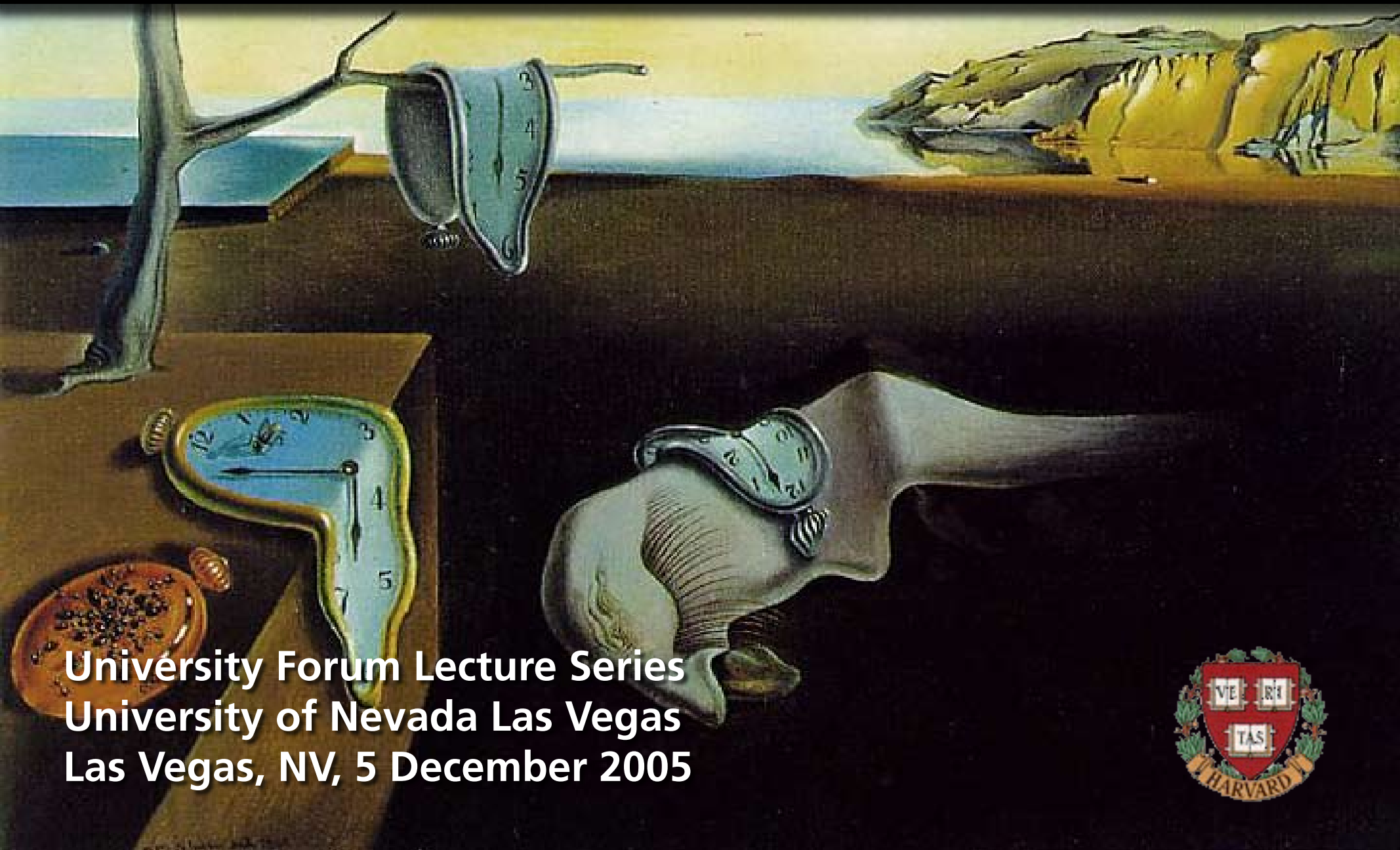


# Stopping Time



University Forum Lecture Series  
University of Nevada Las Vegas  
Las Vegas, NV, 5 December 2005

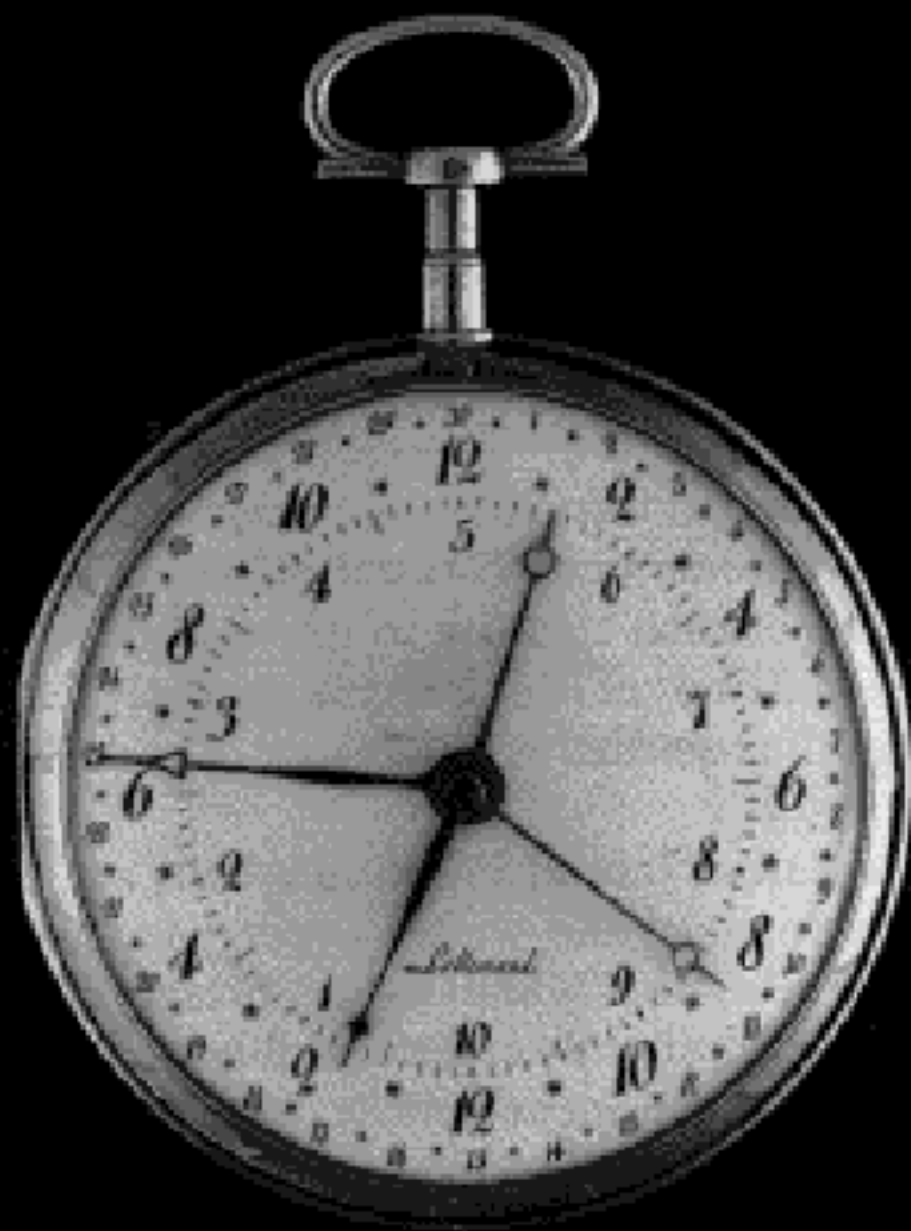


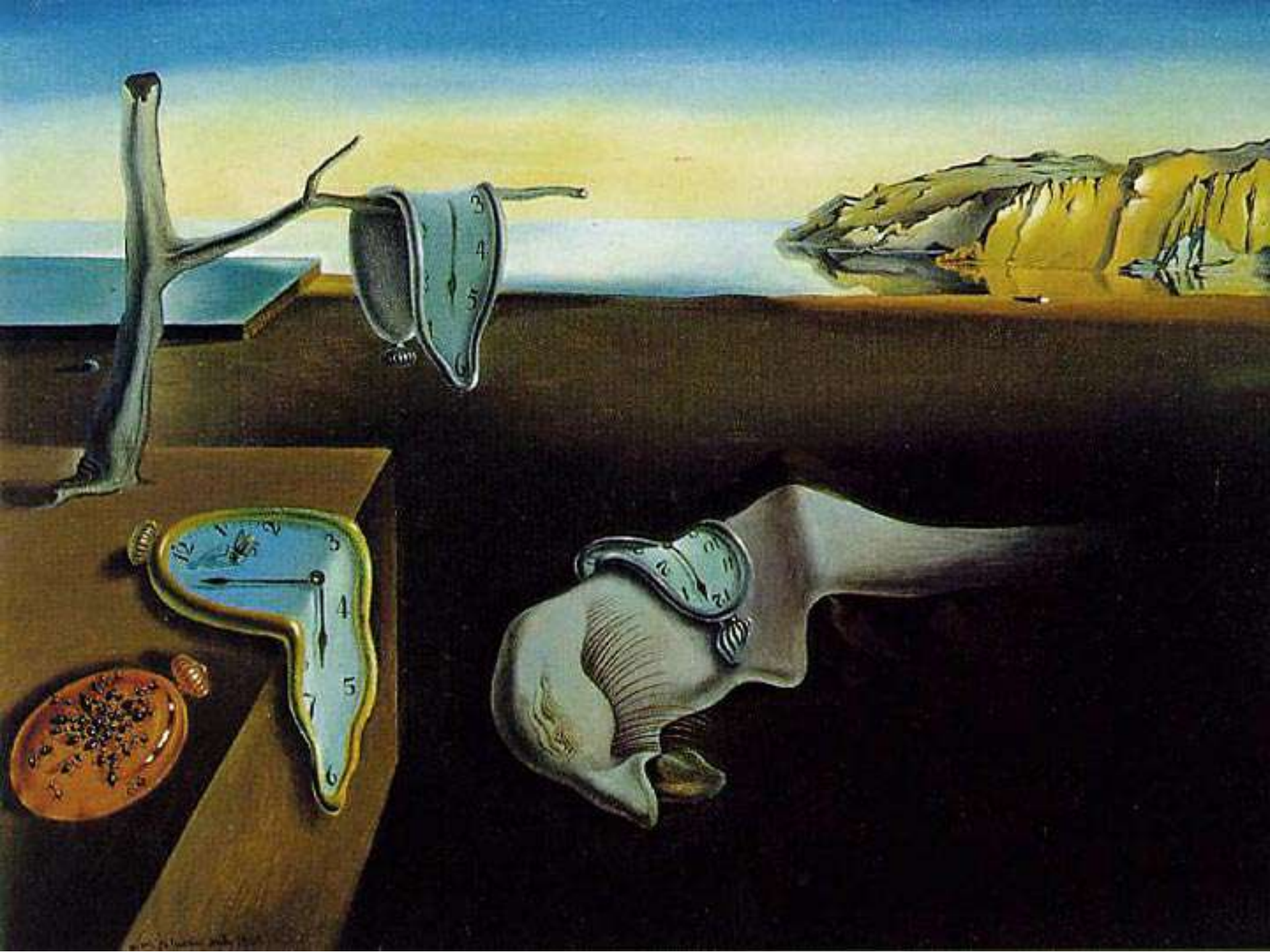




*t*

- ▶ **time: the concept**
- ▶ **time: stopping it**
- ▶ **time: the new frontier**









vorher angestellten Versuchen die warme Lufthülle,  
welche die Kerzenflamme umschließt. Und der

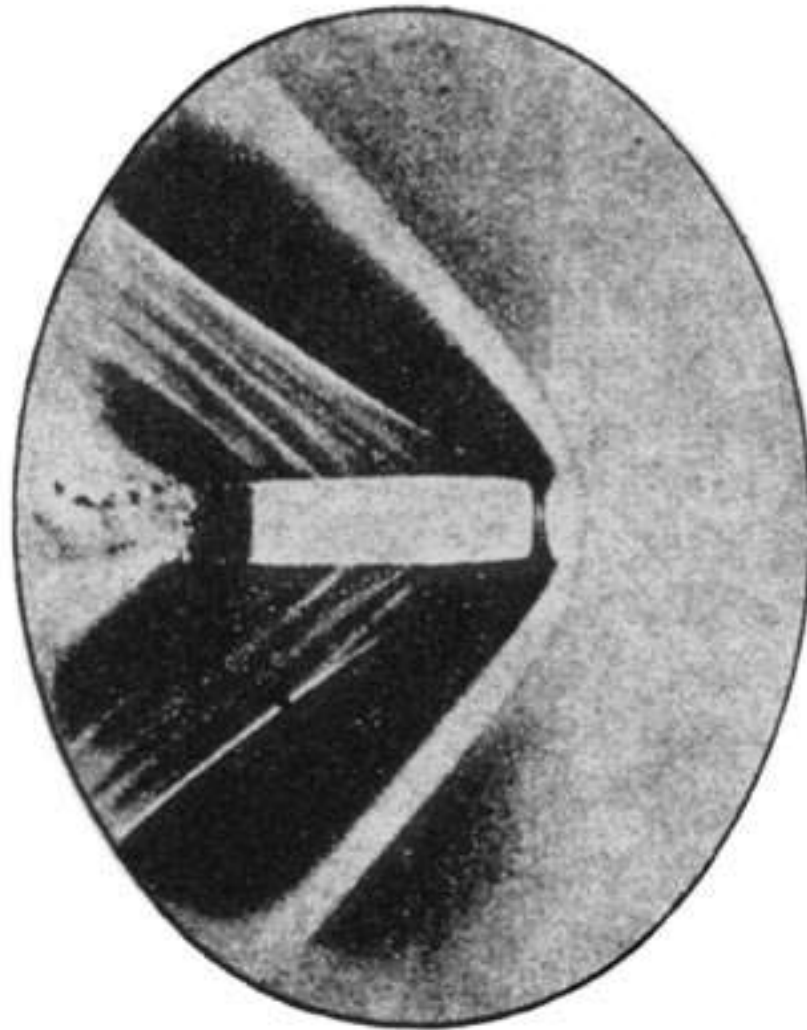
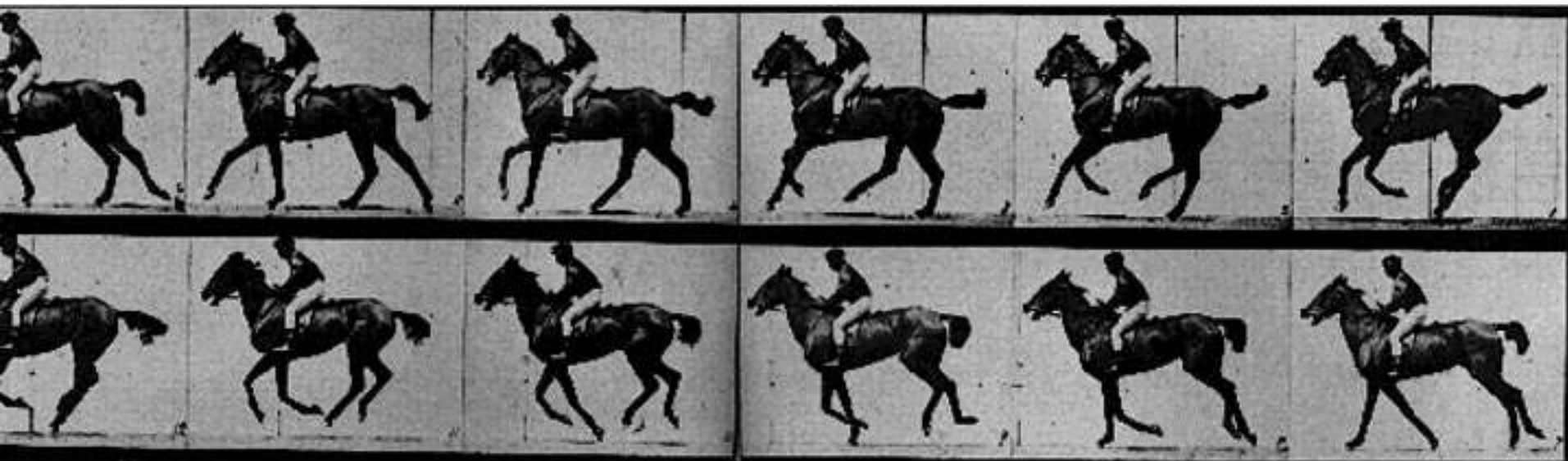
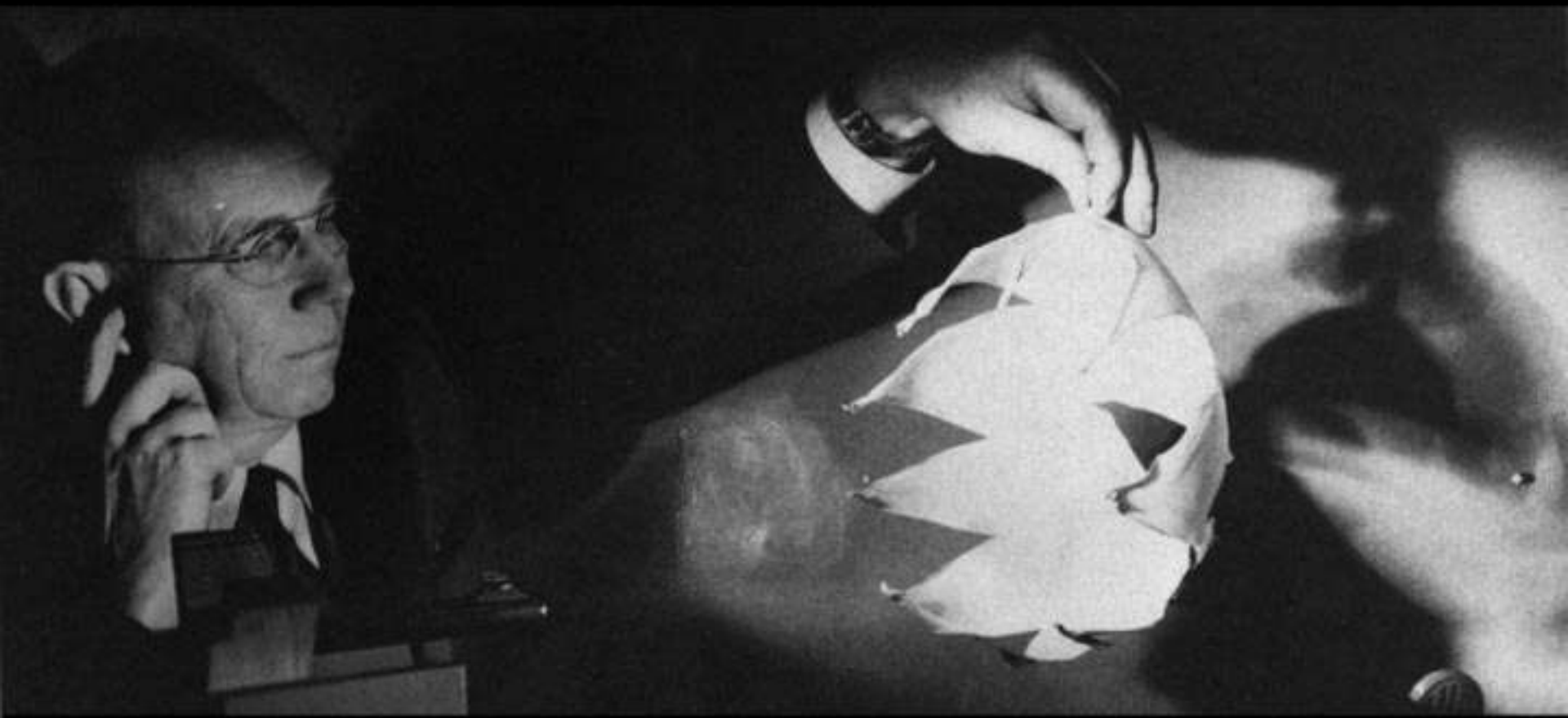
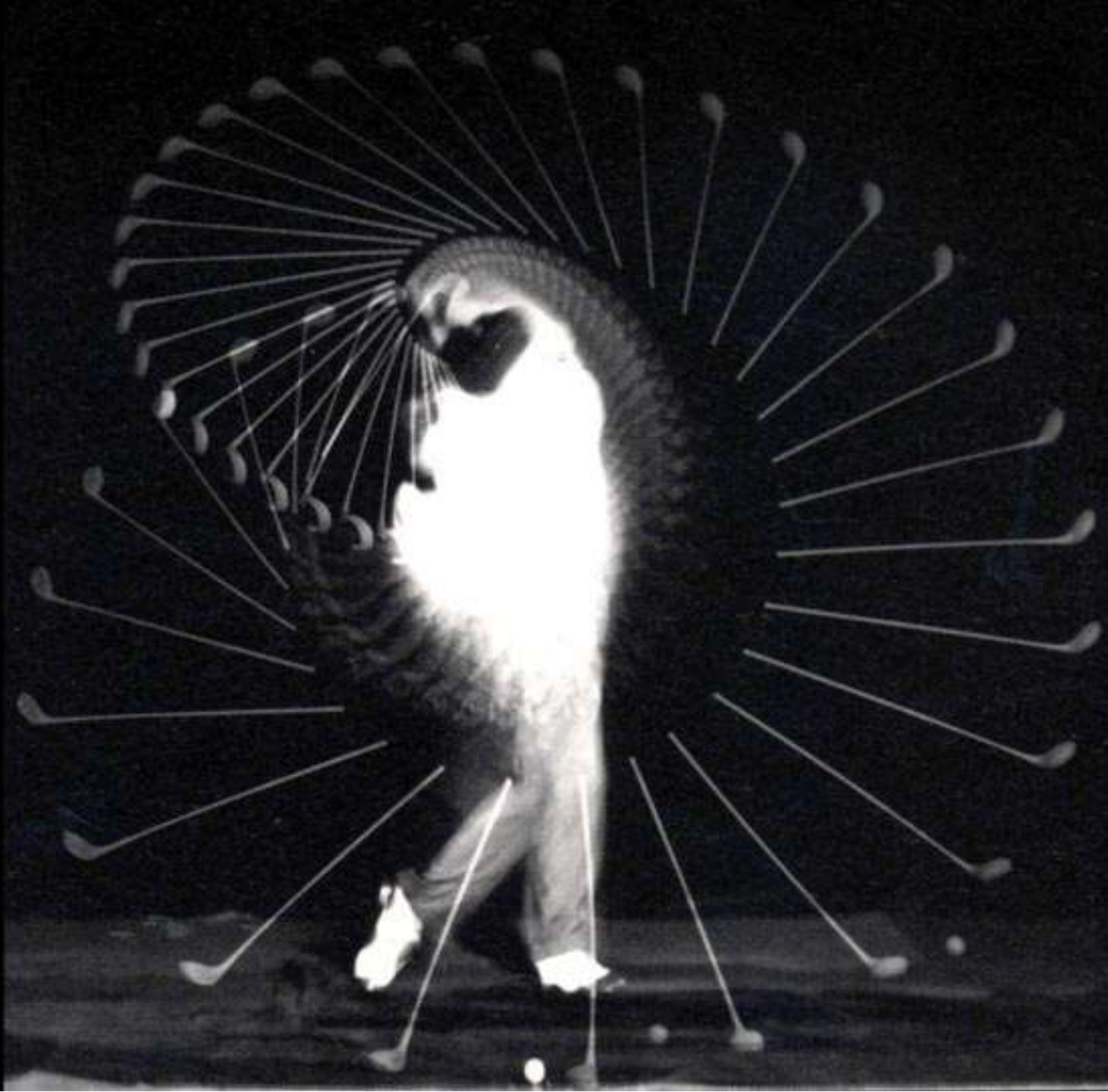


