



Technology Transition Workshop | *Brian Dalrymple*

The Forensic Light Source – History, Evolution, Extension & Acquisition







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History

History

- ❖ Serendipity 1976
- ❖ Ninhydrin on black cardboard
- ❖ Iodine?
- ❖ J.M. Duff
- ❖ Iodine fluorescence in 1911
- ❖ Robert Olsen, Sr.
- ❖ Inherent fluorescence?

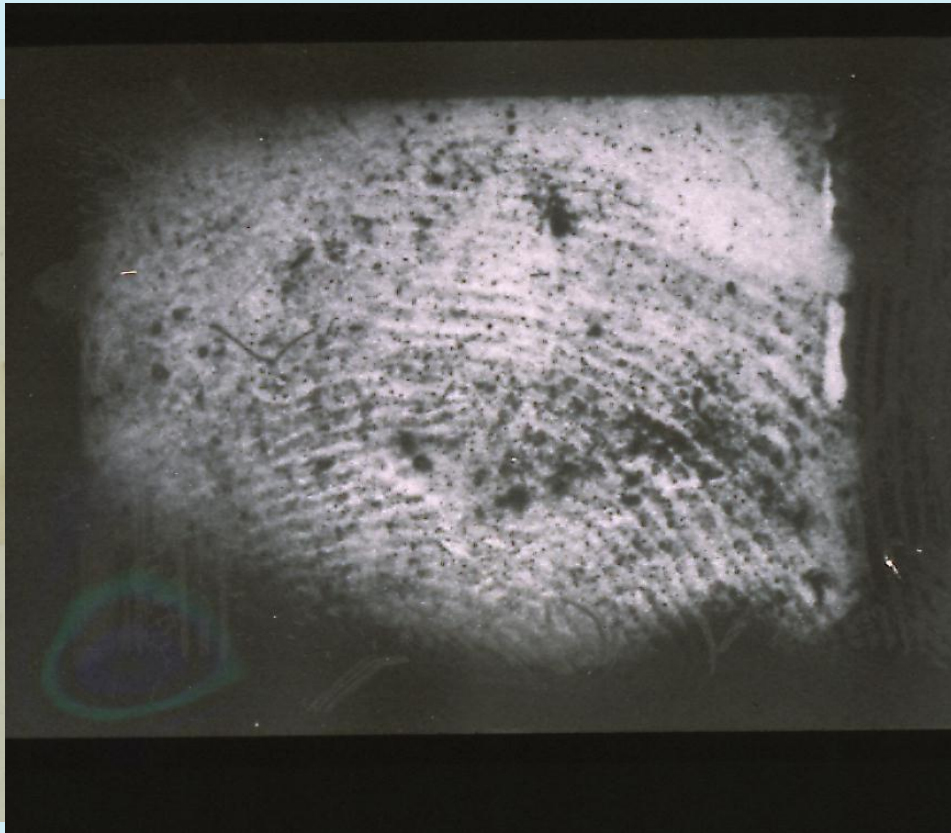
History

- ❖ E.R. Menzel – Argon ion laser
- ❖ TLC plates – fingerprint fluorescence
- ❖ Laser safety goggles
- ❖ Inherent fluorescence on black tape
- ❖ Revealed and photographed by laser
- ❖ Identified as suspect
- ❖ First case in history
 - Laser application
 - Fluorescence as serious tool

1977 – Argon Ion Laser



1977 – Argon Ion Laser



Laser Implications

- ❖ No previous light exploitation
- ❖ UV fluorescent powder ineffective
- ❖ New direction in fingerprint detection
- ❖ % absorption/reflection
- ❖ Nothing absorbs 100% of incident light
- ❖ Nothing reflects 100% of incident light
- ❖ Fixed dynamic range
- ❖ Fingerprints – sub-nanogram
- ❖ Limited detection sensitivity

Luminescence

- ❖ 0% reflected incident light
- ❖ Luminescence of fingerprint
- ❖ Luminescence of substrate
- ❖ Much wider potential dynamic range
- ❖ Much more sensitive



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1976 – Argon Laser

- ❖ Fingerprints on skin
- ❖ Feasibility study – detection on skin
- ❖ Fingerprint photographed on living skin
- ❖ Detected and photographed
- ❖ Immediately after deposition



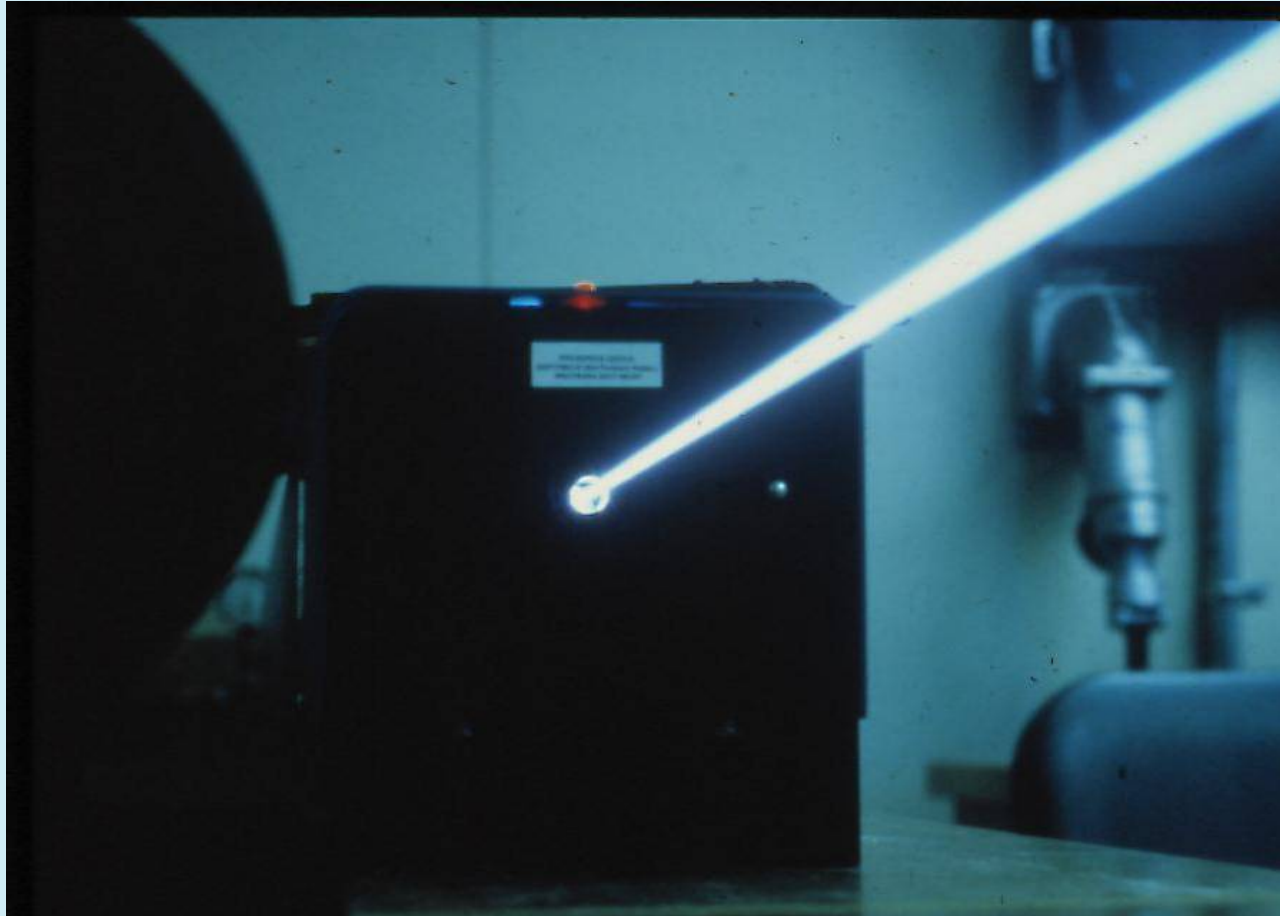
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Fingerprints on Skin

