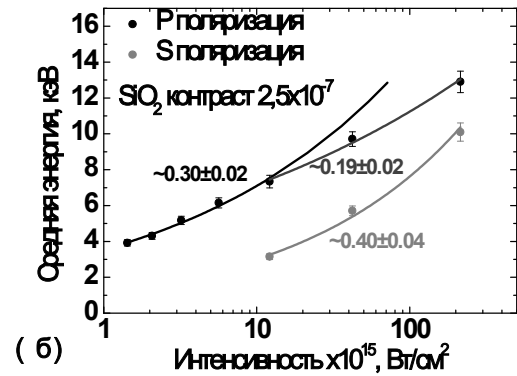
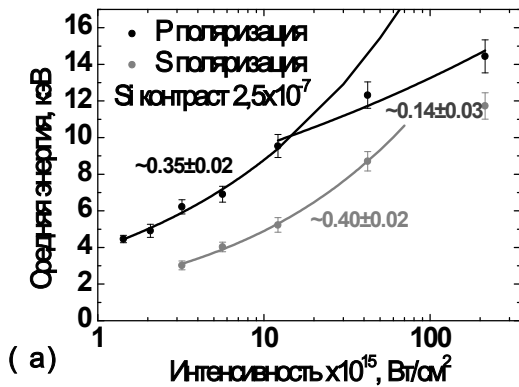
10^{17} / 2

(. 5),

()

().

« »



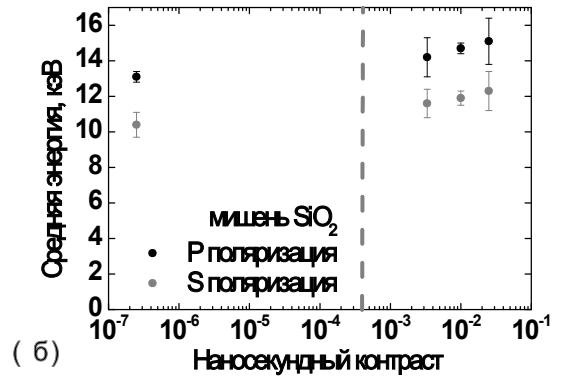
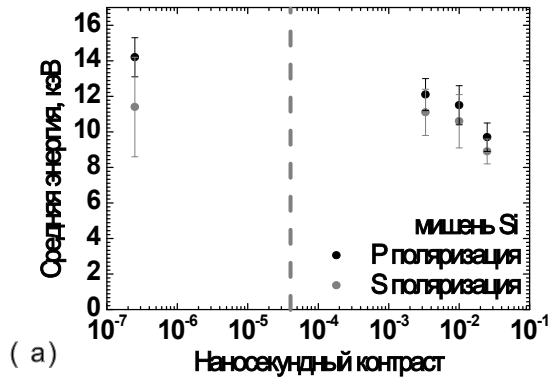
. 5

$Si ()$ $SiO_2 ()$

3.3.4

P-

$10^{17} / \text{cm}^2$



. 6

Si () SiO₂ ()

$2 \times 10^{17} / \text{cm}^2$

($\sim 10^{18} / \text{cm}^2$)
4.2 4.3 ,

$\sim 10^{-2}$,

$\sim 10^{-6}$

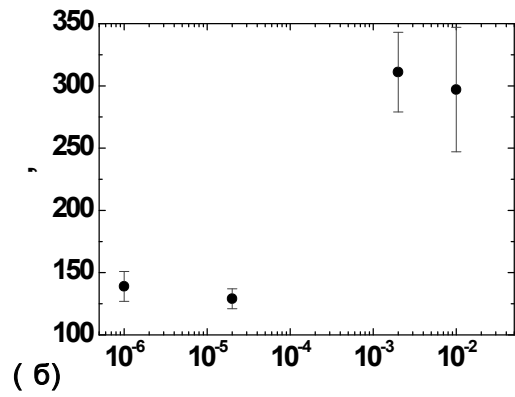
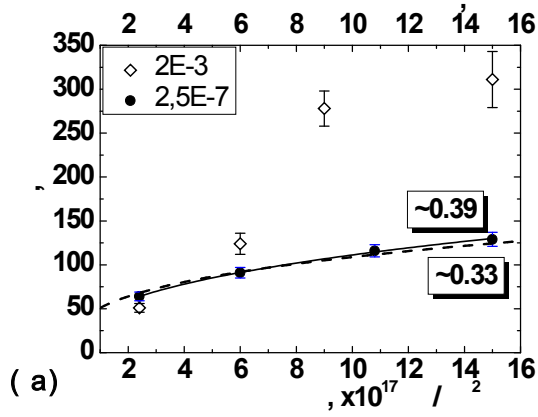
0,1 – 1
 $10^{17} - 10^{18} / \text{cm}^2$
(. 7).