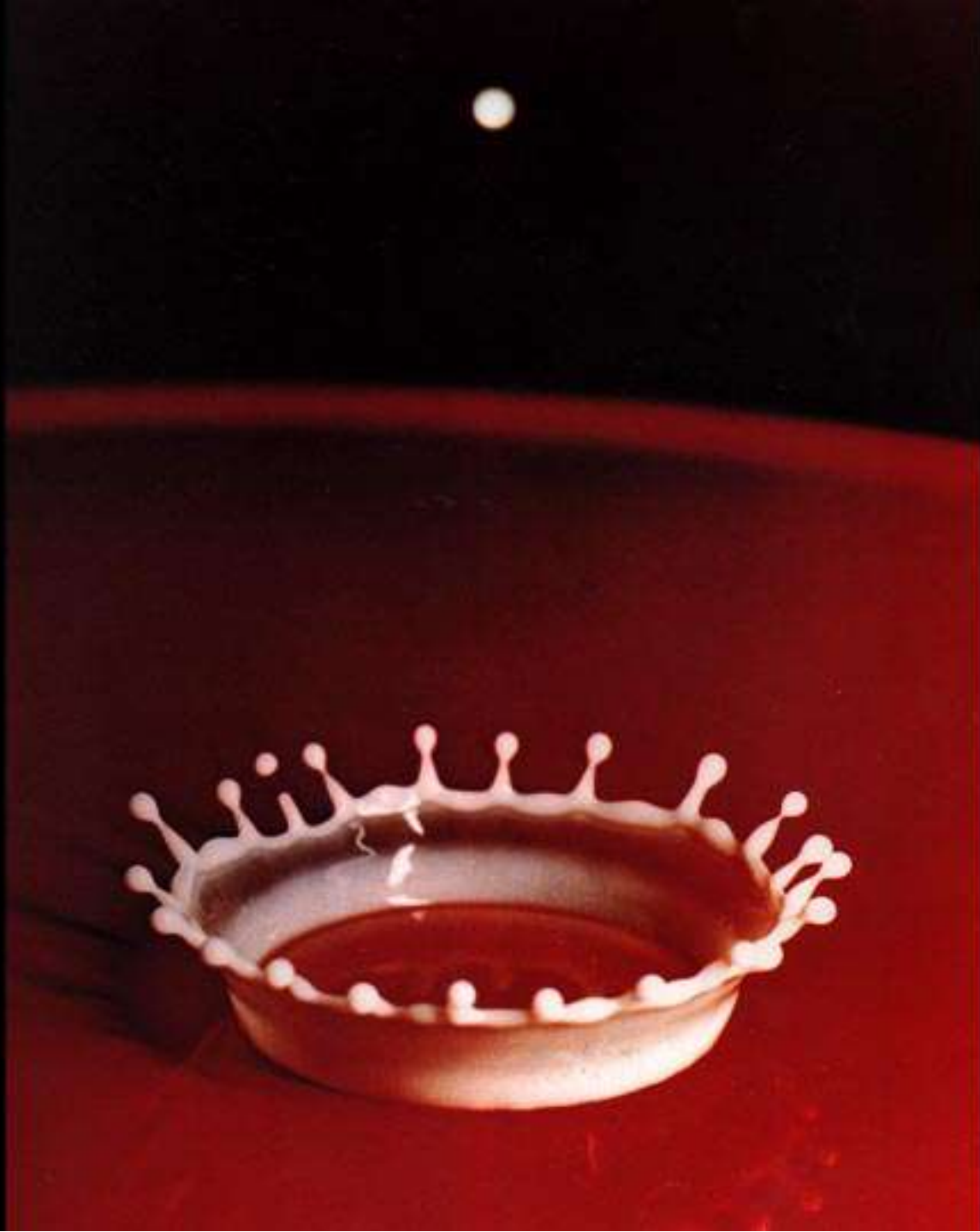
Fig. 52.

Zylinder aus durch Reibung erwärmter Luft, welche  
das Projektil in Form von Wirbelringen abgestreift