Suppositions

- ❖ Body begins decay at death
- ❖ Fingerprint on skin extremely fragile
- ❖ Vulnerable to:
 - Time
 - Temperature
 - Humidity
- ❖ Not feasible on living skin
- ❖ Smooth hairless skin

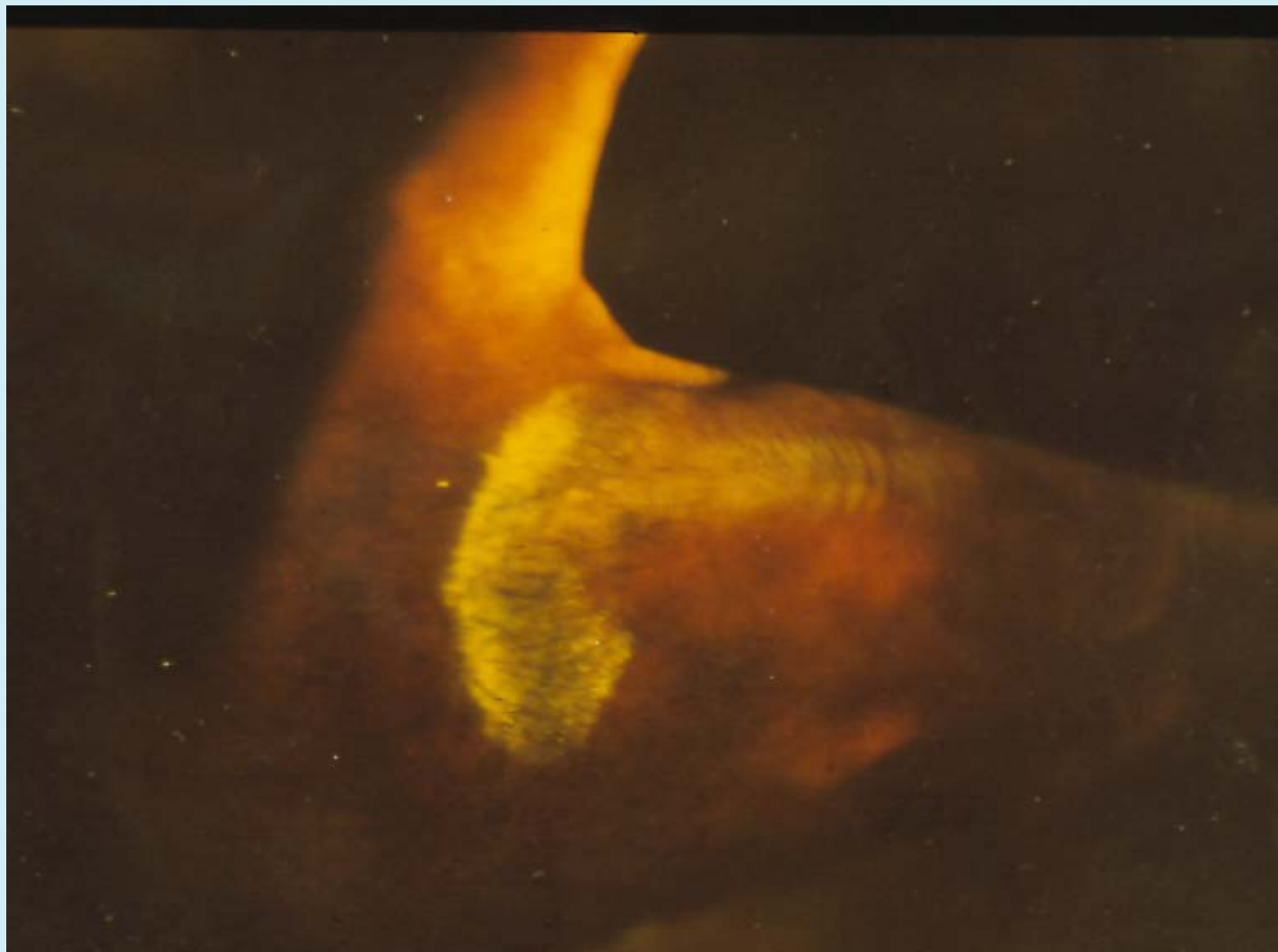


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Visitor to OPP Lab

- ❖ Older man
- ❖ High heat, high humidity
- ❖ Untreated fingerprint on hand
- ❖ Shaking hands
- ❖ Fingerprint classifiable
- ❖ Almost certainly contamination