$2,5 \times 10^{-7}$

2×10^{-3}

$10^{18} / \text{cm}^2$

()



.7

:)

()

$$10^{18} \frac{2,5 \times 10^{-7}}{2}$$

(-)

P_1

P_{cr} :

$$P_{cr} = 17 \frac{n_c}{n_e}$$

3×10^{11}

$L \sim 100-200$

(100)

d_{sf}

$$d_{sf} = \frac{2\lambda}{\pi} \sqrt{\frac{n_c}{n_e}}$$

$\sim 10L$

d

d_{sf}

$d_{sf}(n_e)$

0,5

$$9 \times 10^{19} / 2$$

$n_e \sim n_c$

L

0,1-1

$$10^{18}-10^{19} / \text{cm}^2.$$

E_{\max}

$$E_{\max} = 0.4E_0 a_0^2,$$

$$E_0 (\text{V/cm}) = 0.96 n_e^{0.5} (n_e \text{ cm}^{-3}),$$

$$a_0 = 0.86(I_{18}\lambda^2)^{0.5} \text{ Ma}$$

2,4

15

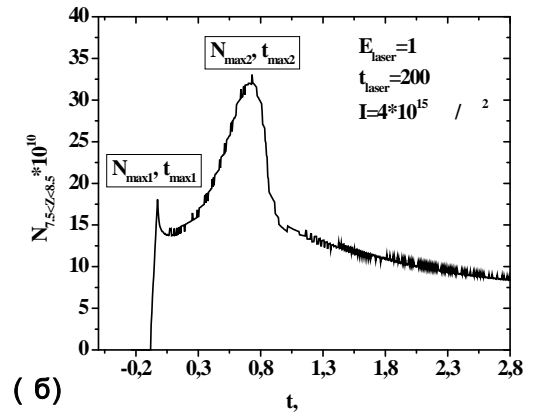
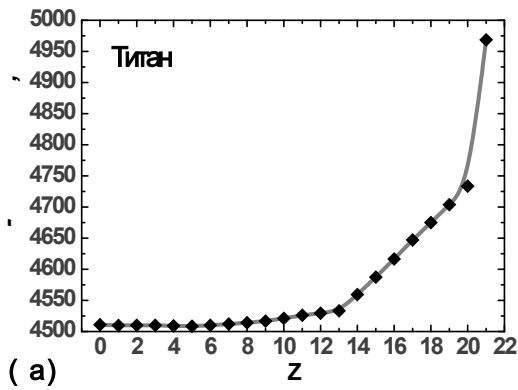
α -

5.2

(.8).

5.4

(.8).



.8

α

($E=1$, $I=4 \times 10^{15} / \text{cm}^2$, $\tau=200$) (N , $7.5 < Z < 8.5$) ($t=0$)

5.5

α -

Al^{+9}

$10^{16} / \text{cm}^2$ $10^{17} / \text{cm}^2$ 100
 $5 \times 10^{16} / \text{cm}^2$ 200
 Ti^{+15} Ti^{+16} , α -
 ~ 10

10^{15} $10^{18} / \text{cm}^2$ 100
 50 ± 5 10
 $0,2$ 13
 $2,5 \times 10^{-7}$ 7
 5×10^{-4} 10^{-5}
 10^{-7} $M^2 = 1,8 \pm 0,3$ 1
 5 $3,5$ 56%
 10 50
 $\sim 10^{18} / \text{cm}^2$

3.

10 (2,5×10⁻⁷) :

55±12

0,1 .

(5 100) 61±9 .

0.1-1 ()

139±12 .

~10¹⁸ / ²

0,2 .

4.

10¹⁷ / ² (2 ,)

) () : 10¹⁷ / ²

1 10 .

5×10¹⁶ / ²

10¹⁵-10¹⁶ / ² P-
2,5×10⁻⁷
I

E

$$E \propto (I_{16} \cdot \lambda_{\mu}^2)^{0.3 \pm 0.35}$$

$$2 \cdot 10^{17} / 2$$

$$E \propto (I_{16} \cdot \lambda_{\mu}^2)^{0.14 \pm 0.19}$$

S-

$$3,6 \times 10^{15} / 2$$

$$1,4 \times 10^{16} / 2$$

$$E \propto (I_{16} \cdot \lambda_{\mu}^2)^{0.40}$$

5.

$$10^{17} / 2$$

$$14,2 \pm 1,1$$

$$9,7 \pm 0,8$$

P-

6.

$$2,5 \times 10^{-7} \quad 2 \times 10^{-3}$$

$$10^{18} / 2$$

$$10^{18} / 2,$$

$$5 \times 10^{17} / 2$$

$$2 \times 10^{-3}$$

$$2,5 \times 10^{-7},$$

$$10^{18} / 2$$

$$2 \times 10^{-3}$$

$$1,5 \times 10^{18} / 2$$

$$297 \pm 20$$

$$0,1-1$$

$$10^{-2} \quad 2 \times 10^{-3}$$

$$2 \times 10^{-5}$$

7.

$$10^{16} / 2$$

$$100$$

α -

$10^{16} / \text{cm}^2$ $10^{17} / \text{cm}^2$ 100 1 $5 \times 10^{16} / \text{cm}^2$ 100 200 Ti^{+16} α - Ti^{+15} ~ 10

1. . . . , . . . , . . . , . . . “
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