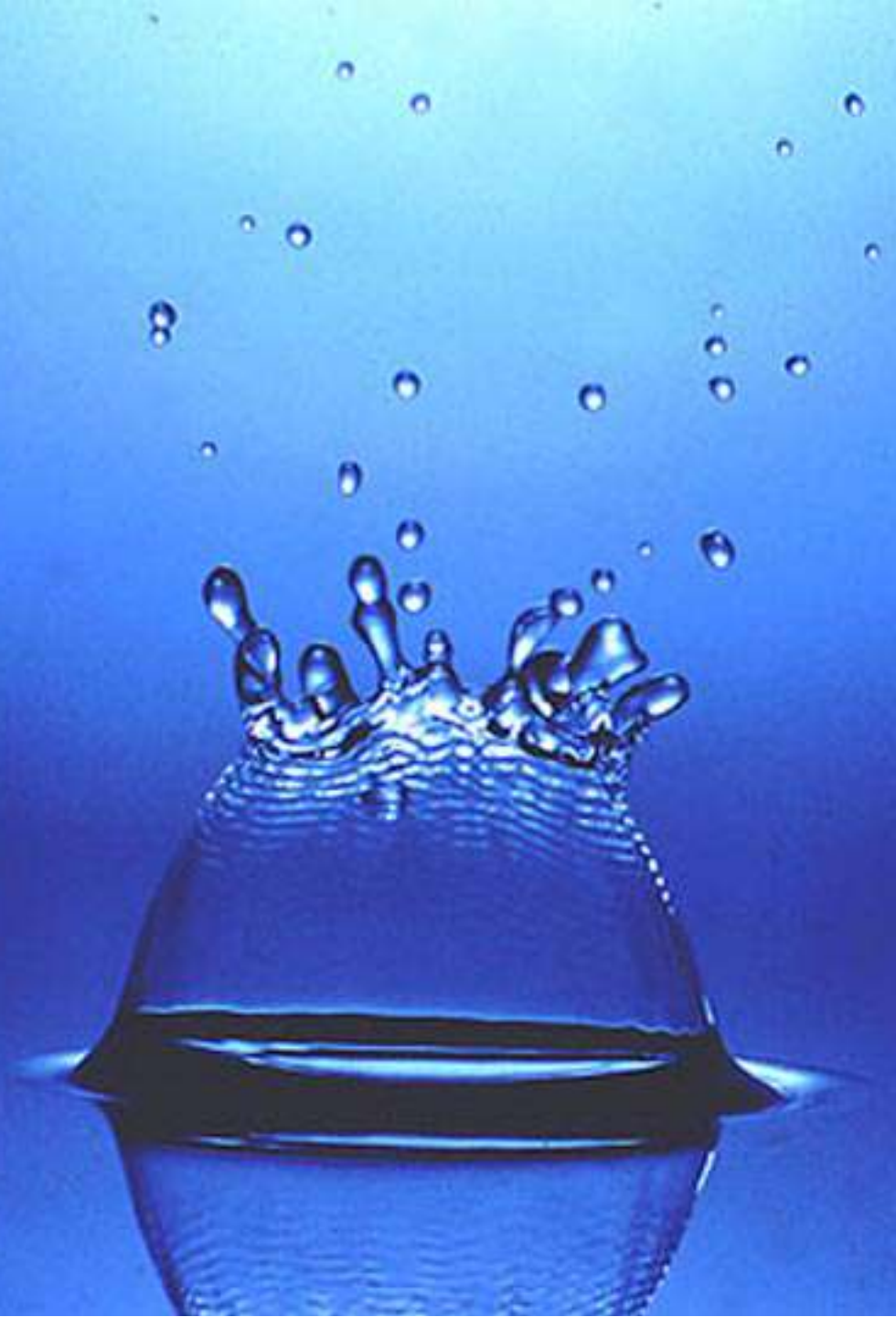








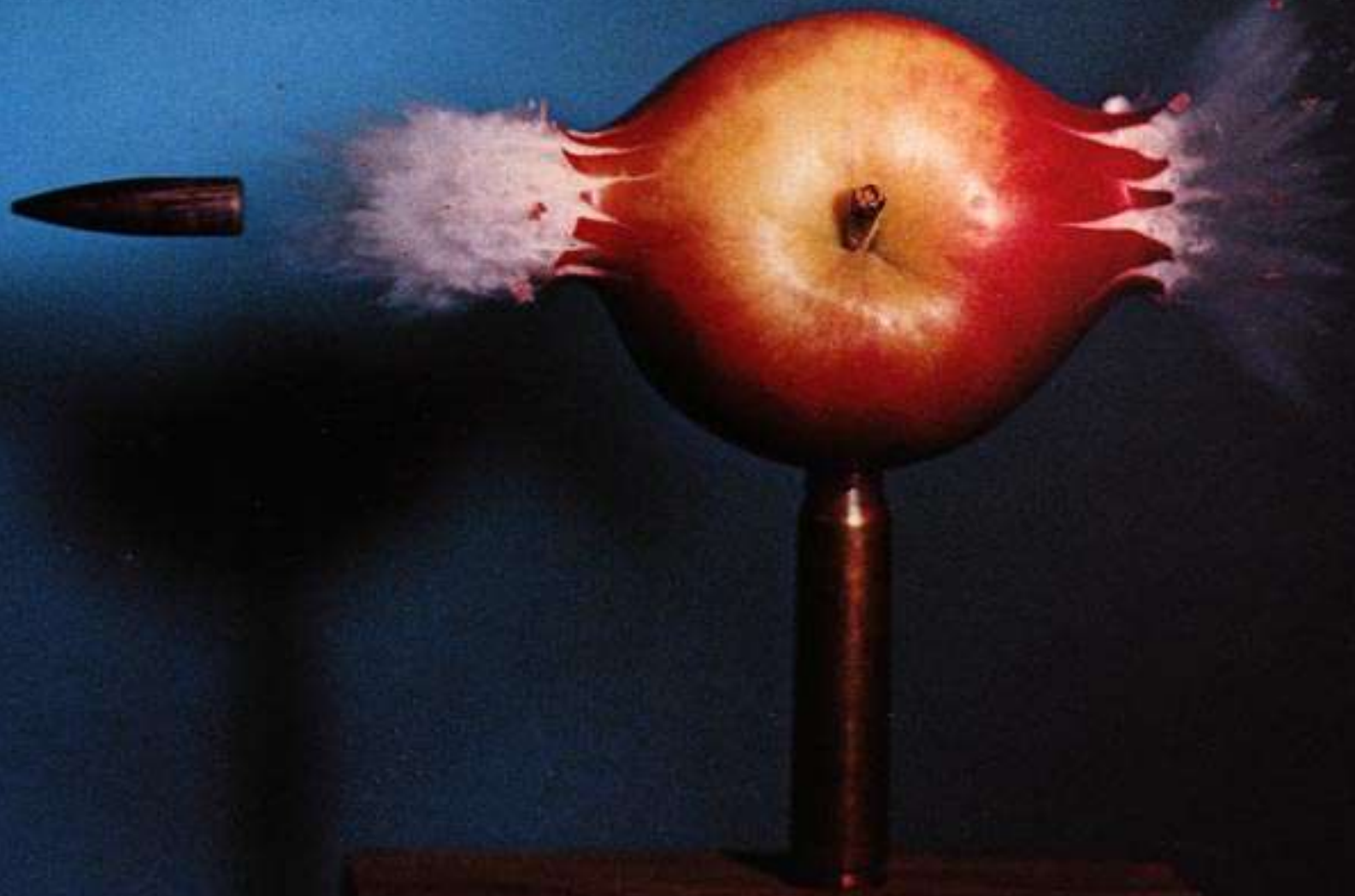




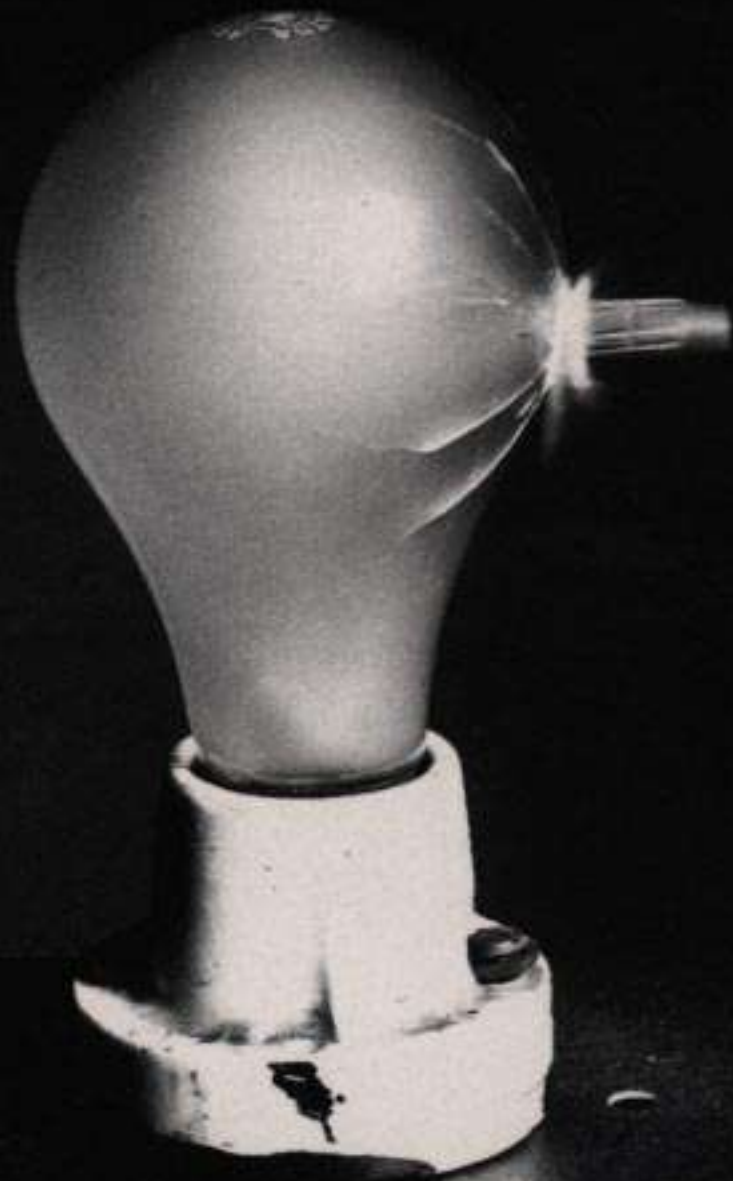




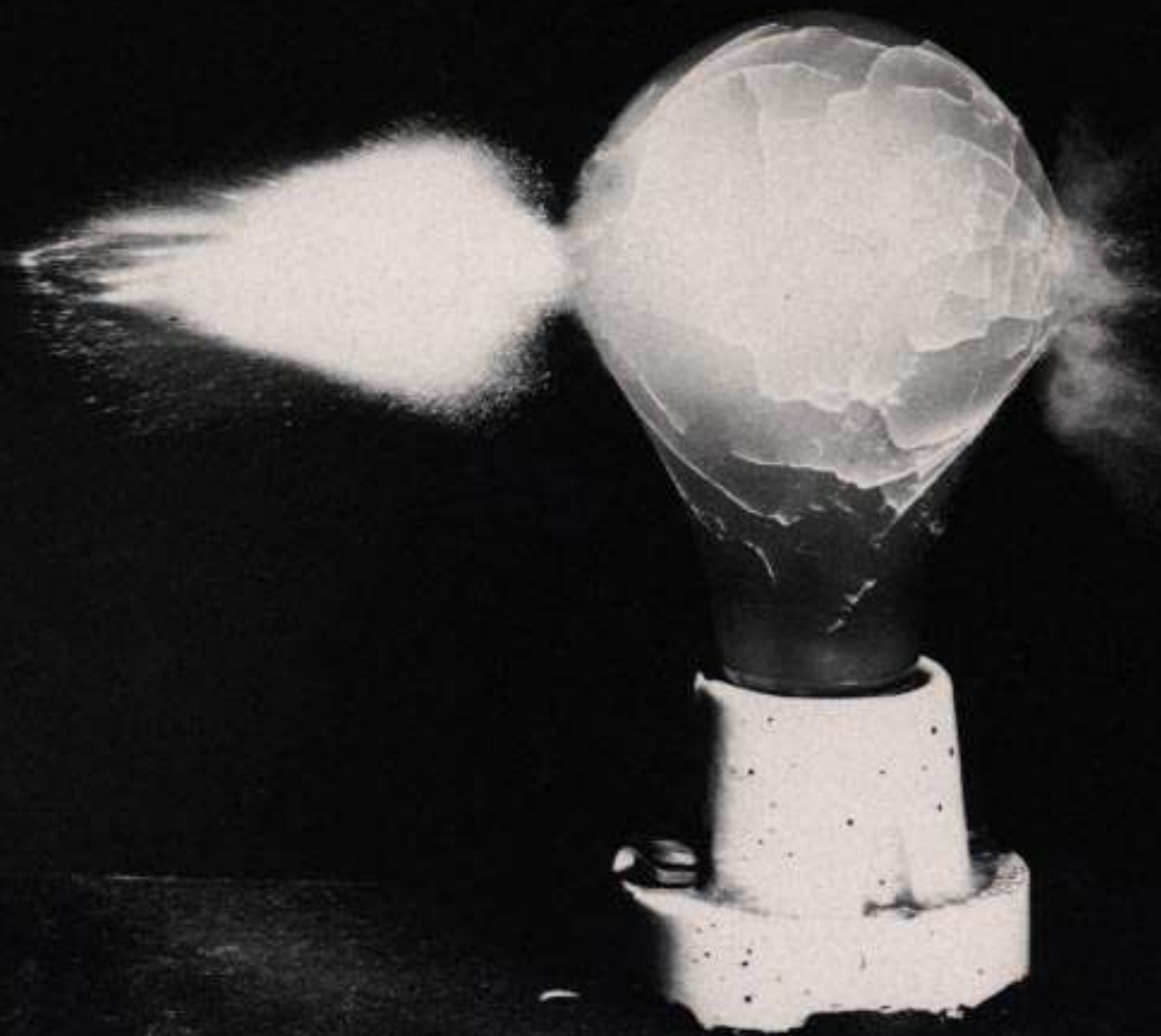














moon

$10^0$  s



one second



$10^1$  s



10 seconds

$10^2$  s



one minute

# RT to sun

$10^3$  s



17 minutes

# Uranus

$10^4$  s



average baseball game

$10^5$  s



1 day

$10^6$  s



2 weeks

$10^7$  s



one semester

# Proxima Centauri

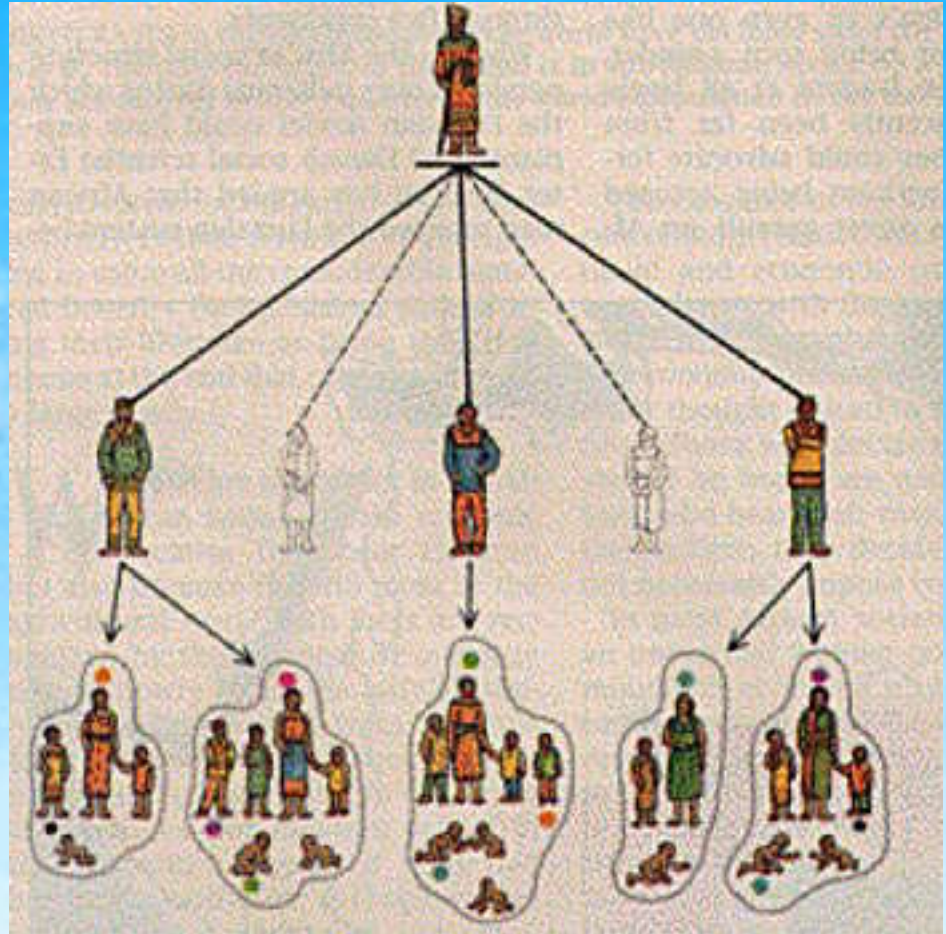
$10^8$  s



3 years

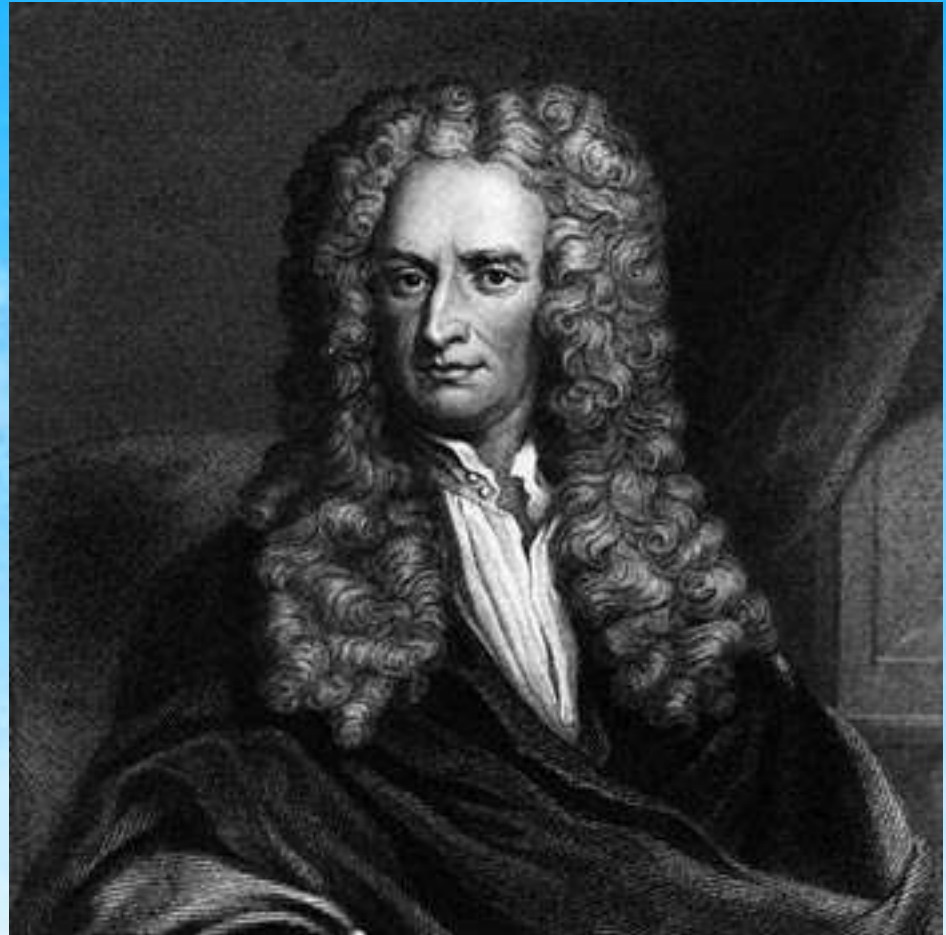


$10^9$  s



human generation