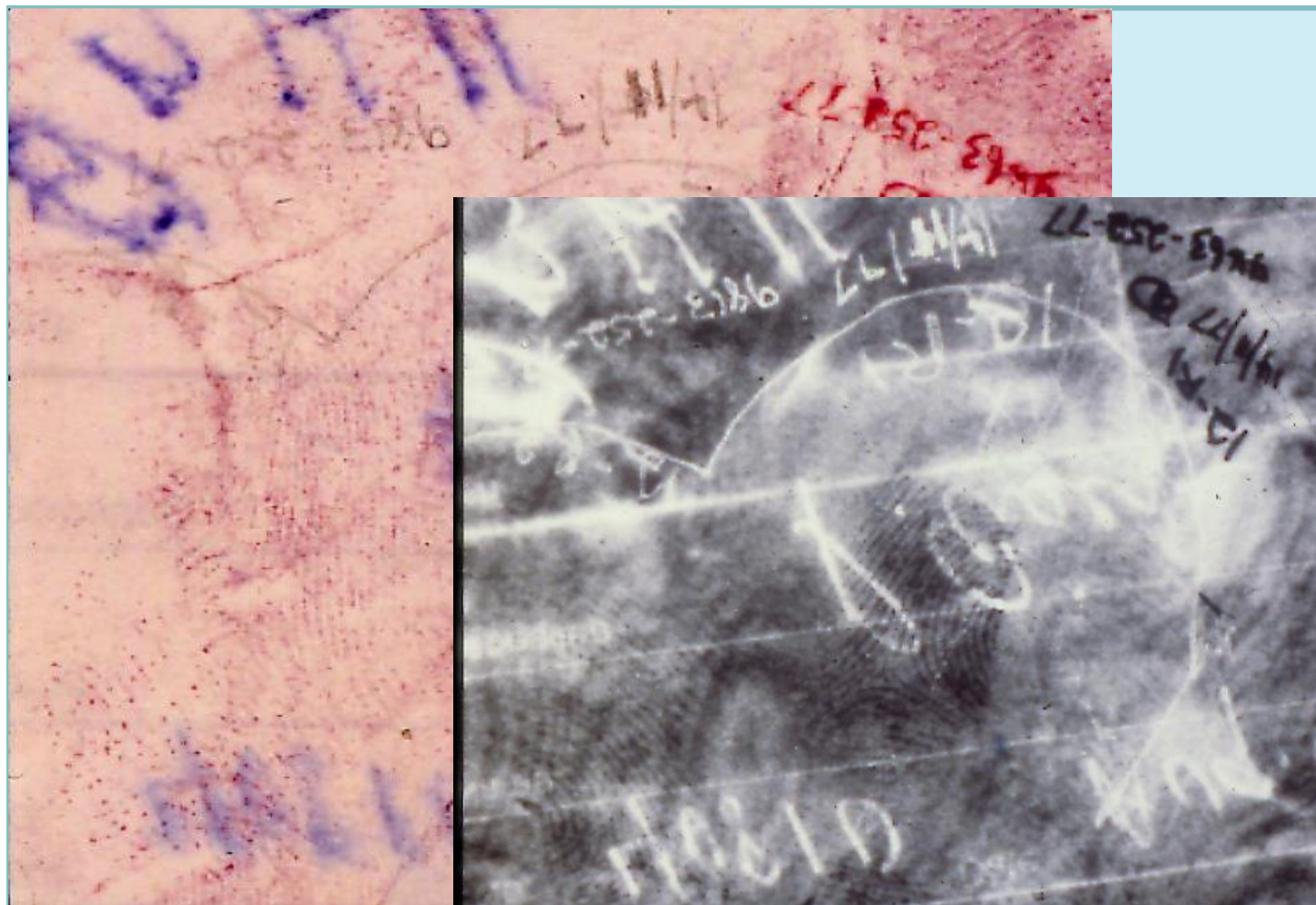
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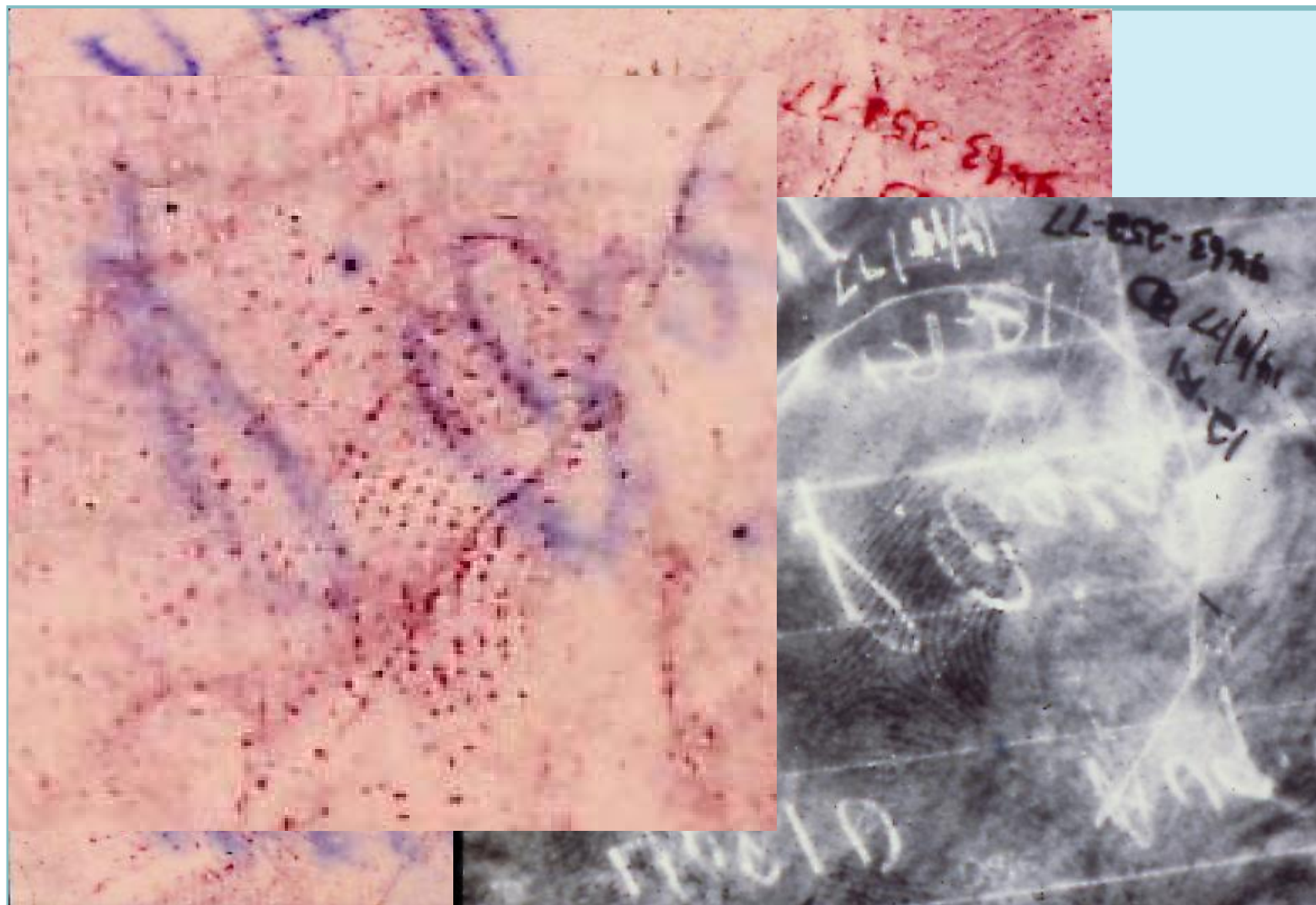