$10^{10}$  s



time since Newton

$10^{11}$  s



ancient civilizations

center of galaxy

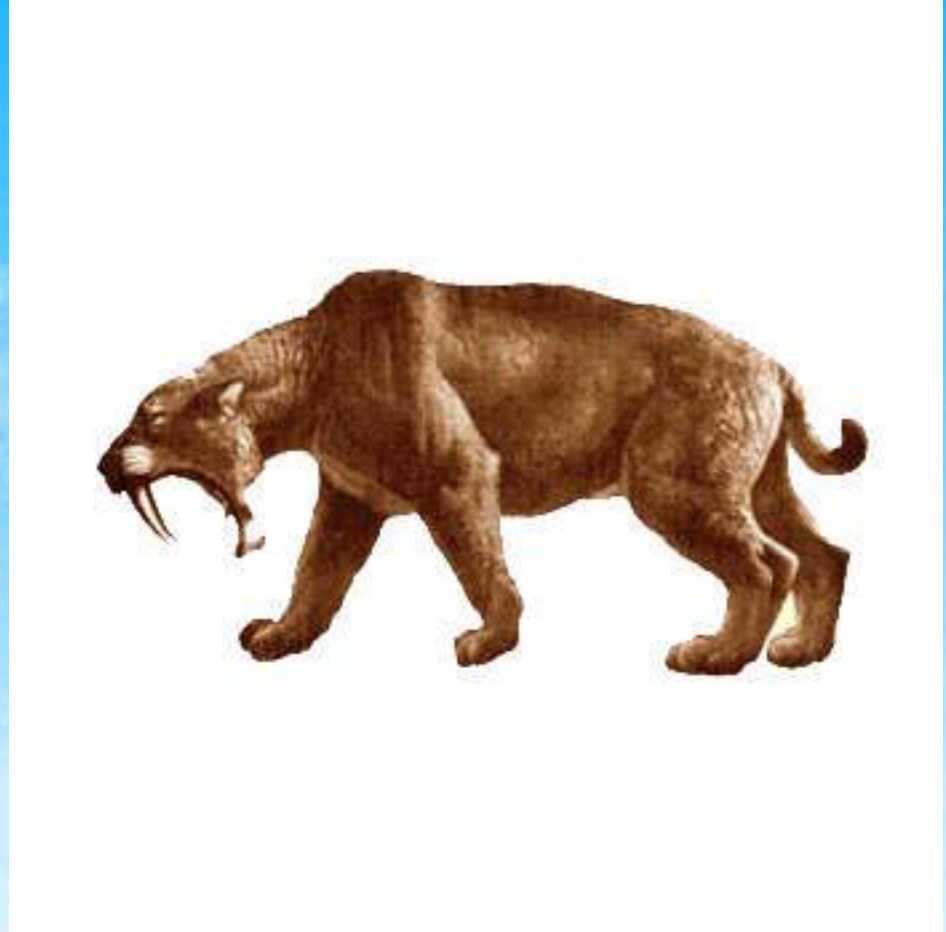
$10^{12}$  s



most recent ice age

# Andromeda galaxy

$10^{13}$  s



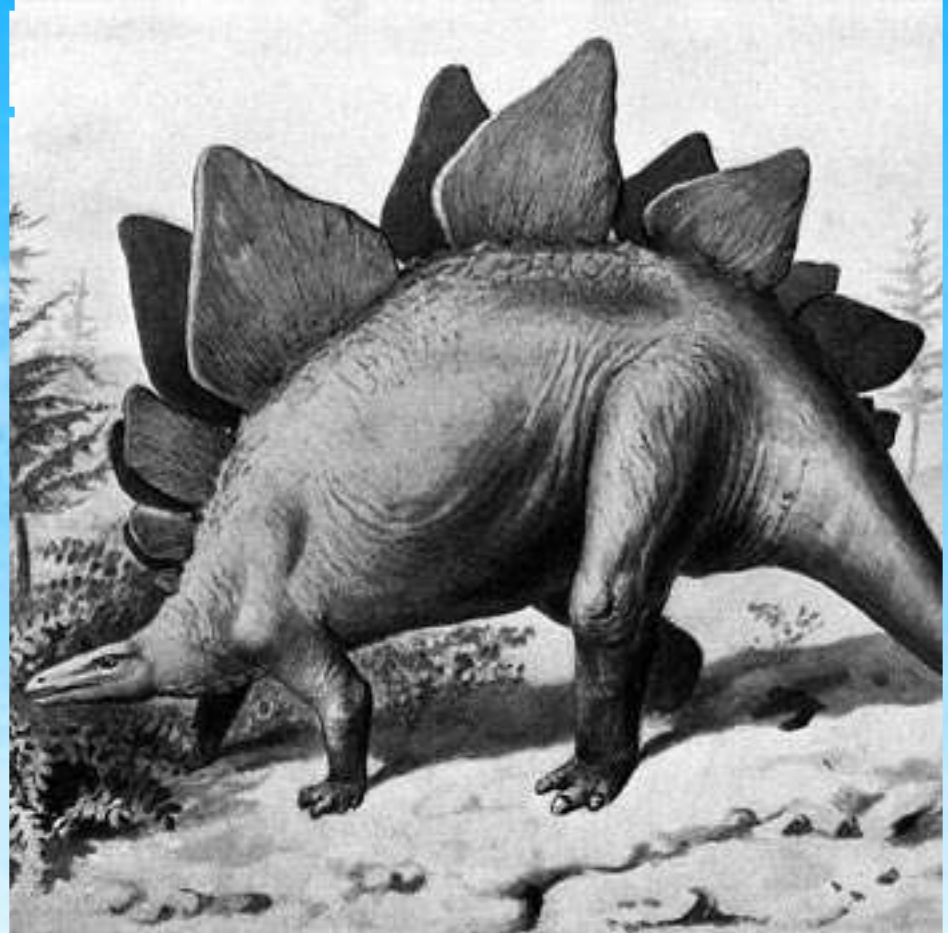
300,000 years

$10^{14}$  s



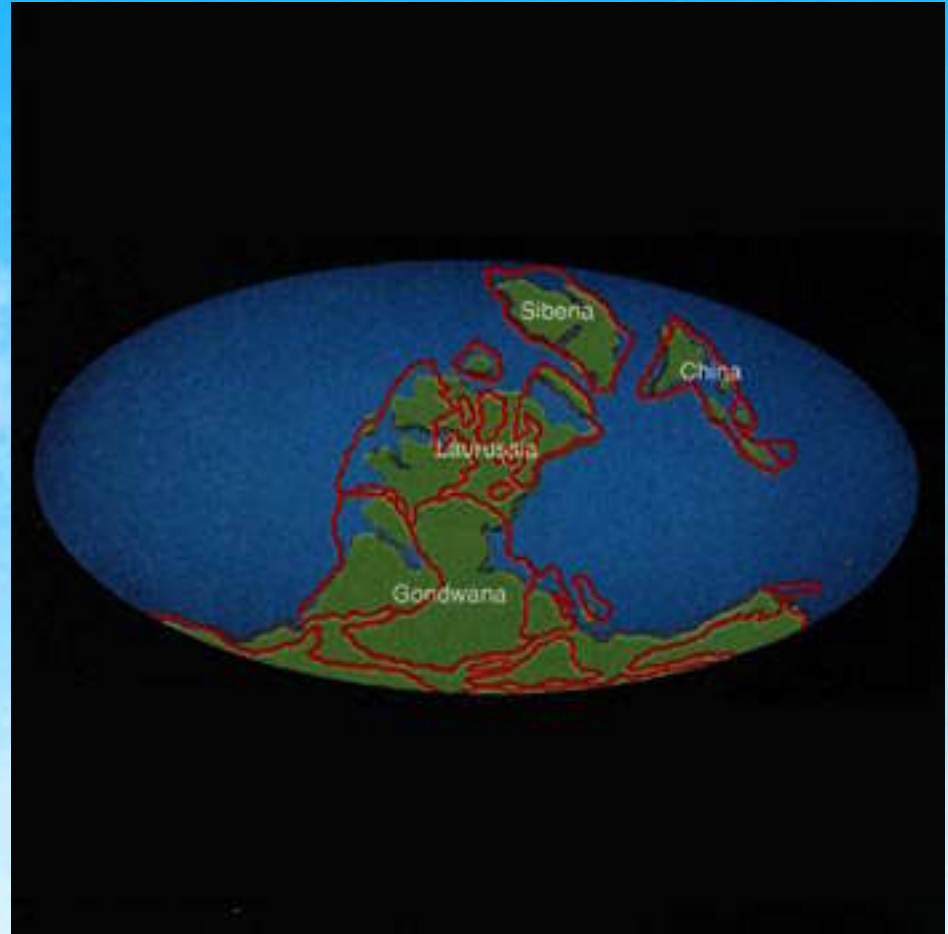
earliest human

$10^{15}$  s



dinosaurs

$10^{16}$  s



continental drift



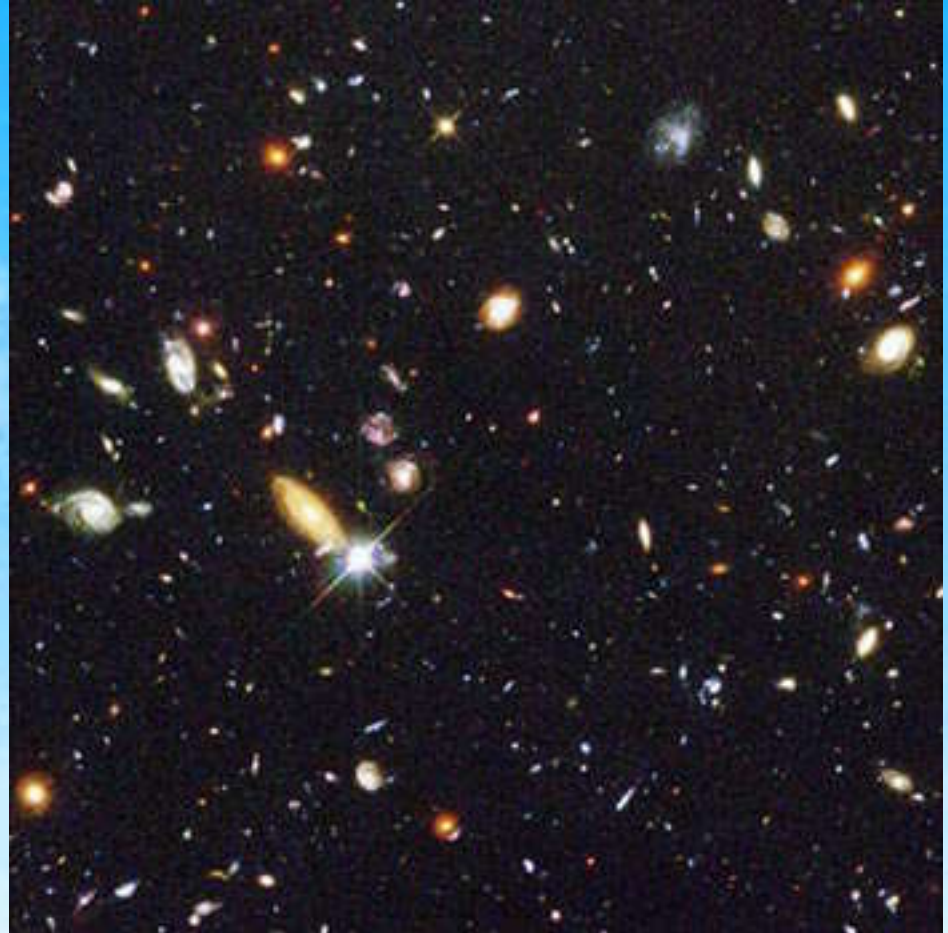
$10^{17}$  s



age of the solar system

# edge of the universe

$10^{18}$  s



age of known universe

moon

$10^0$  s



one second

$10^{-1}$  s



blink of an eye

$10^{-2}$  s



golf swing

# San Francisco

$10^{-3}$  s



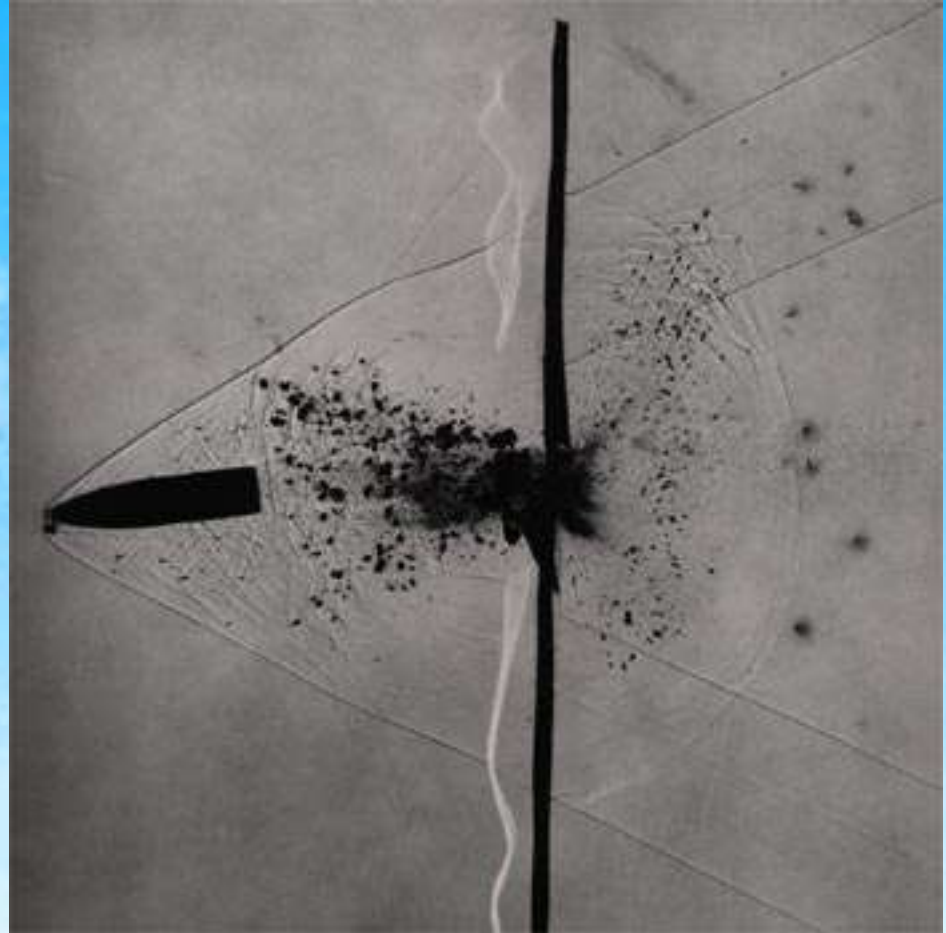
wingbeat of fly

$10^{-4}$  s



lightning

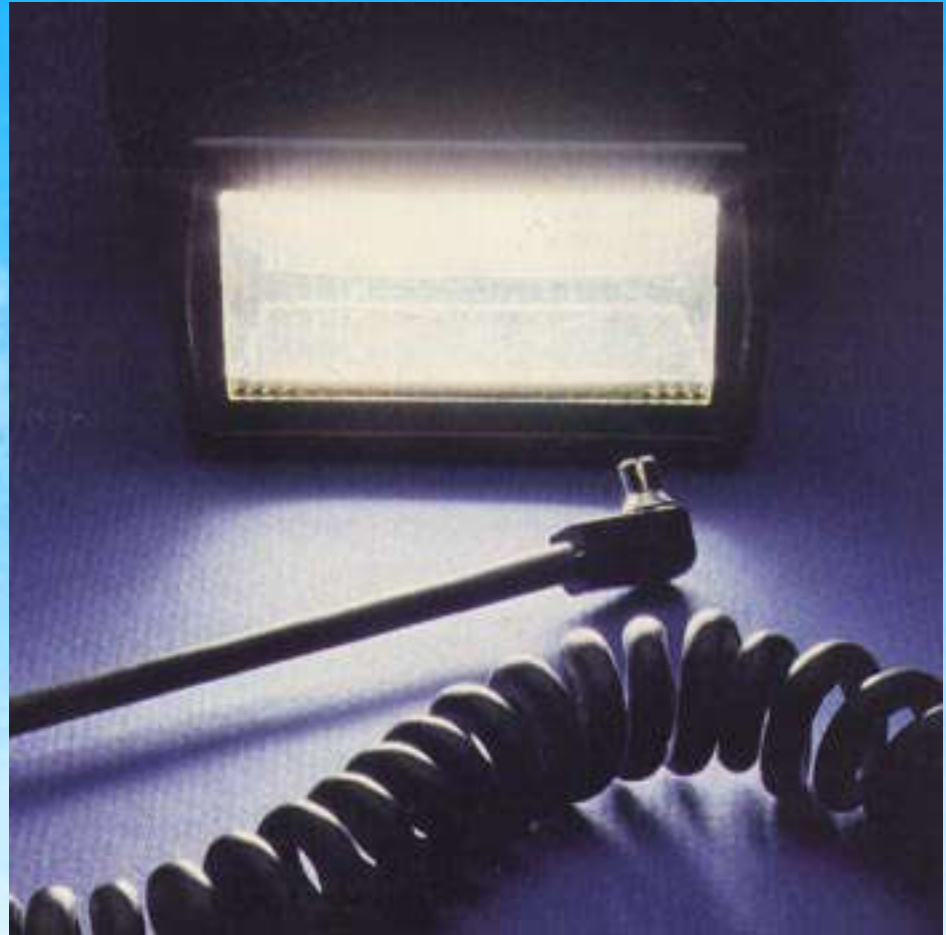
$10^{-5}$  s



bullet through glass



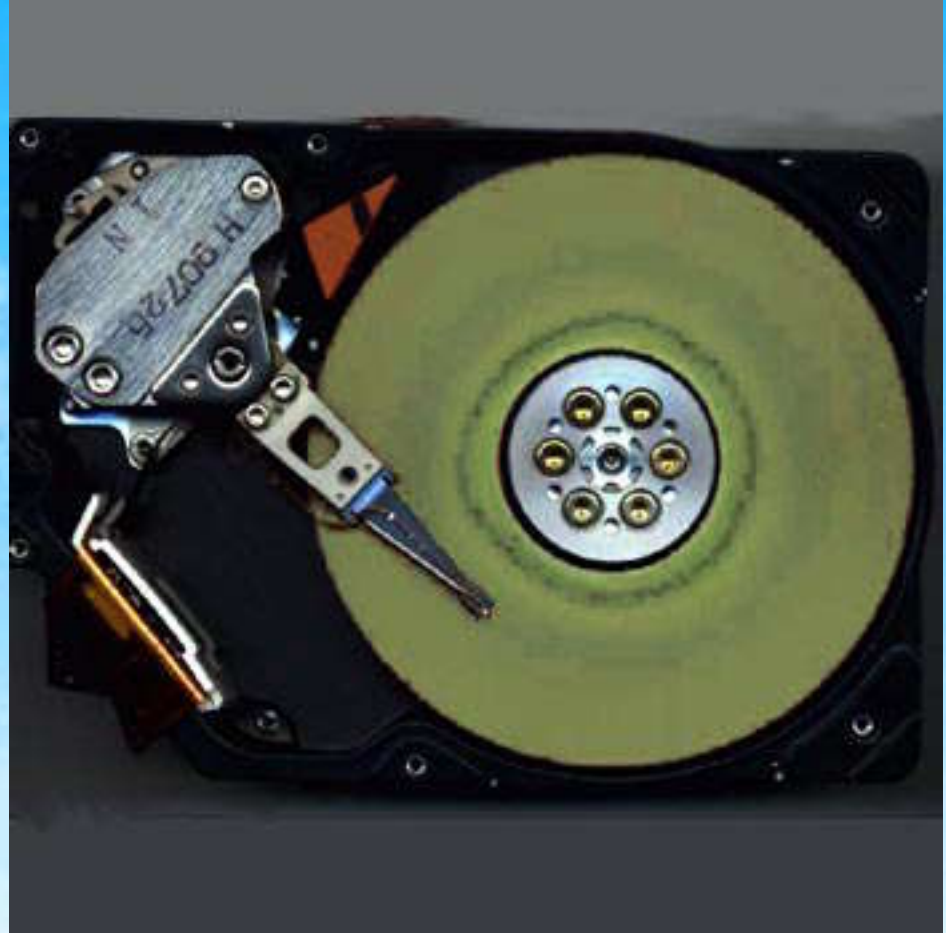
$10^{-6}$  s



strobe flash

# lecture hall

$10^{-7}$  s



hard disk write time

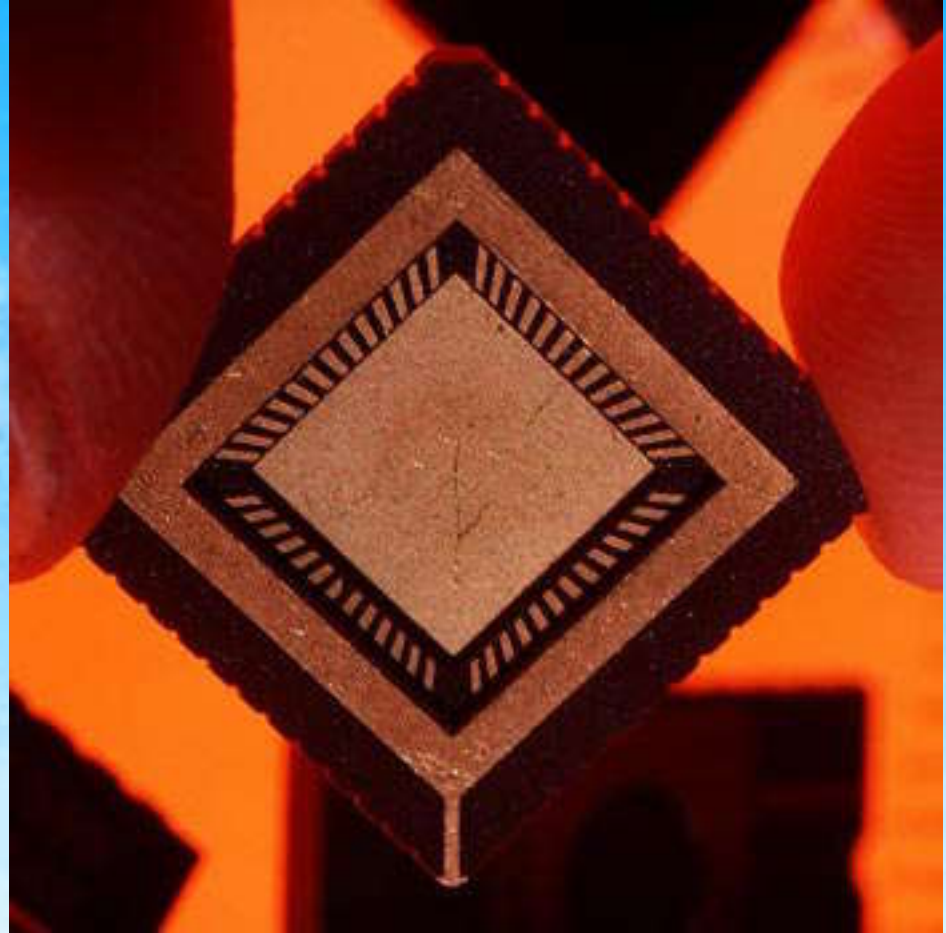
$10^{-8}$  s



Deep Blue calculation

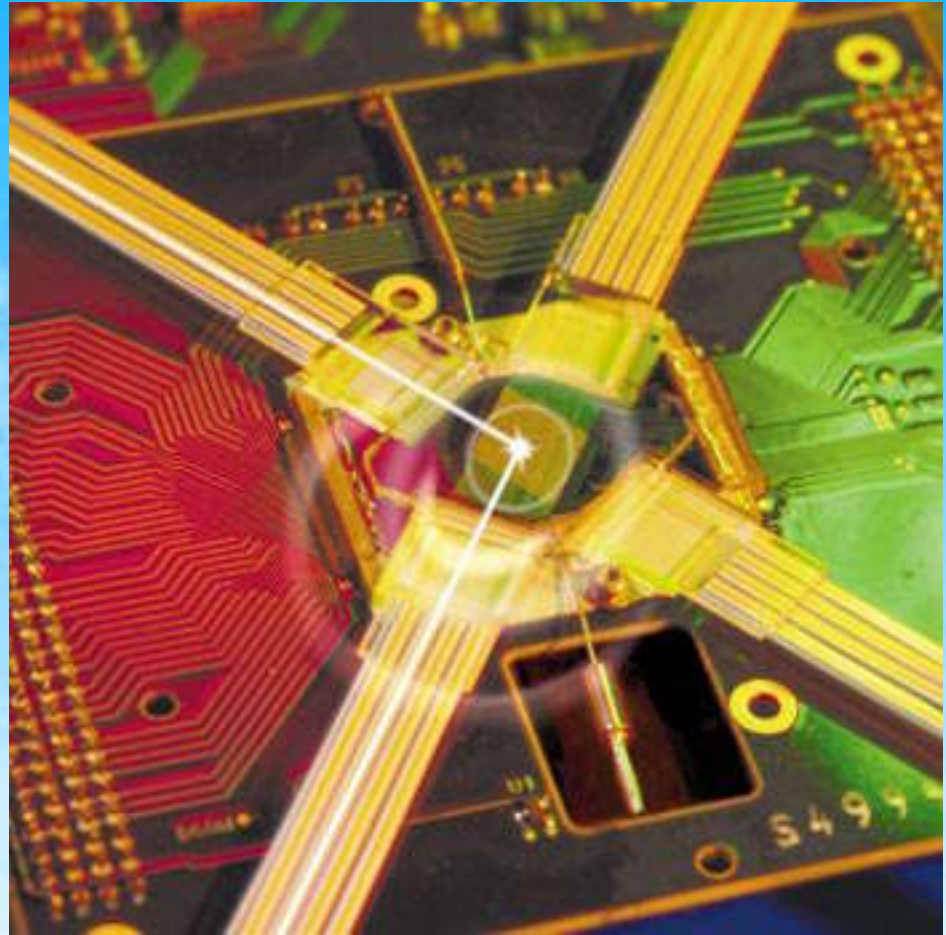
one foot

$10^{-9}$  s



clock speed of chip

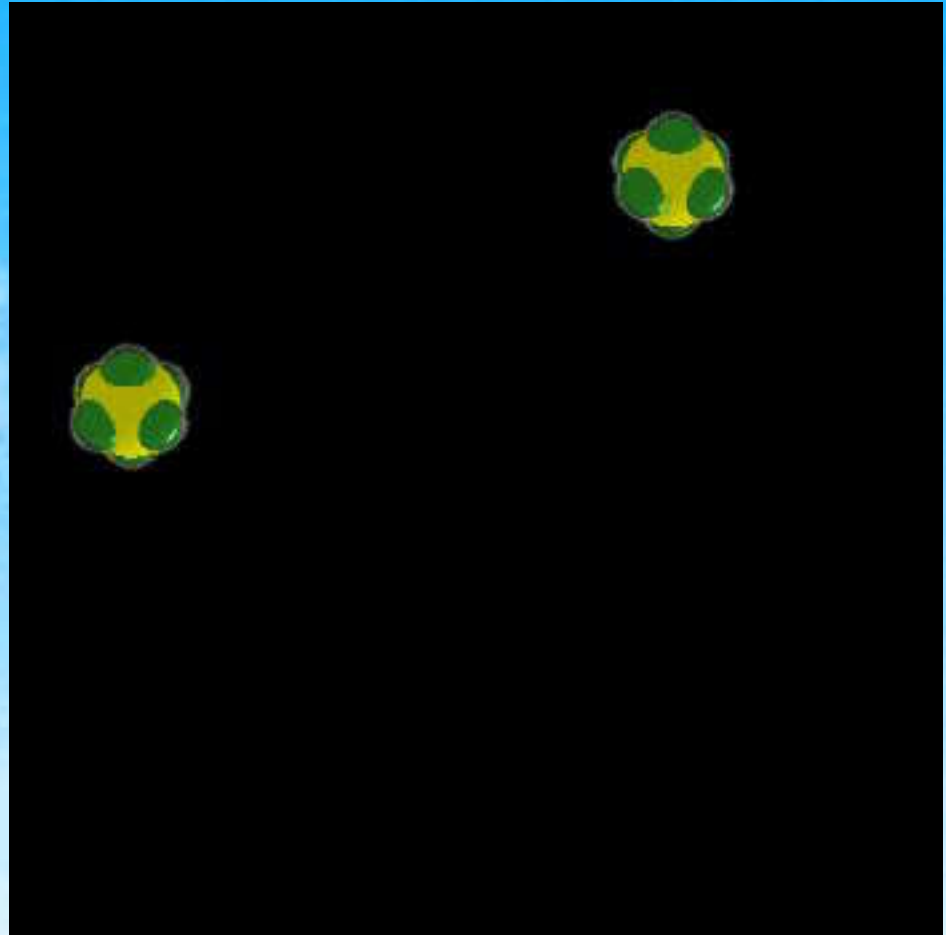
$10^{-10}$  s