Argon Laser – 1977

- ❖ 80 fraud cheques
- ❖ Examined by laser
- ❖ 4 impressions located
- ❖ One identified as suspect
- ❖ Treated with ninhydrin
- ❖ 60 impressions developed
- ❖ Several suspects identified
- ❖ **Not the one revealed by laser**

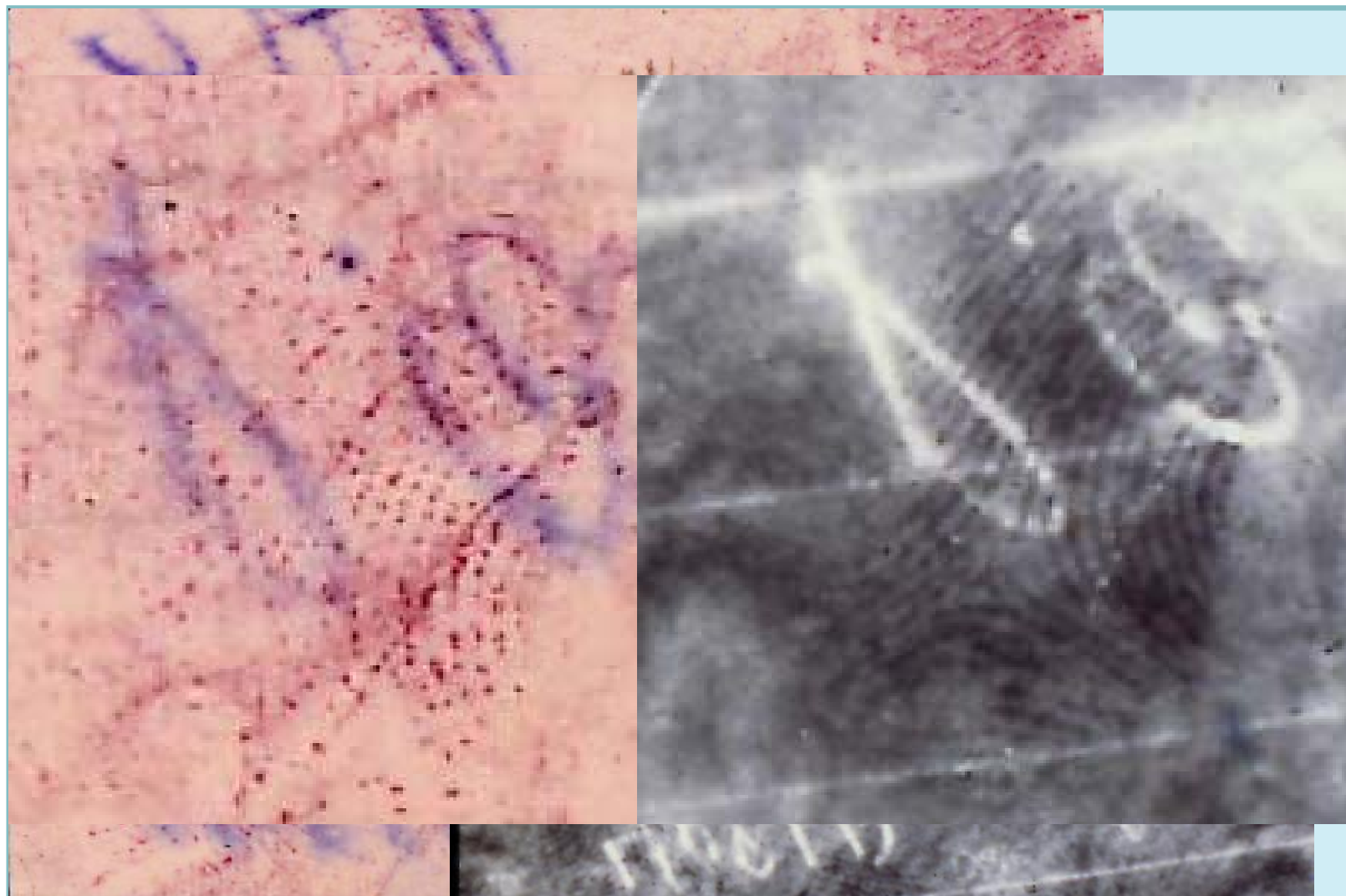




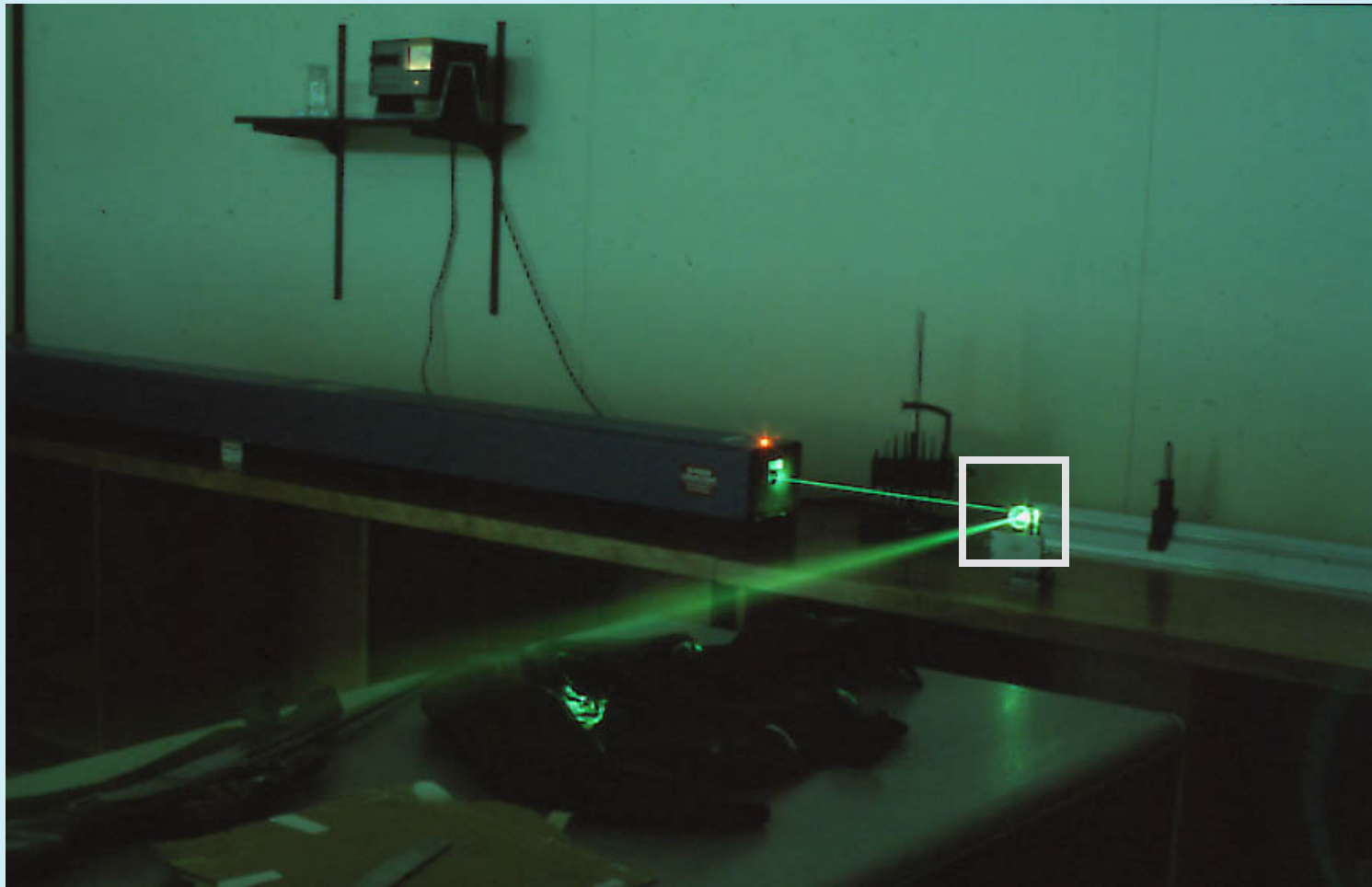


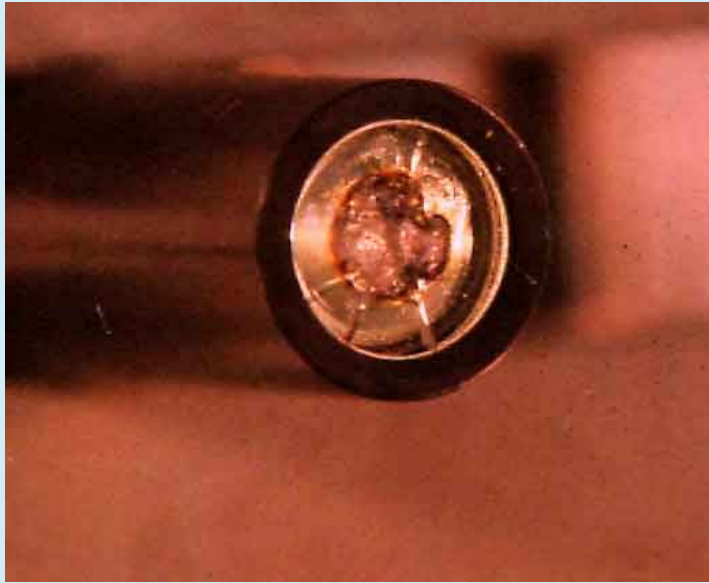
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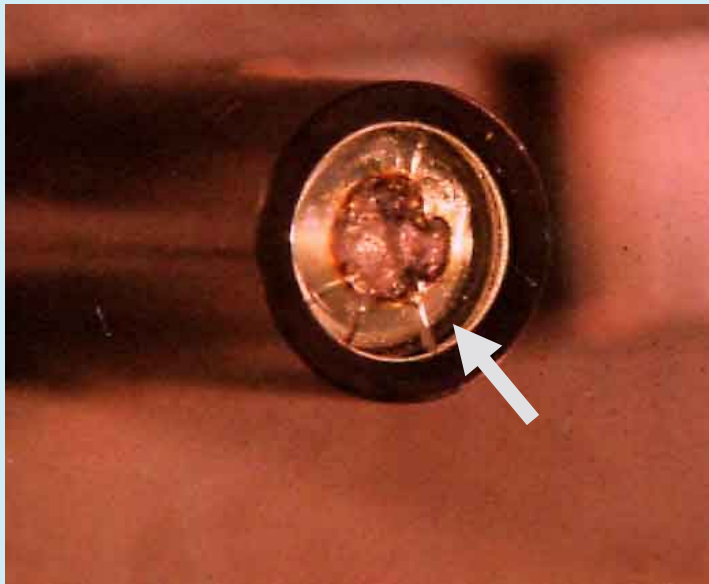