fastest electronic switch

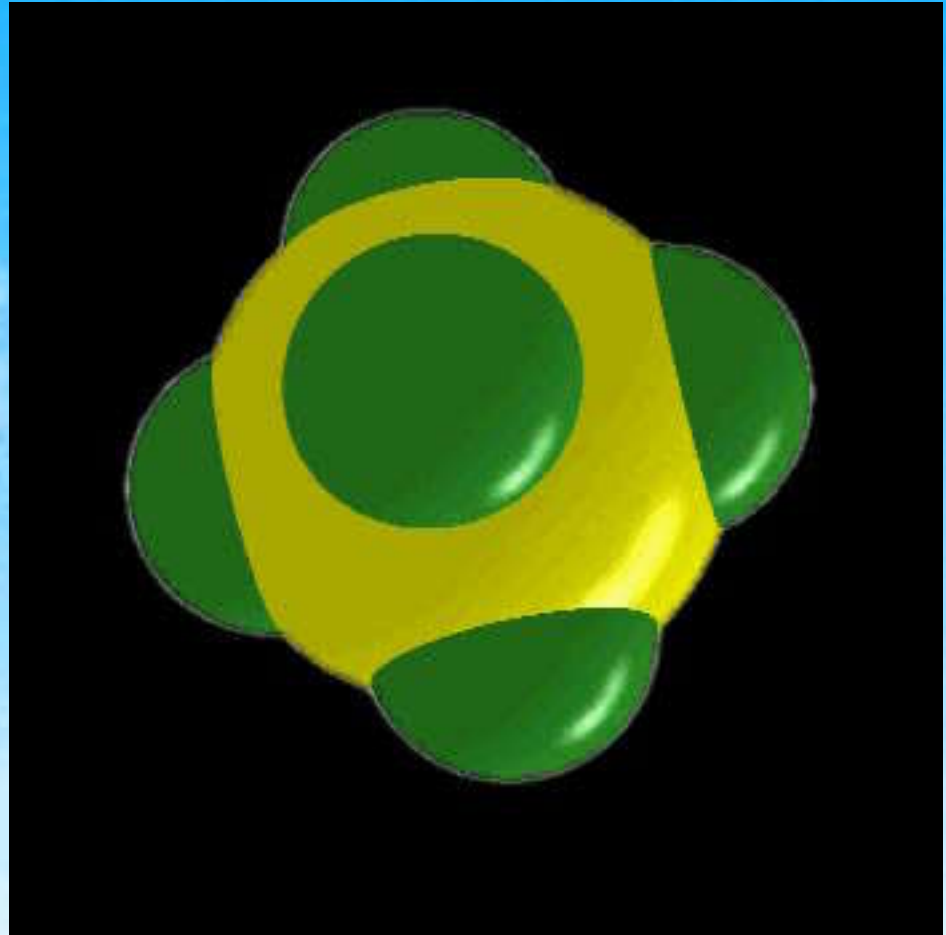
window pane

$10^{-11}$  s



molecular collision

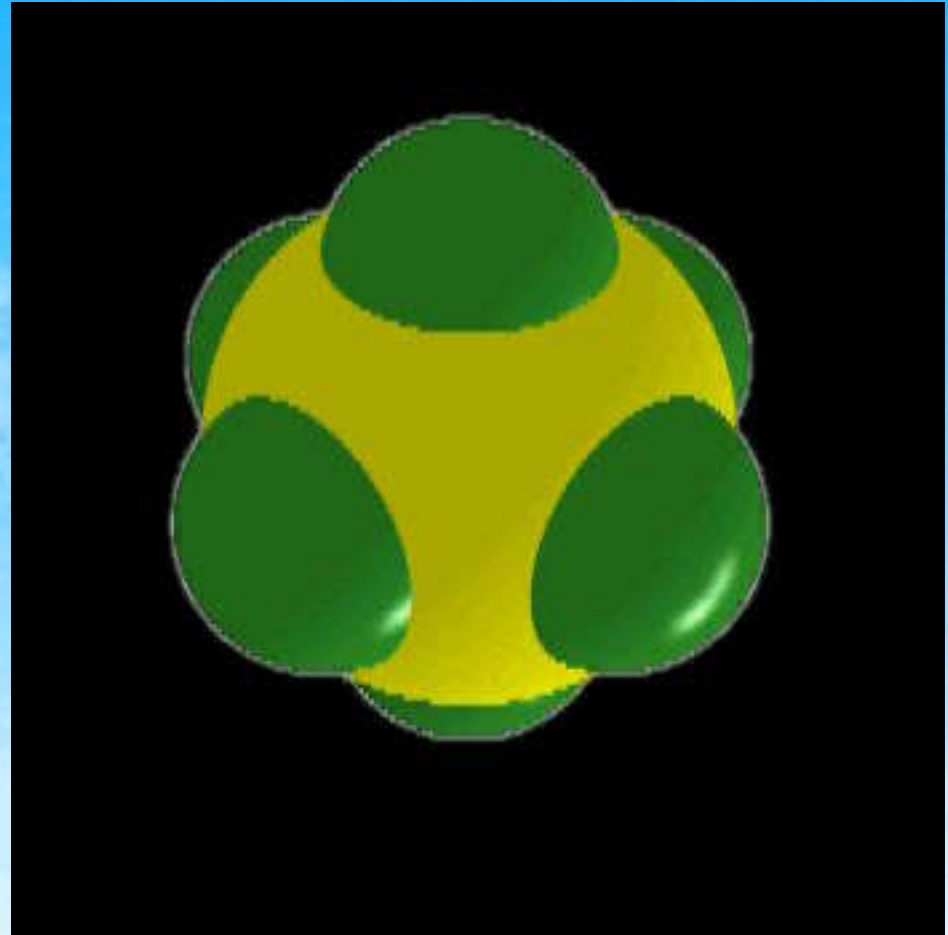
$10^{-12}$  s



molecular rotation

width of human hair

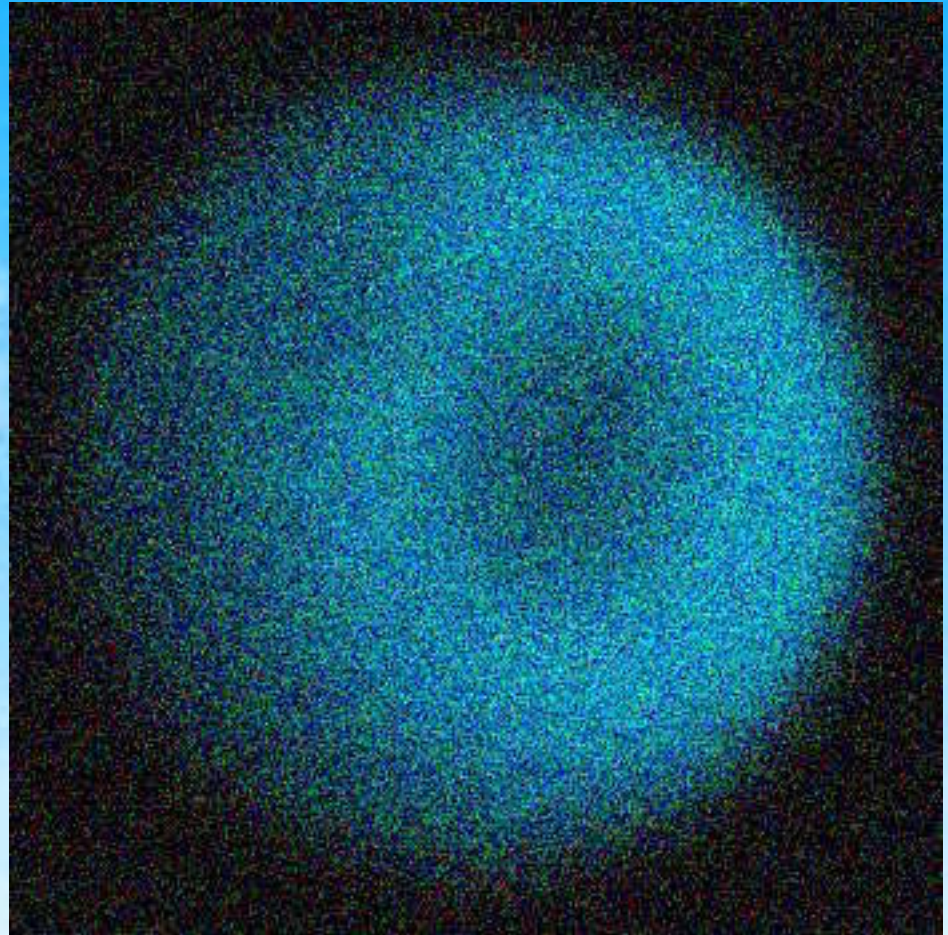
$10^{-13}$  s



molecular vibration



$10^{-14}$  s

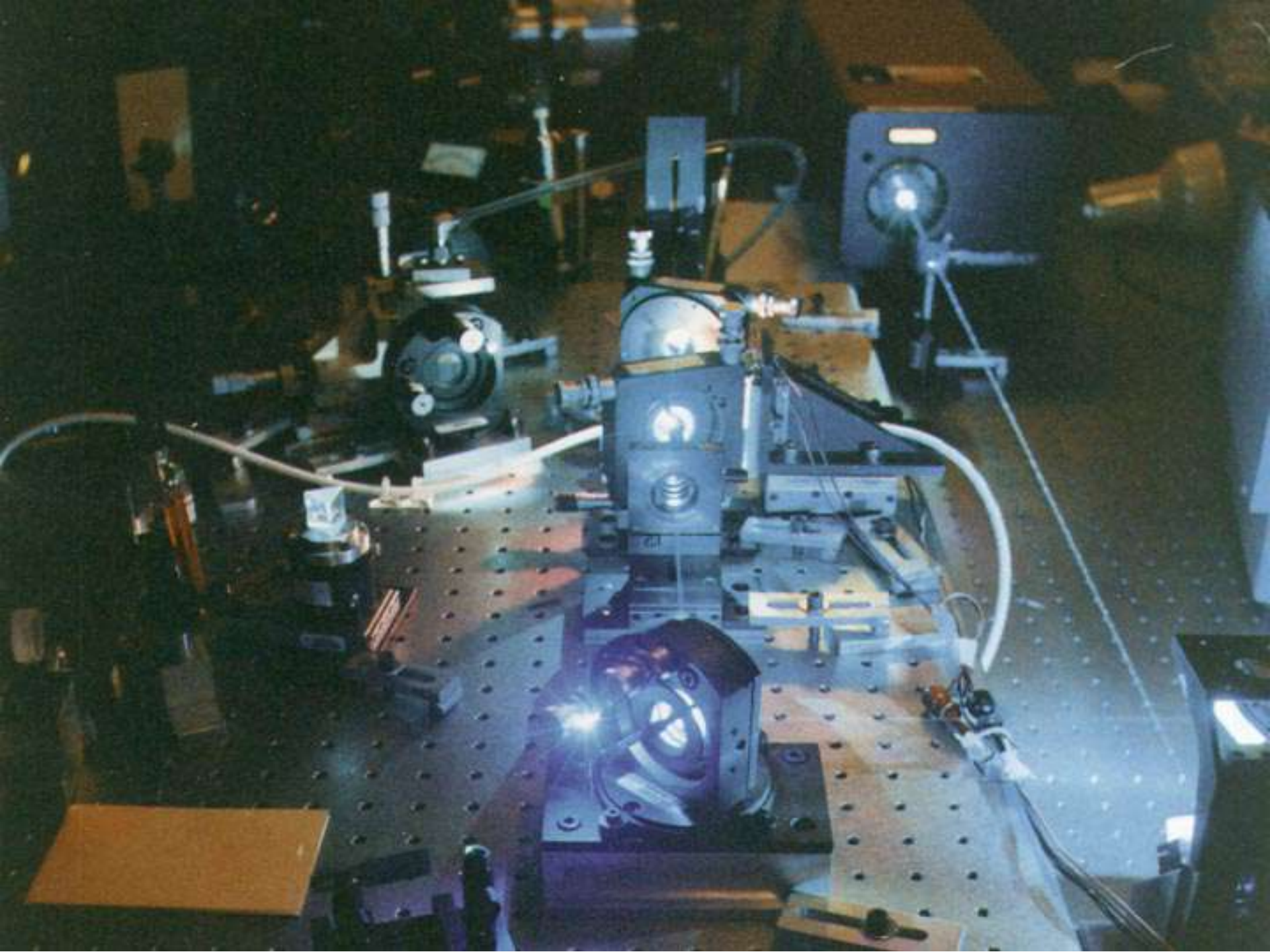


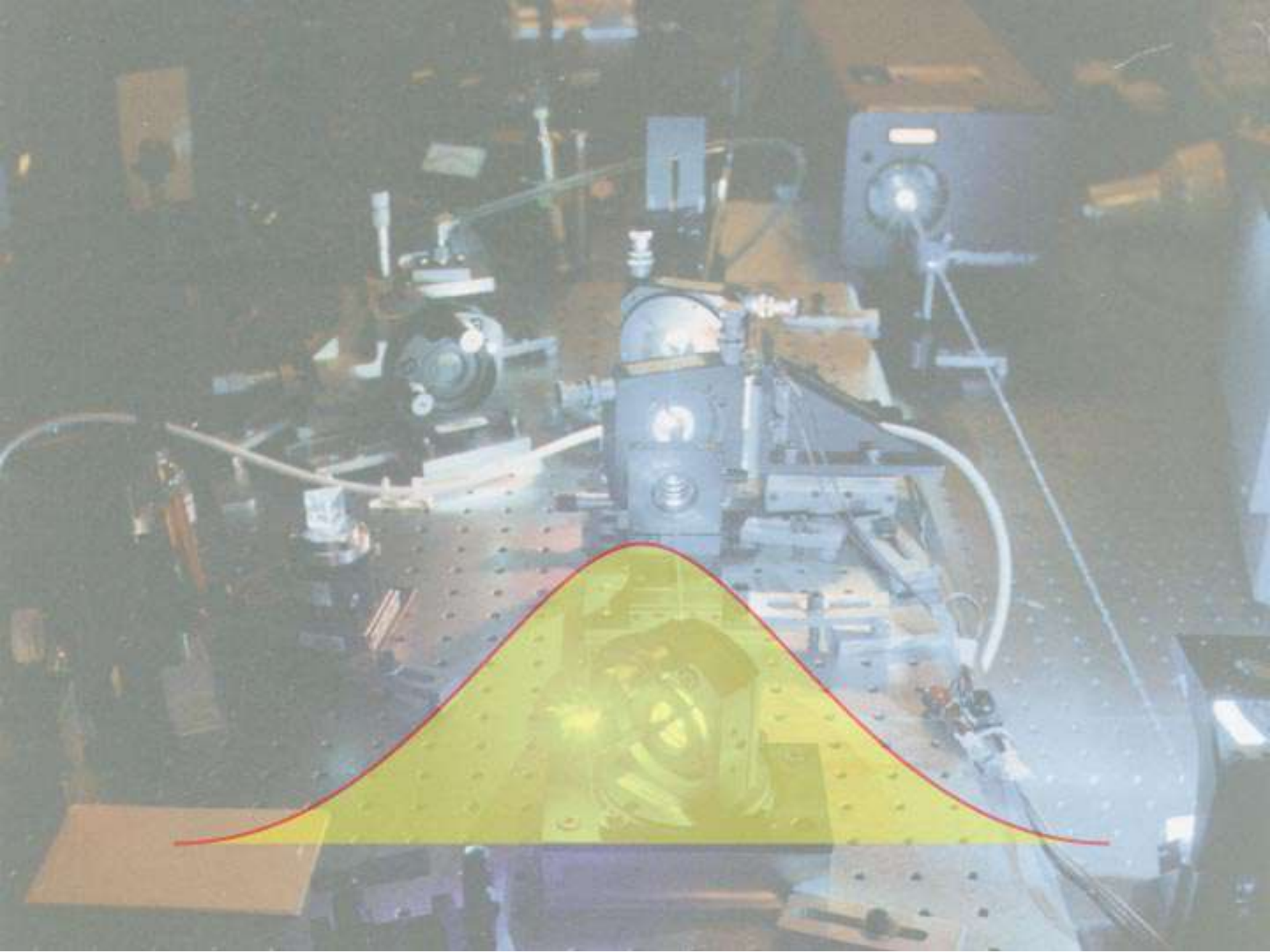
electronic collision

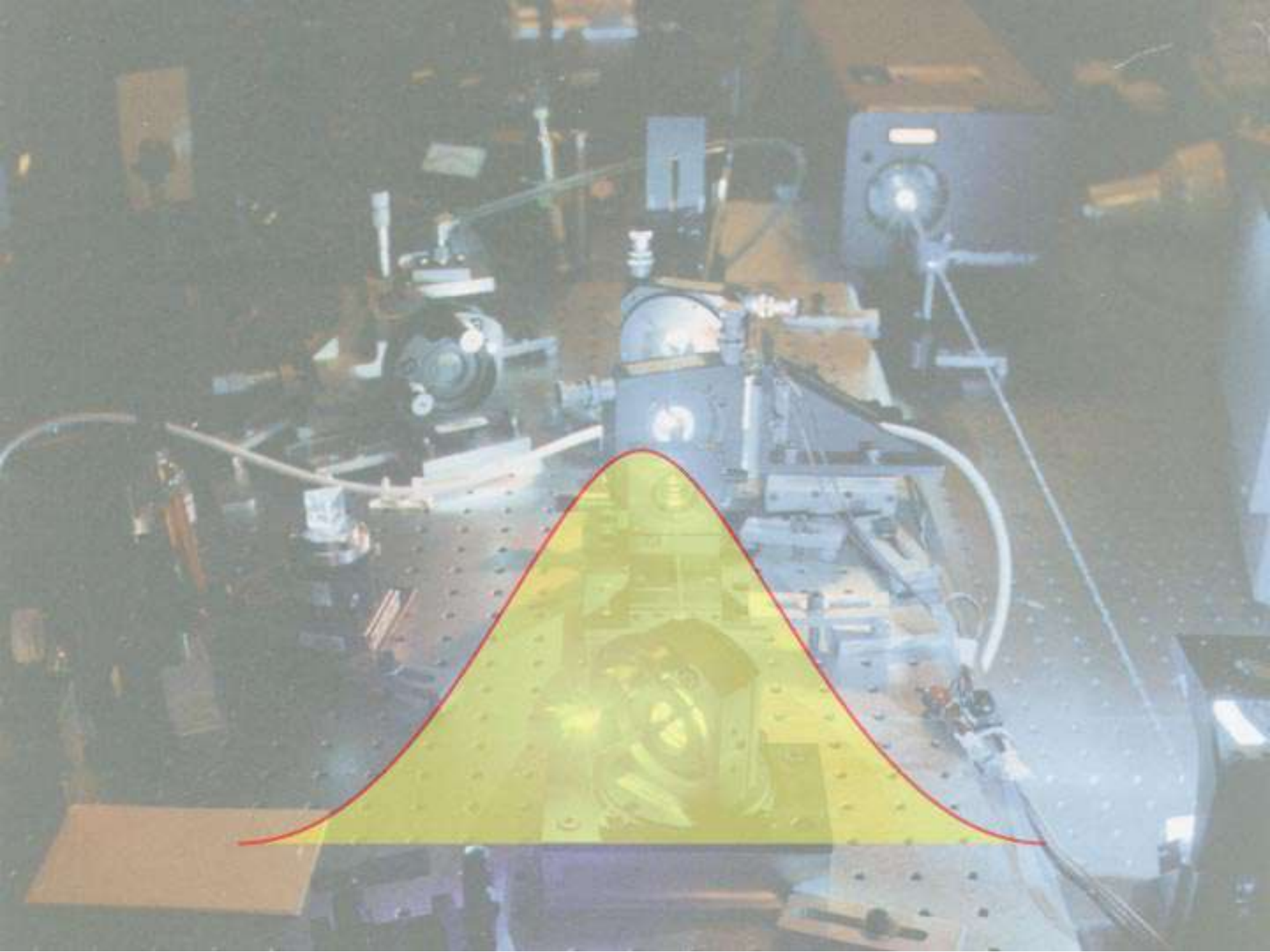
100 atomic layers

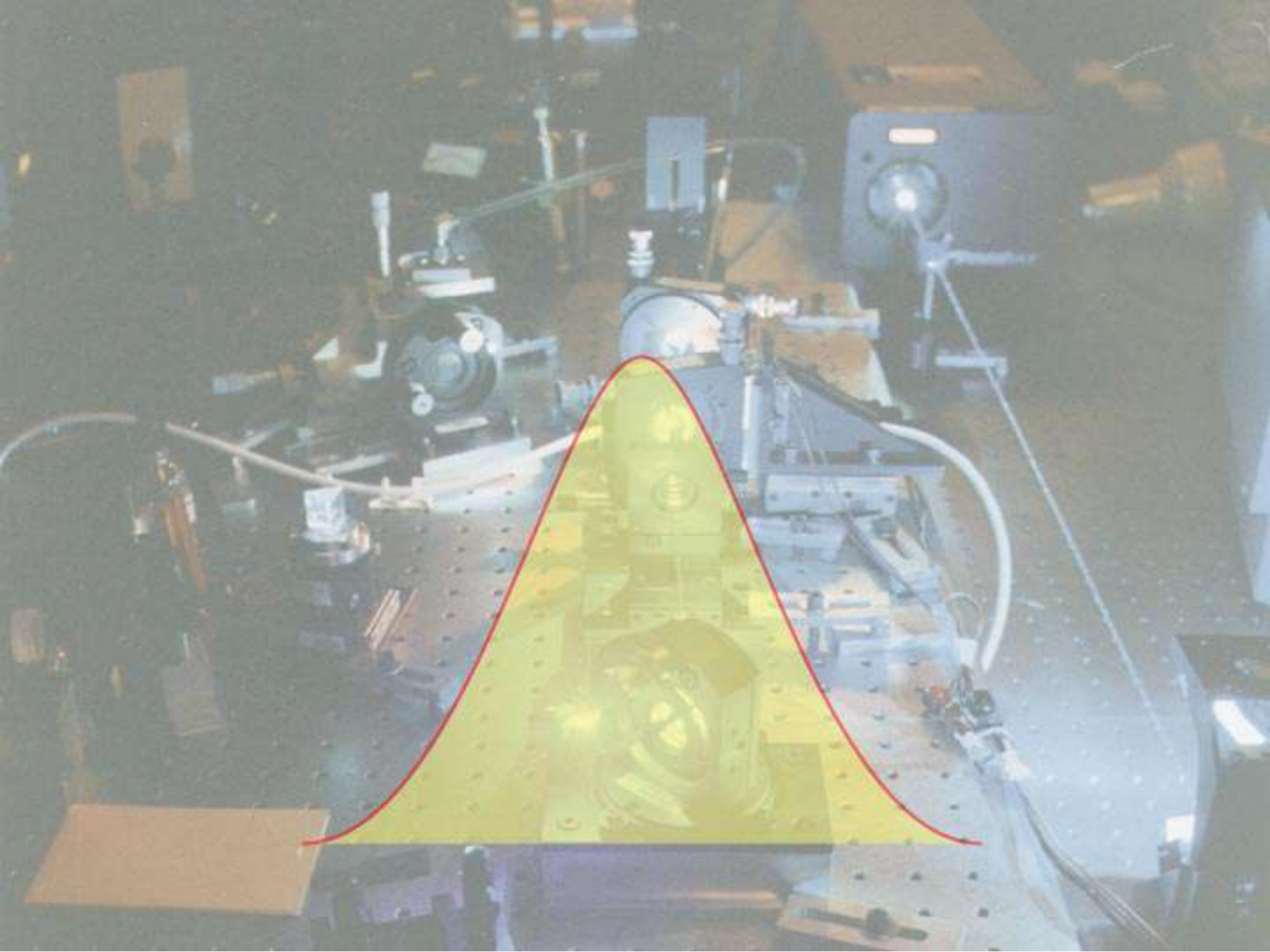
$10^{-15}$  s

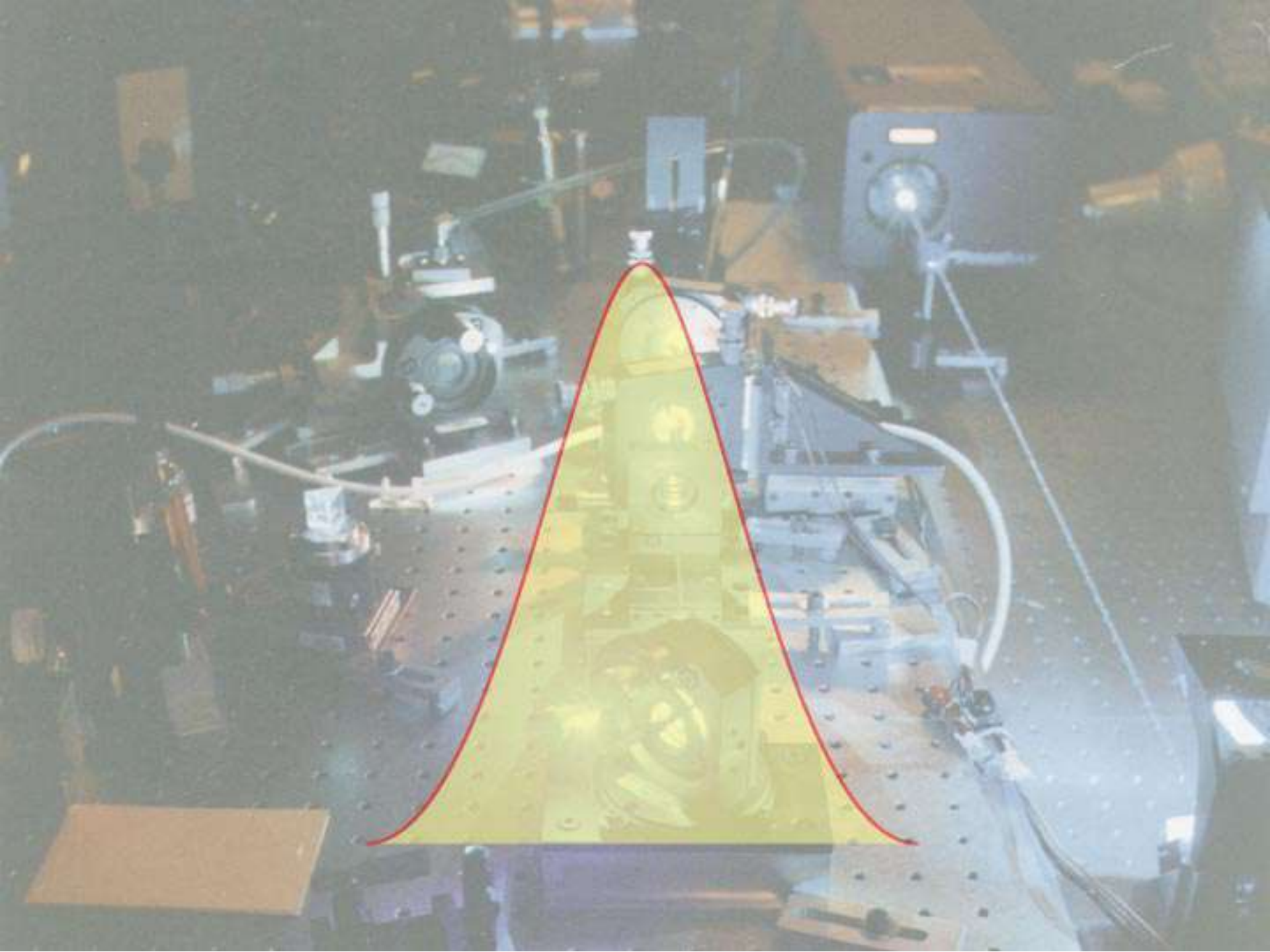
one "femtosecond"

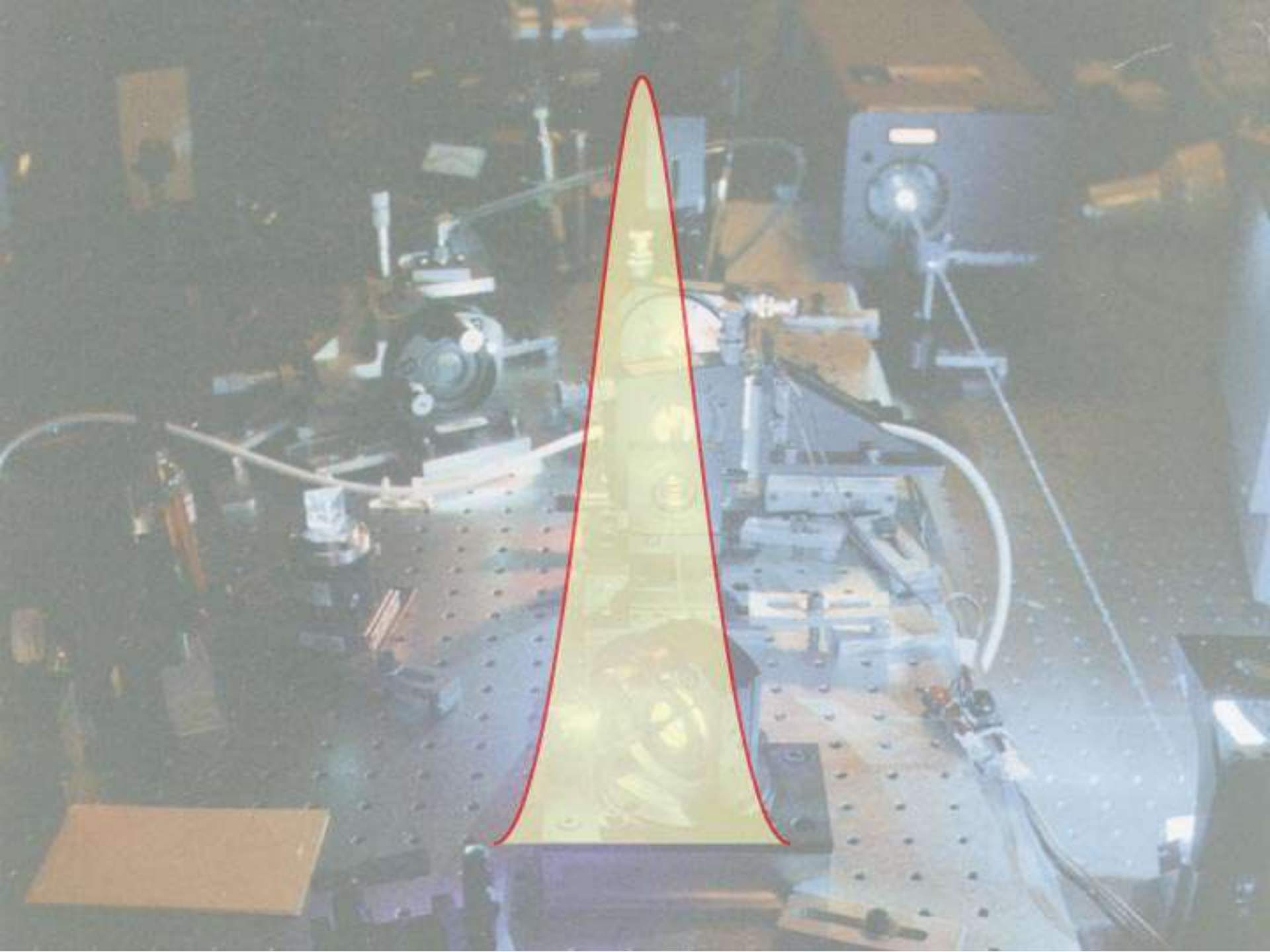




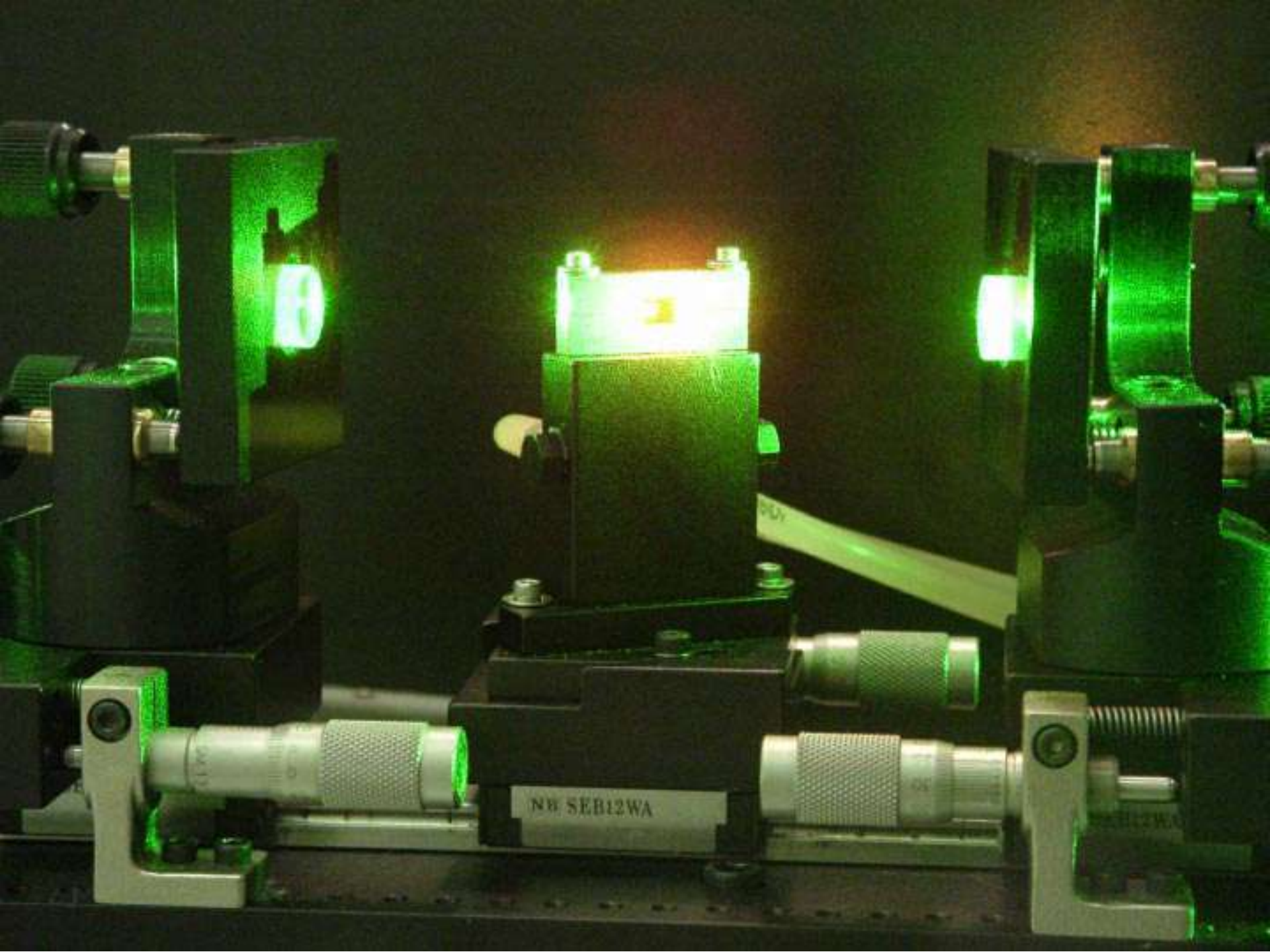




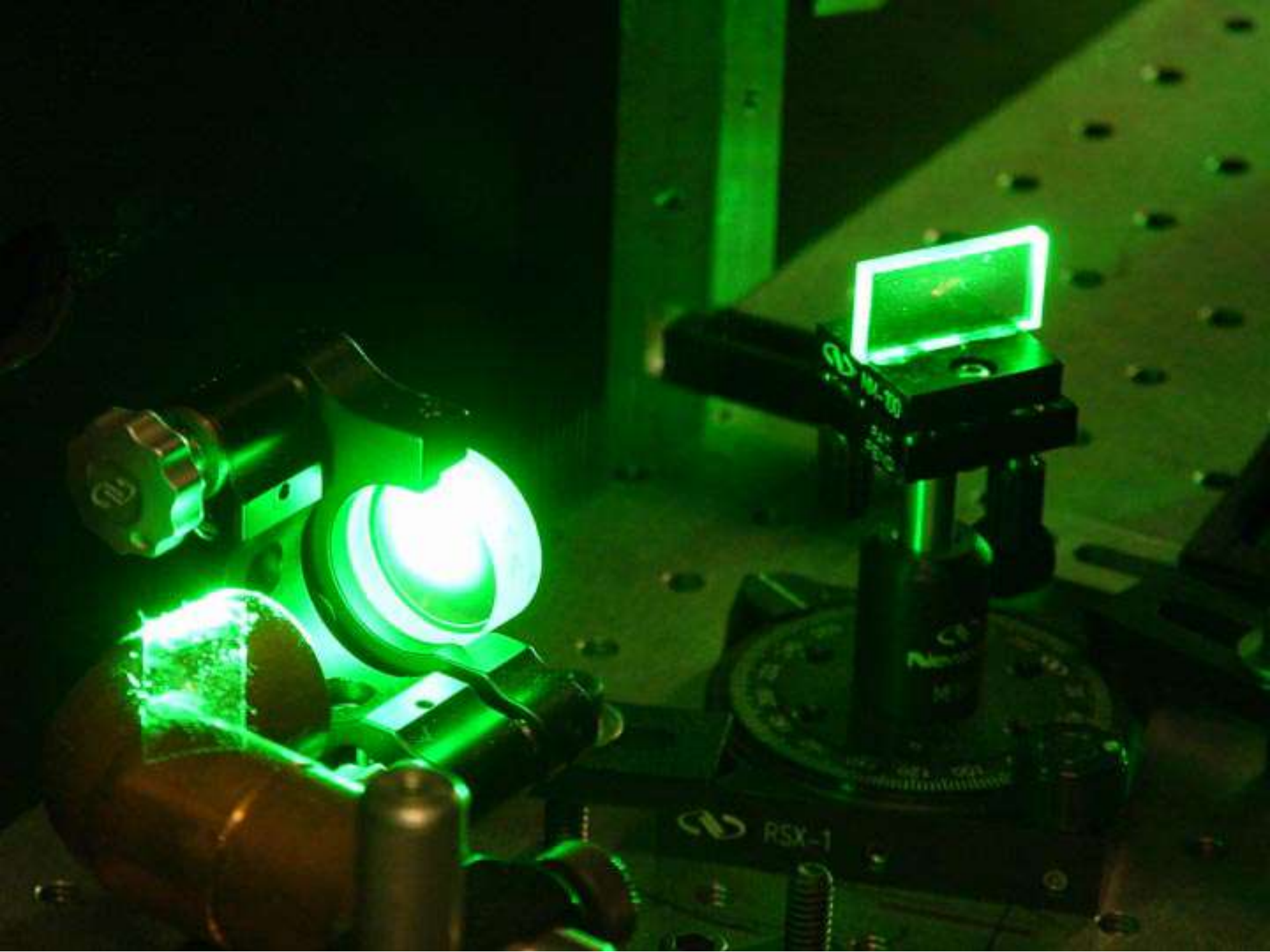


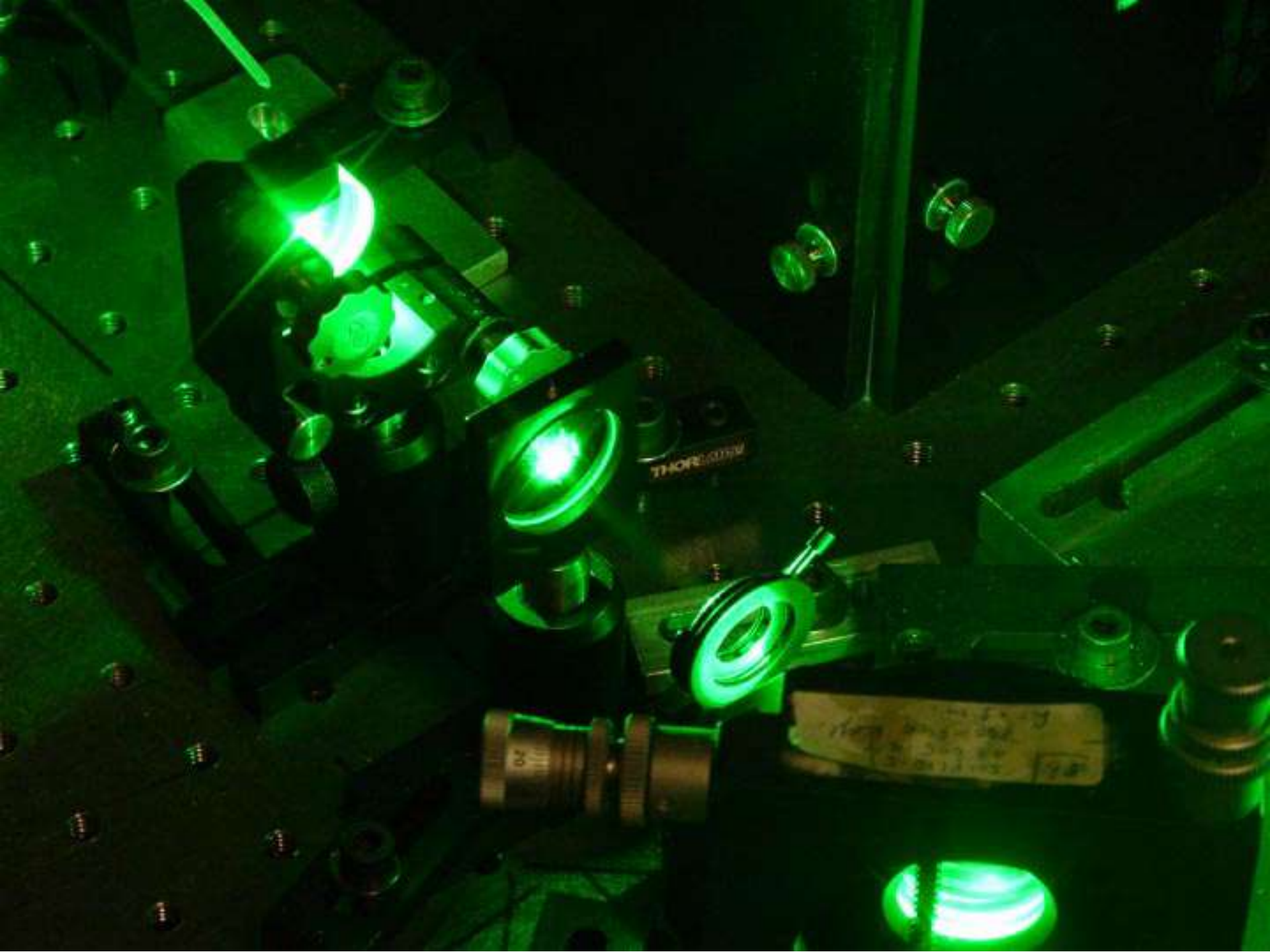


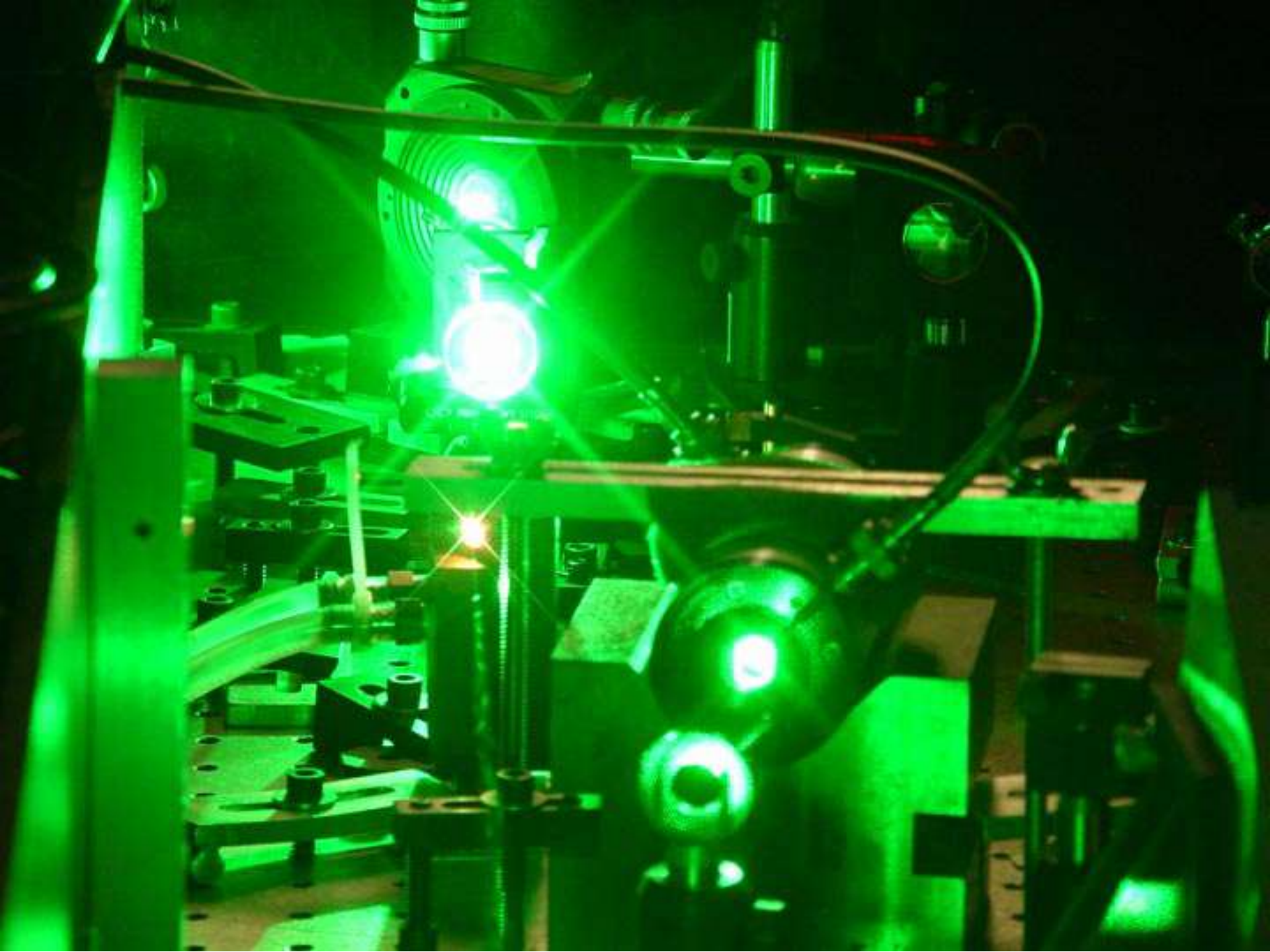


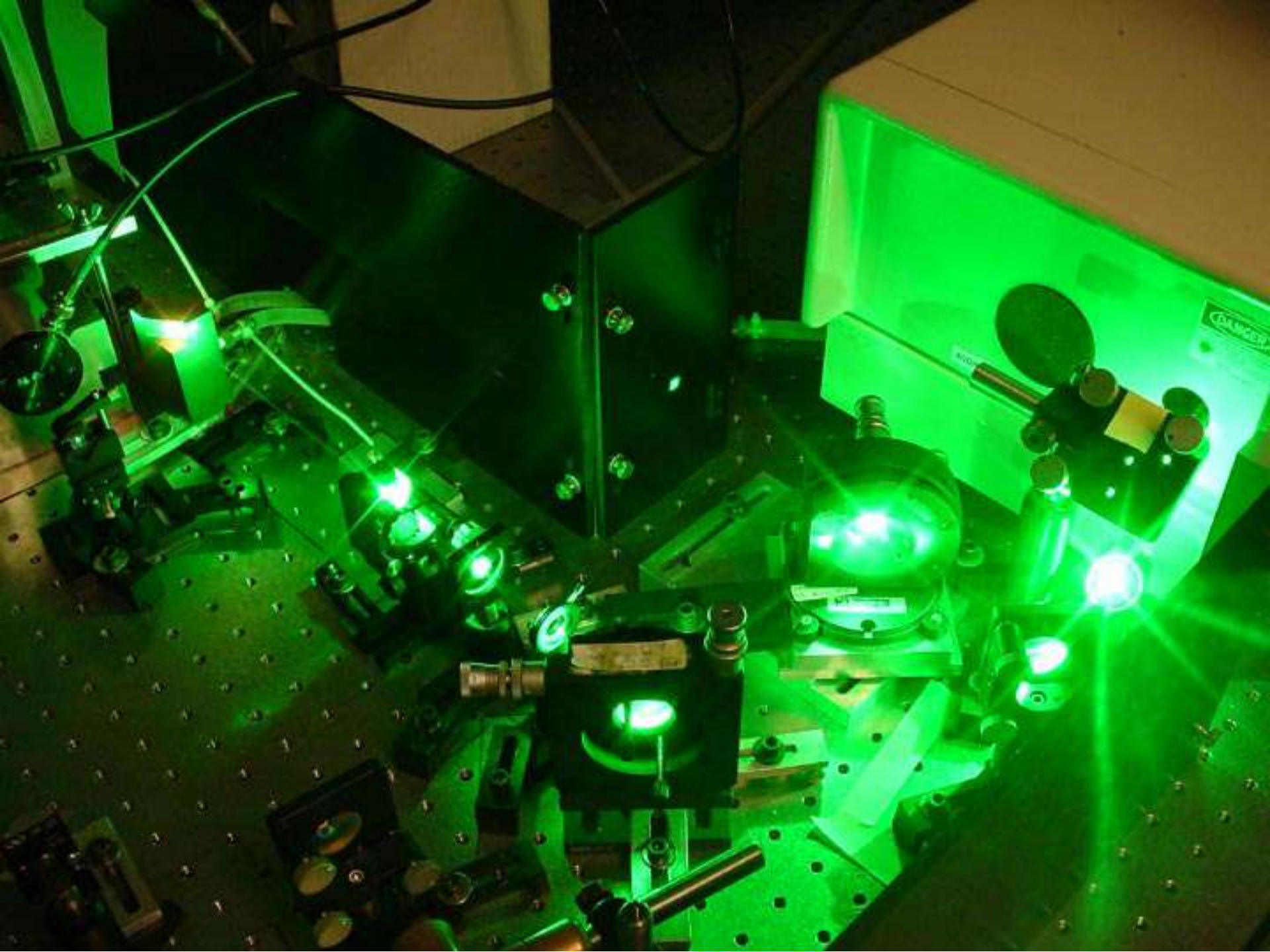


NB SEB12WA

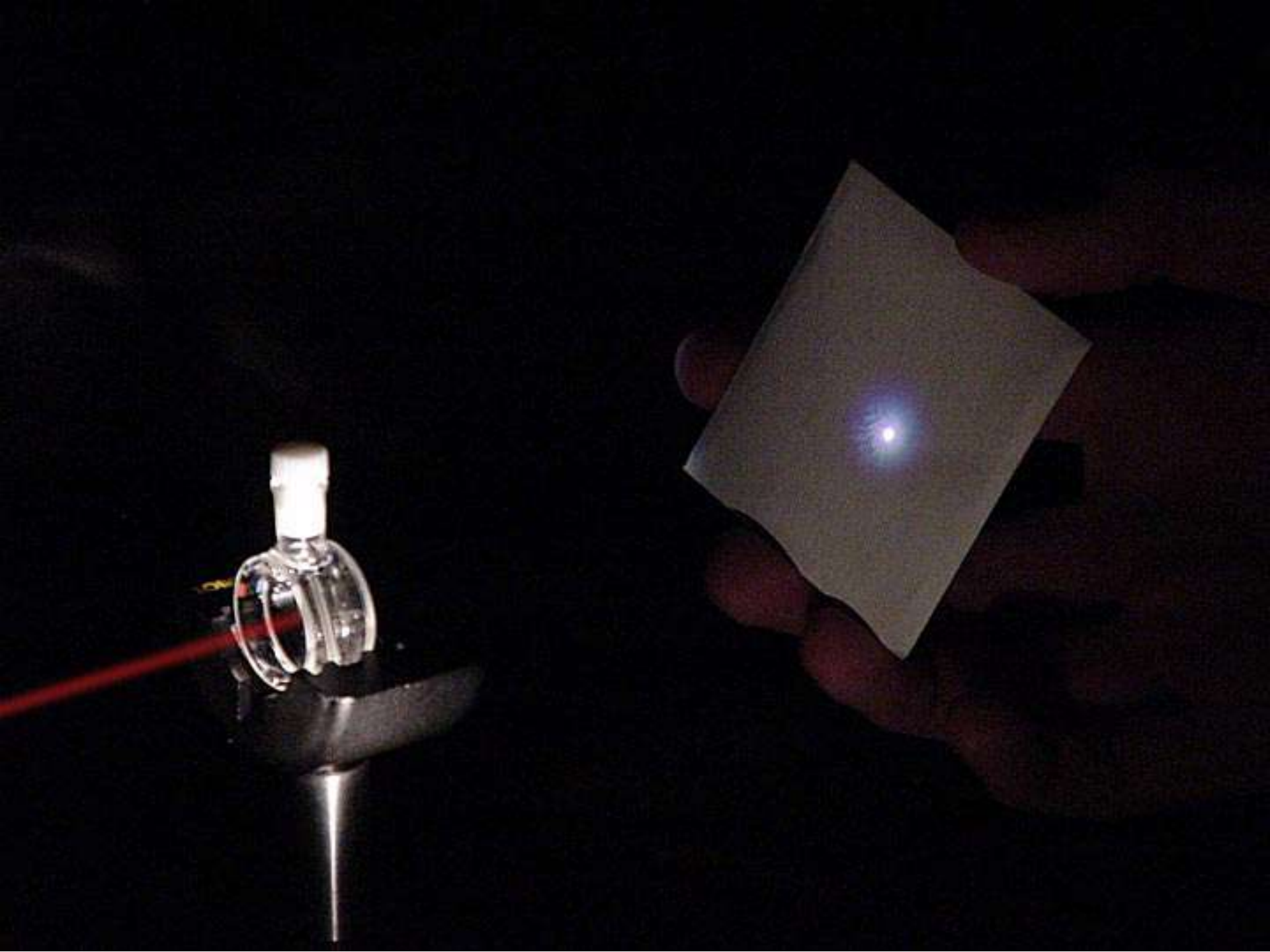


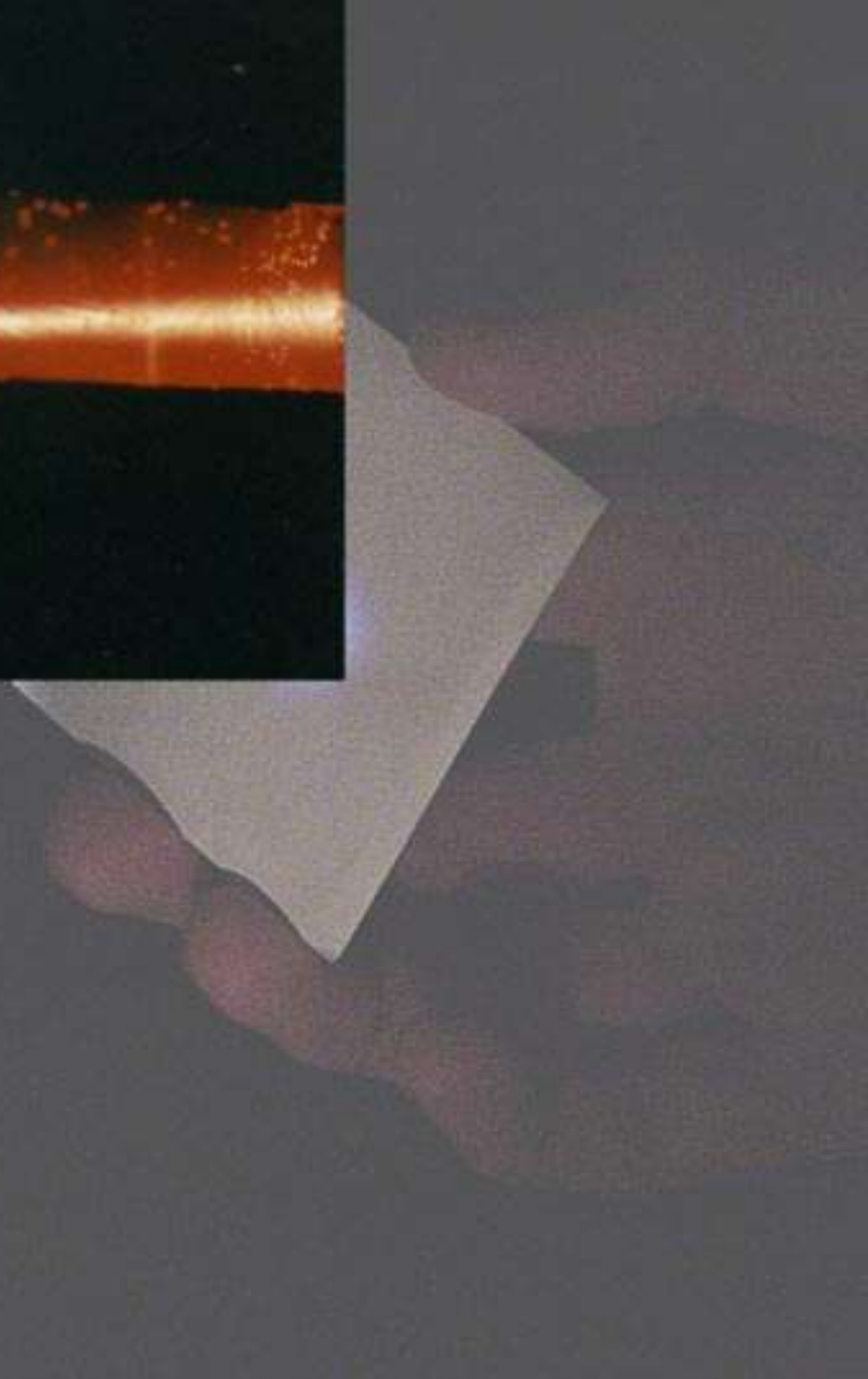
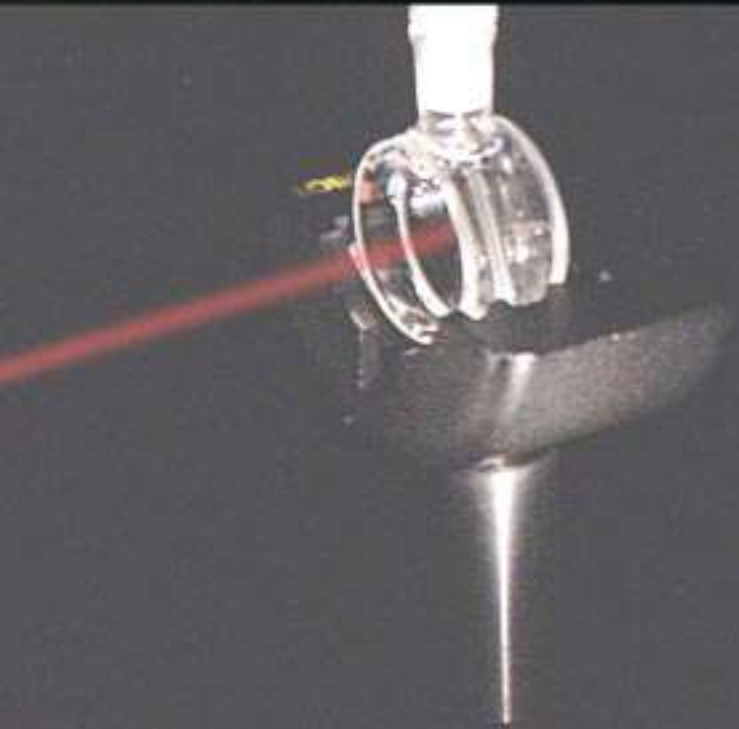