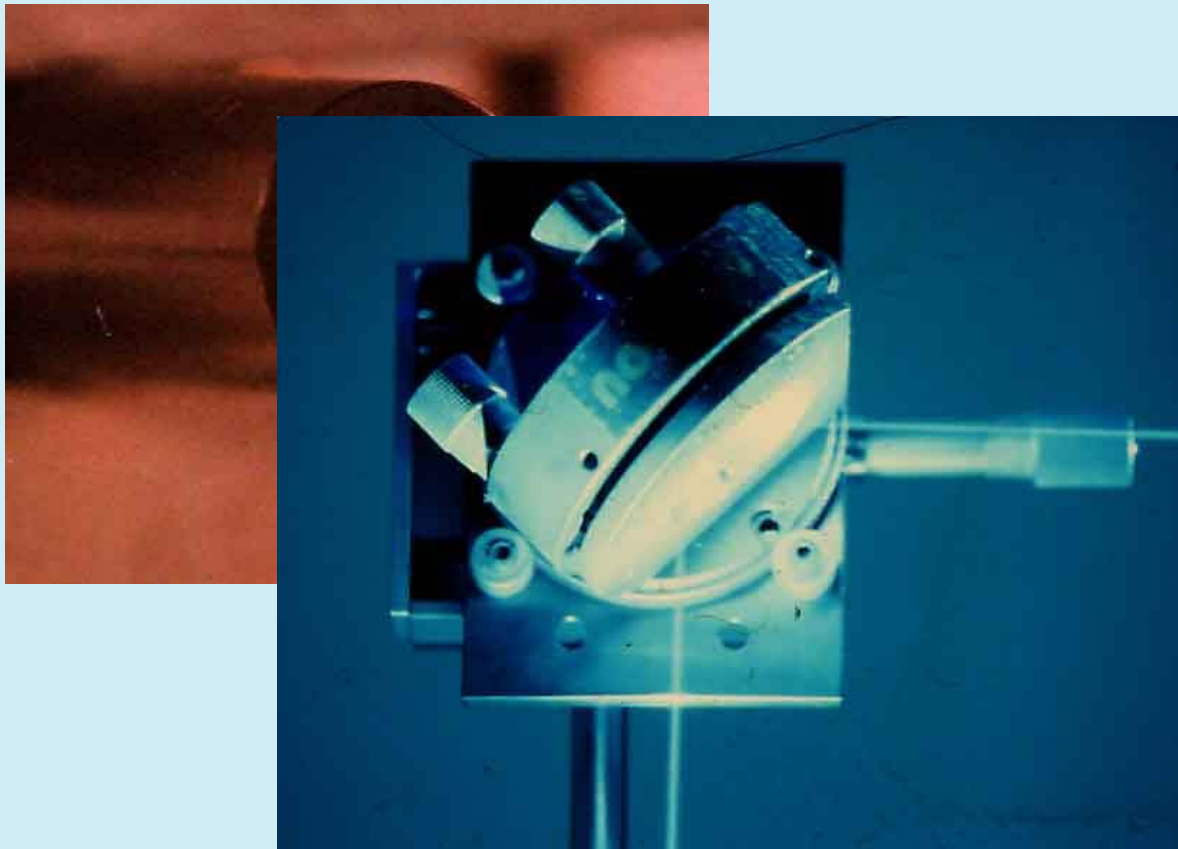


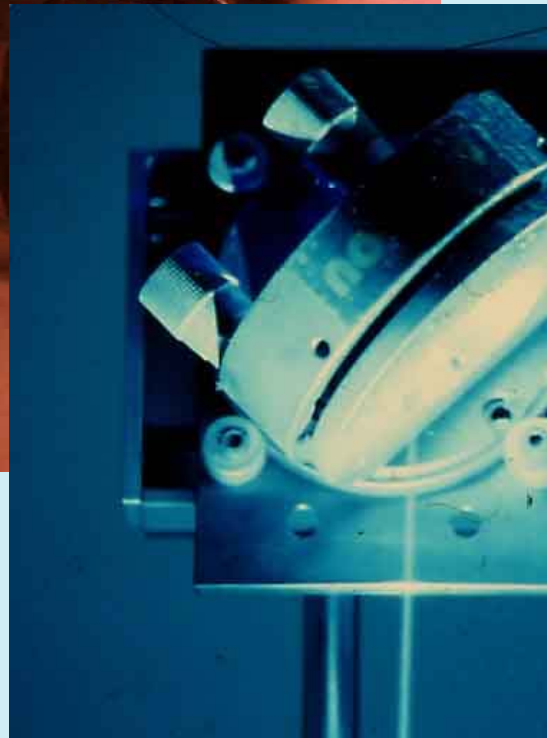
Evolution











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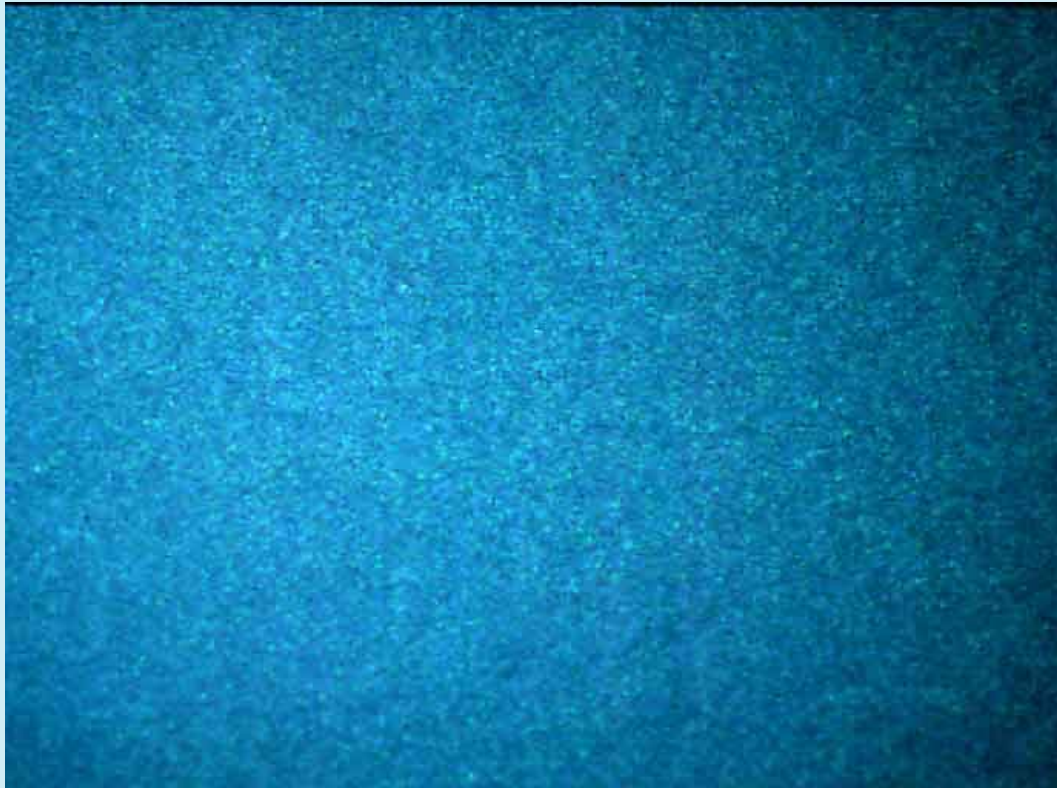
Circa 1980

- ❖ Introduction of YAG laser
- ❖ Portable
- ❖ Durable
- ❖ 110 V
- ❖ 532nm emission
- ❖ Pulse laser
- ❖ Low repetition rate
- ❖ Discontinued

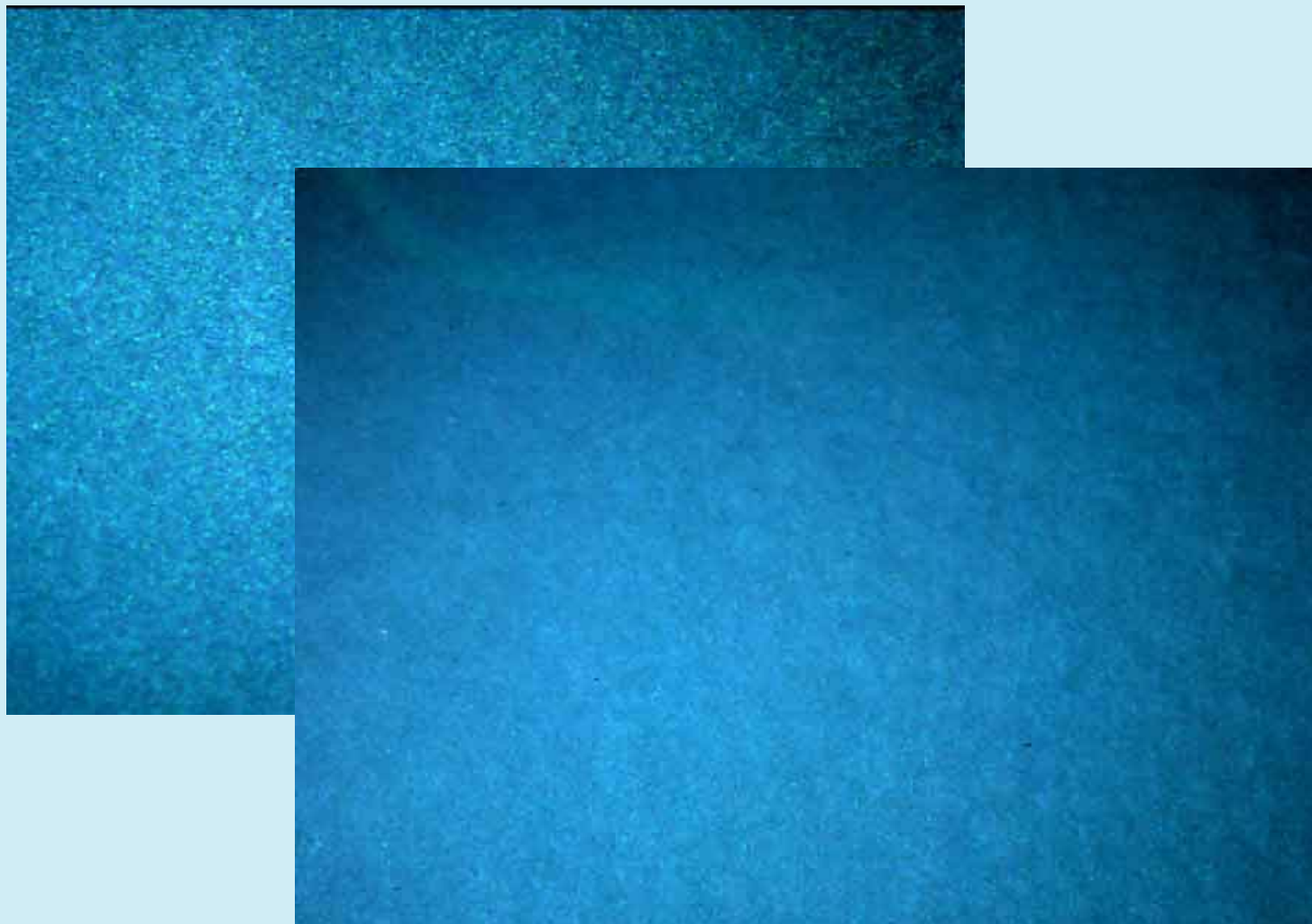


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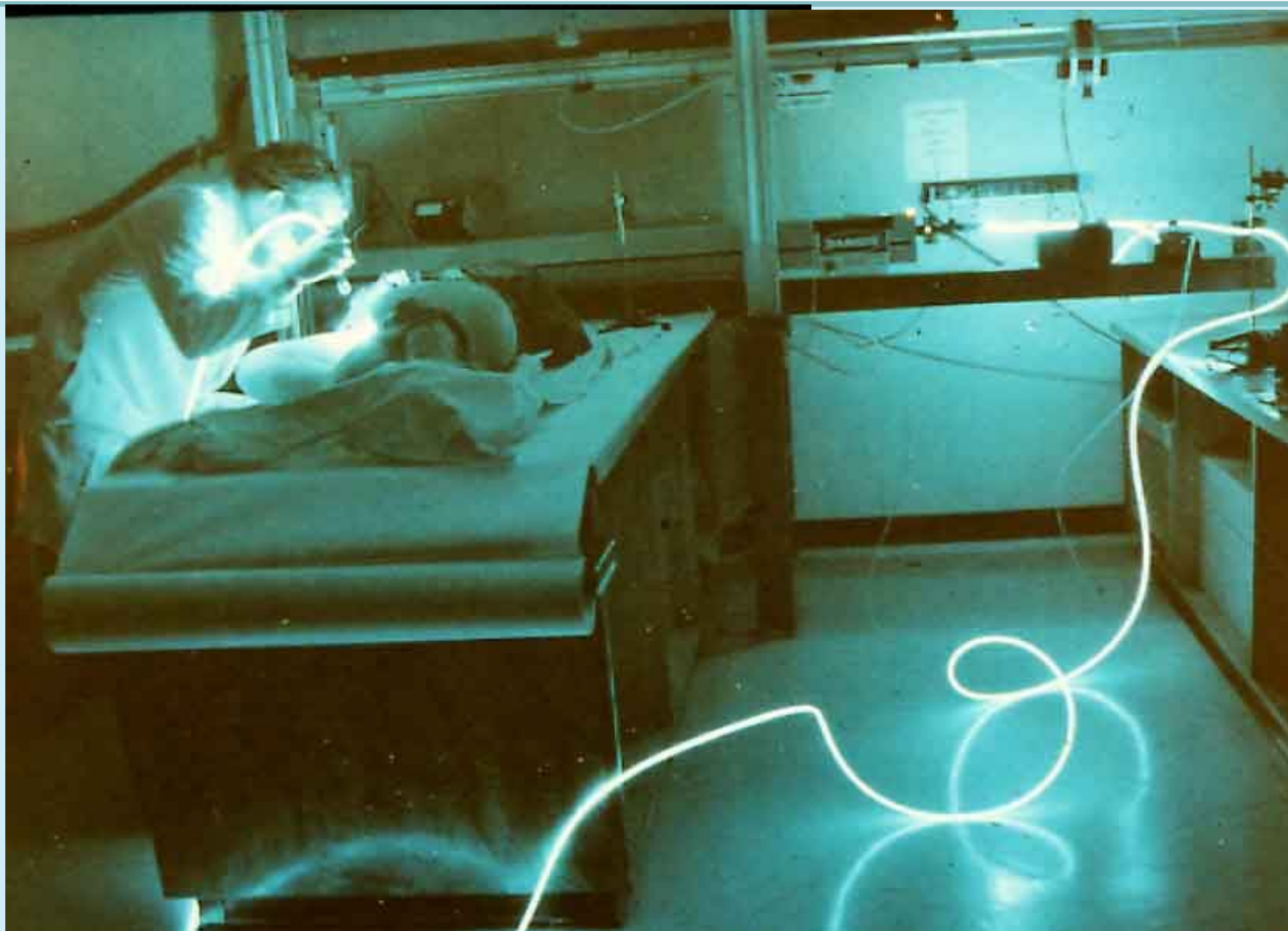