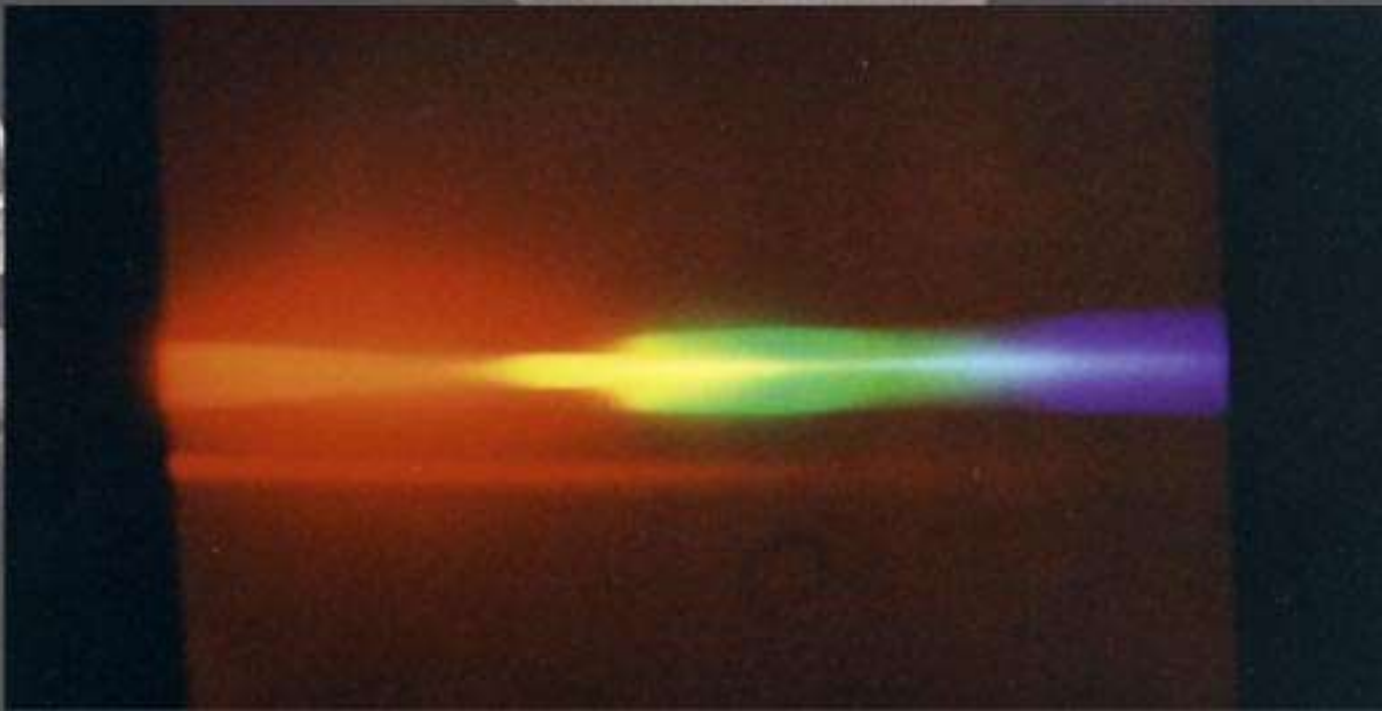






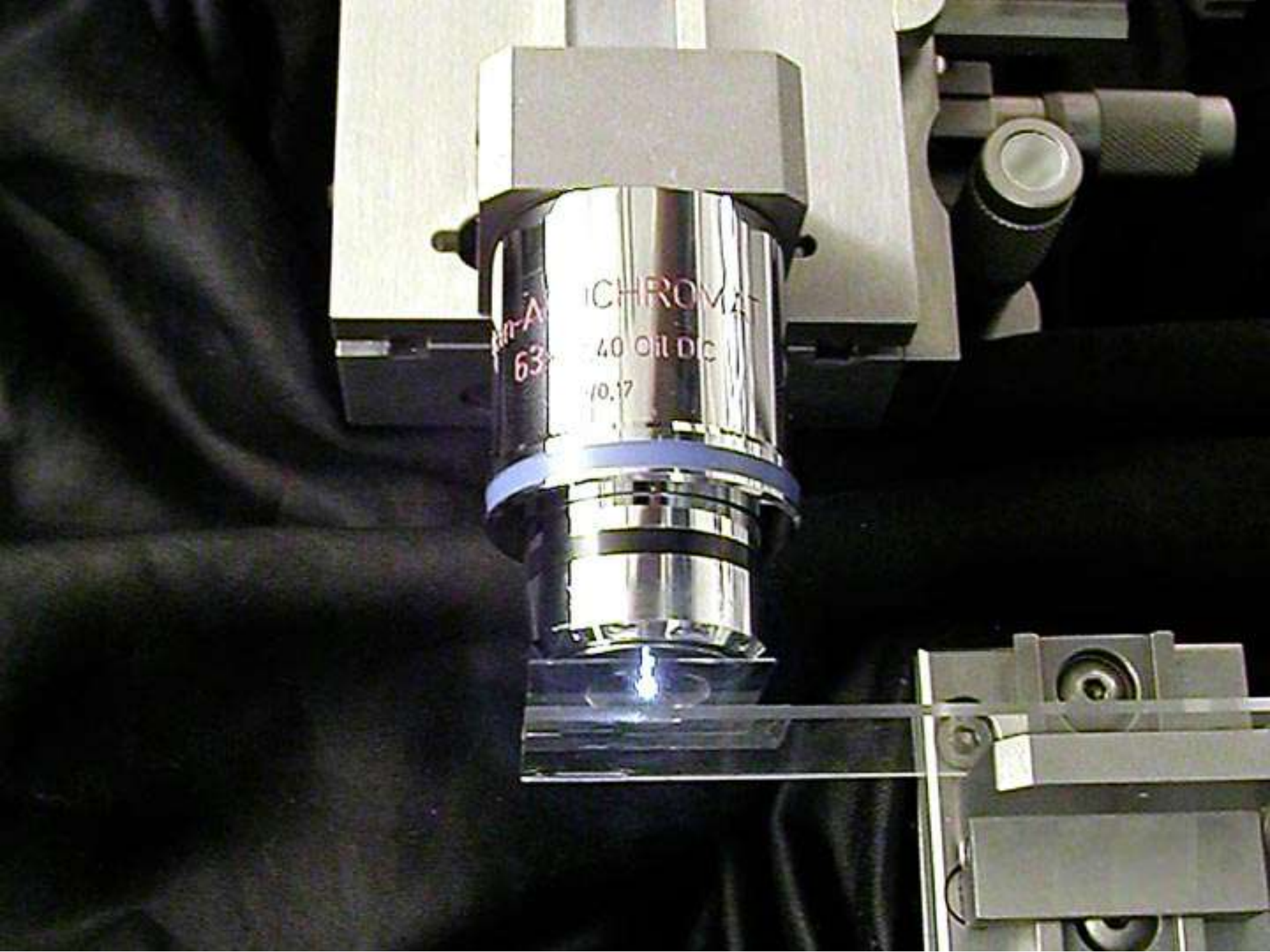






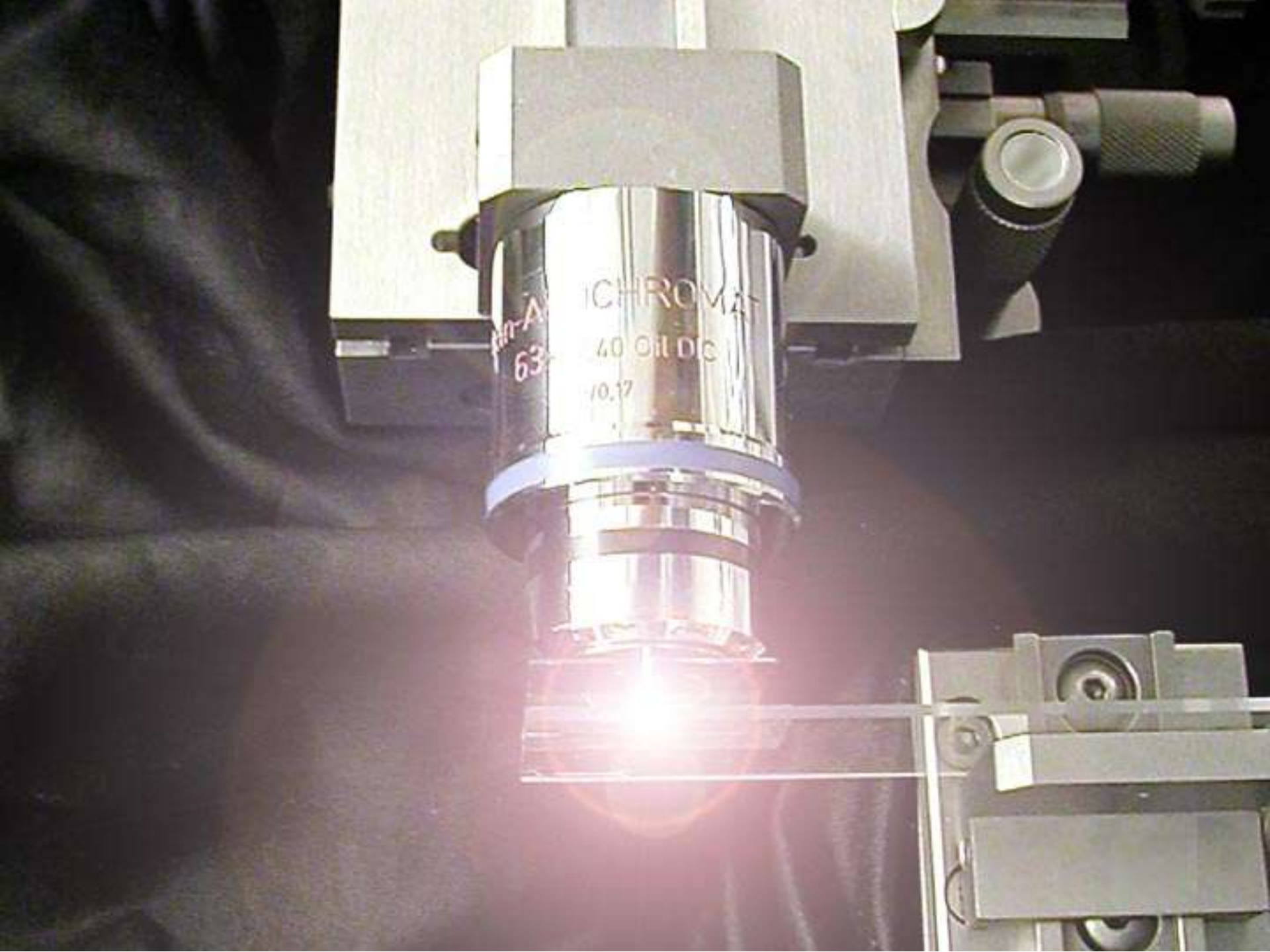






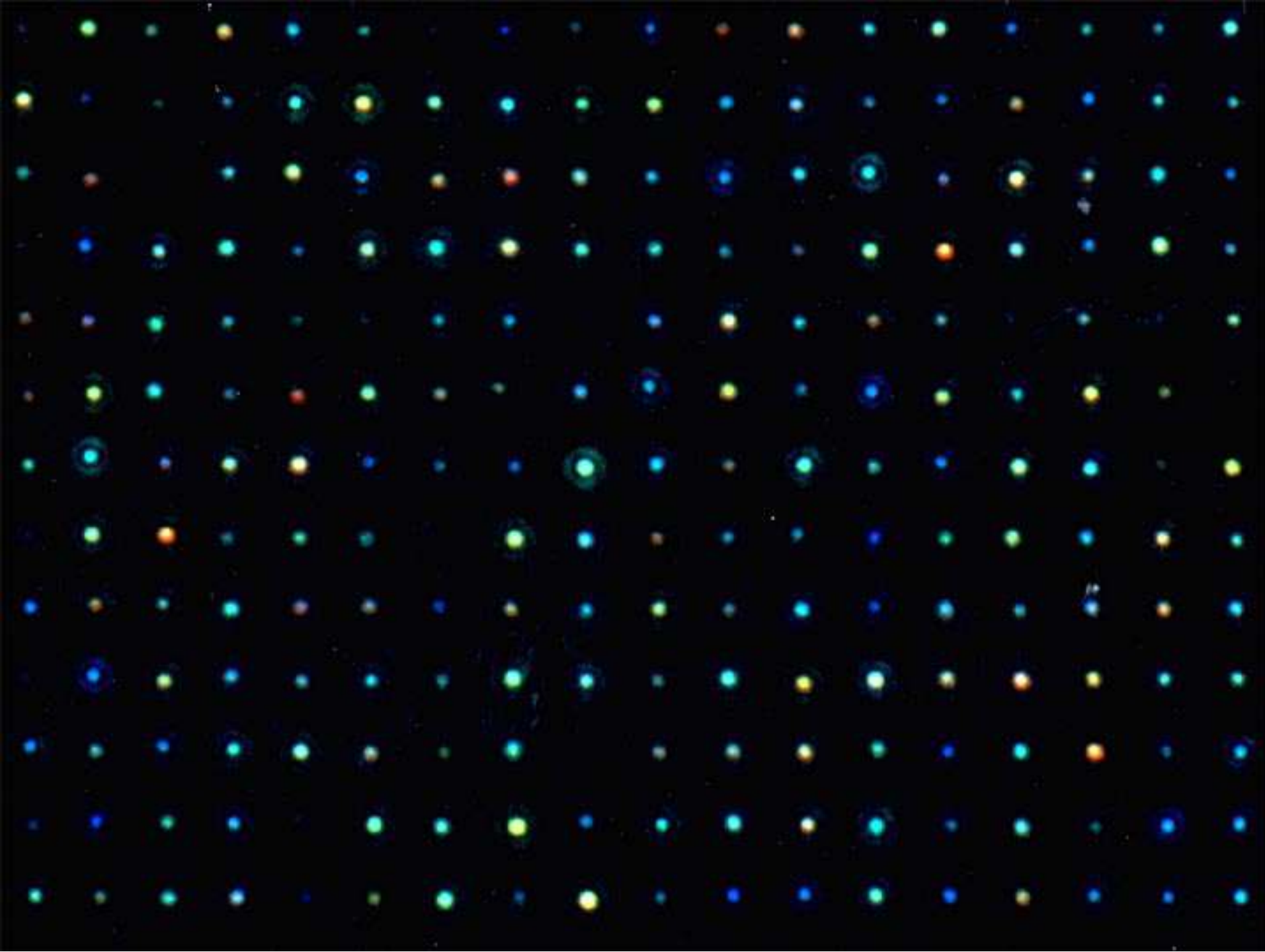
APRO  
63

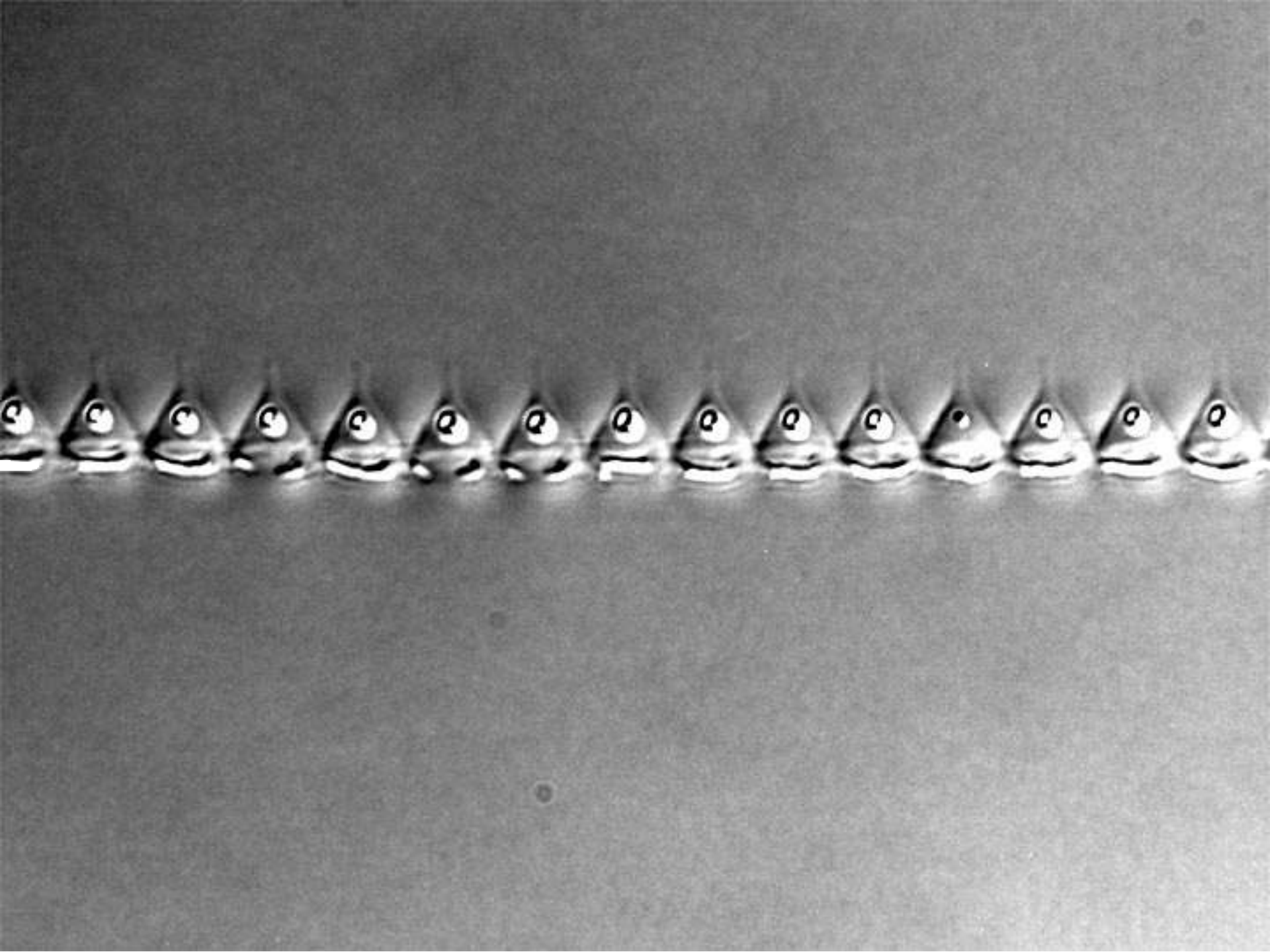
ACHROMAT  
40 Oil DC  
10.17

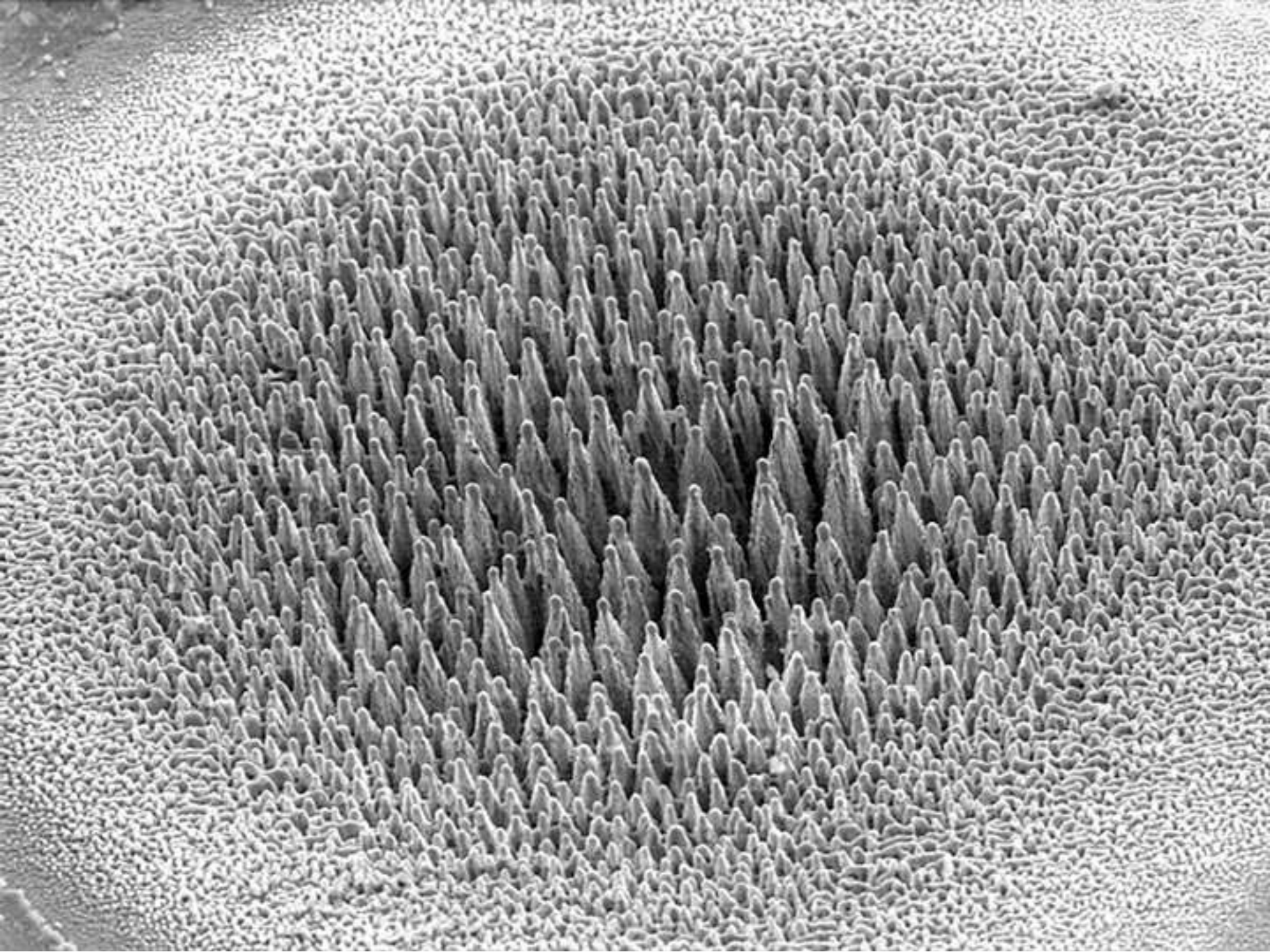


100-A  
63

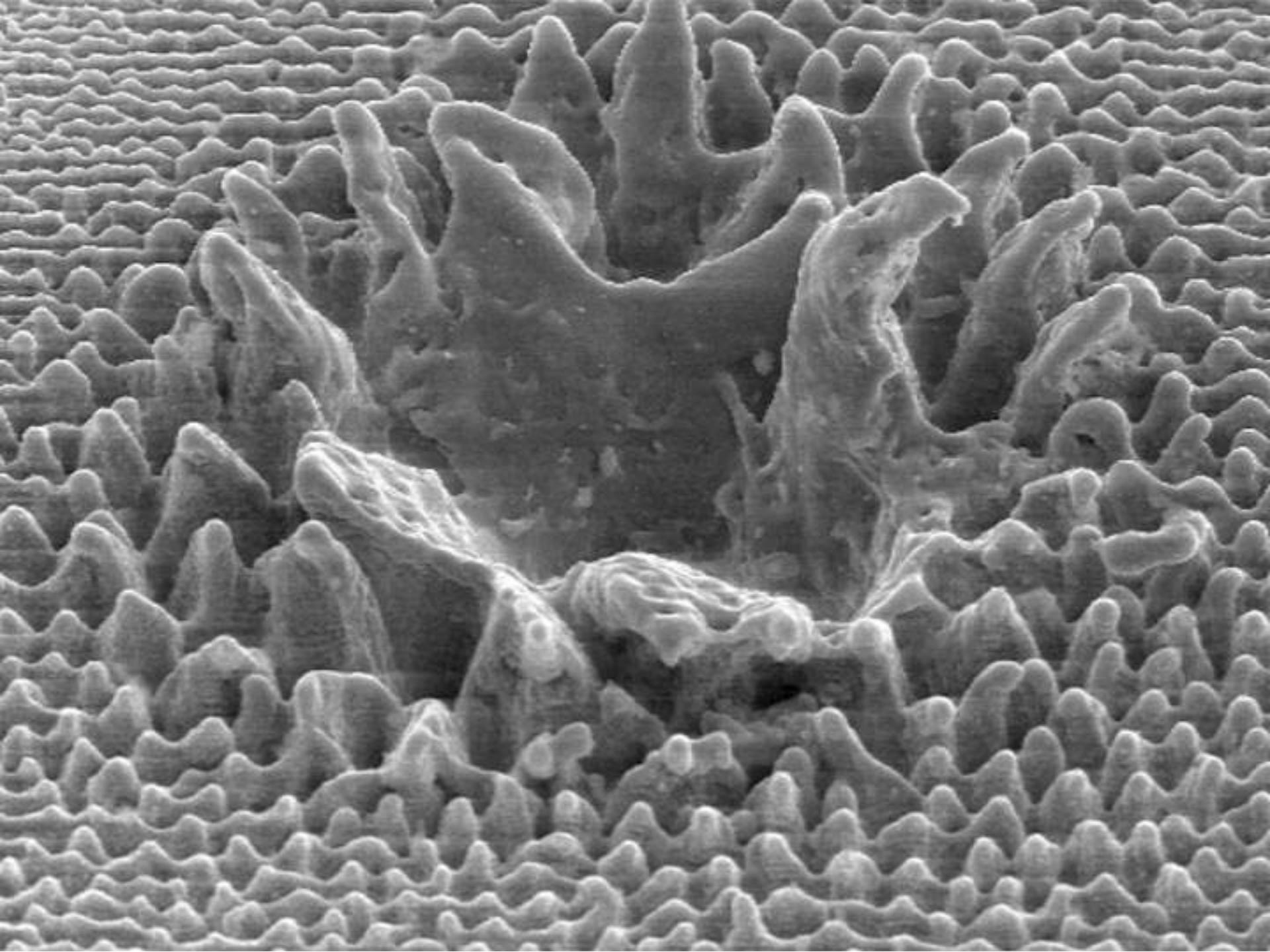
ACHROMAT  
40 Oil DC  
10.17

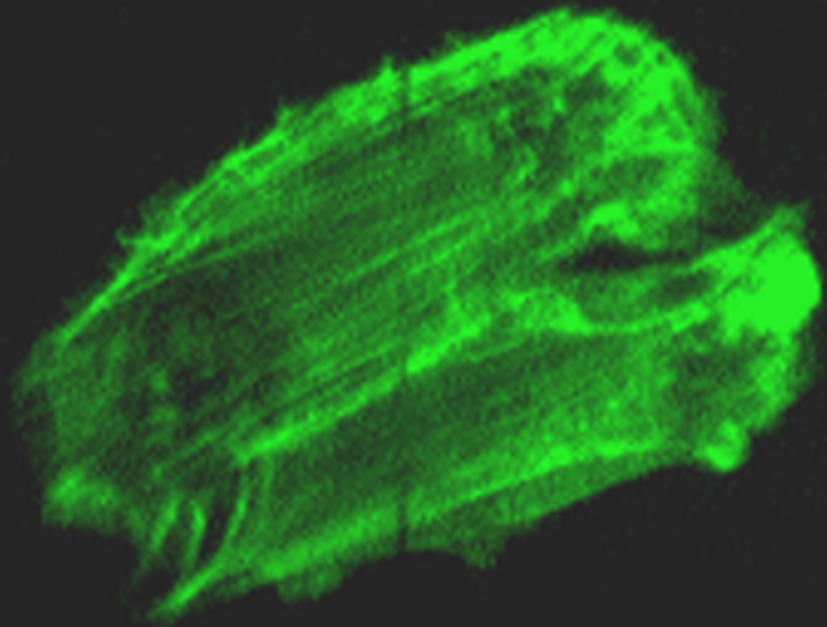












**Oh, Time, suspend your flight!  
and you, auspicious hours,  
suspend your course!  
Let us savor the fleeting joy  
of our most beautiful days!**

***Alphonse de Lamartine (1817)***

**Plenty of unhappy ones down here**

**beg you; fly by for them!**

**Along with their days**

**take the worries that consume them;**

**Forget the happy ones!**

***Alphonse de Lamartine (1817)***

**In vain I ask for a few more moments,  
But time escapes and flees;  
I say to this night: “Slow down,”  
but dawn will dissipate the night.**

***Alphonse de Lamartine (1817)***

# Special Thanks to:

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Nico Bloembergen

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Juen Kai Wang



**For additional information  
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