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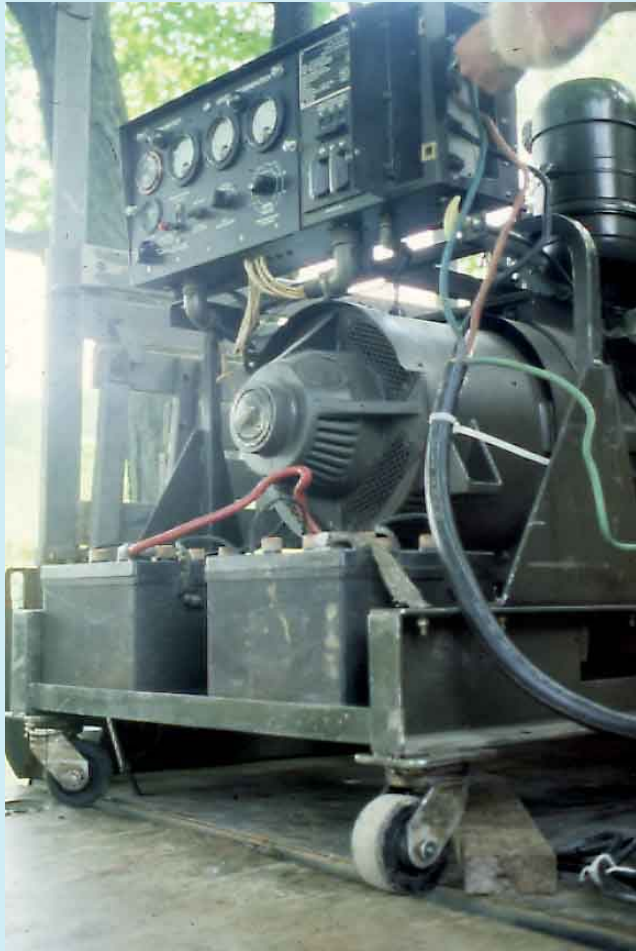






1991 – 1992 Serial Killer

- ❖ Suspect's home discovered
- ❖ Home examined by Lumilite
- ❖ Traces of ridge detail detected



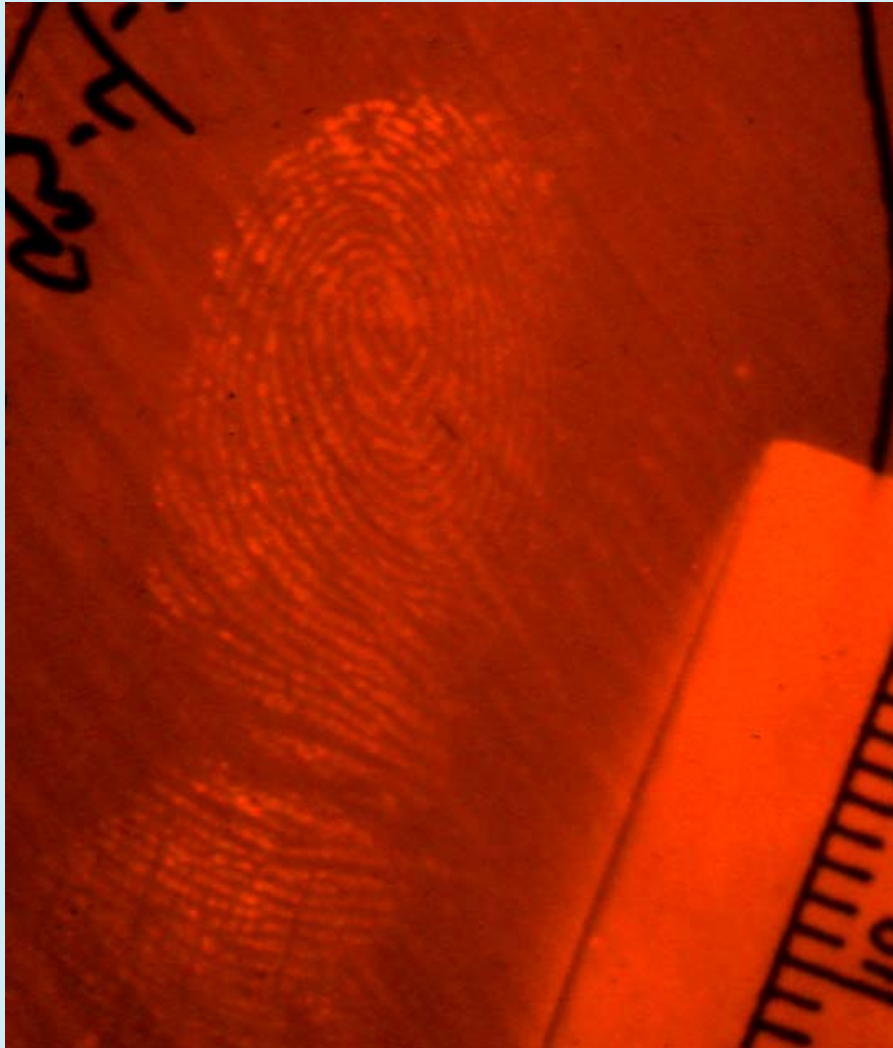


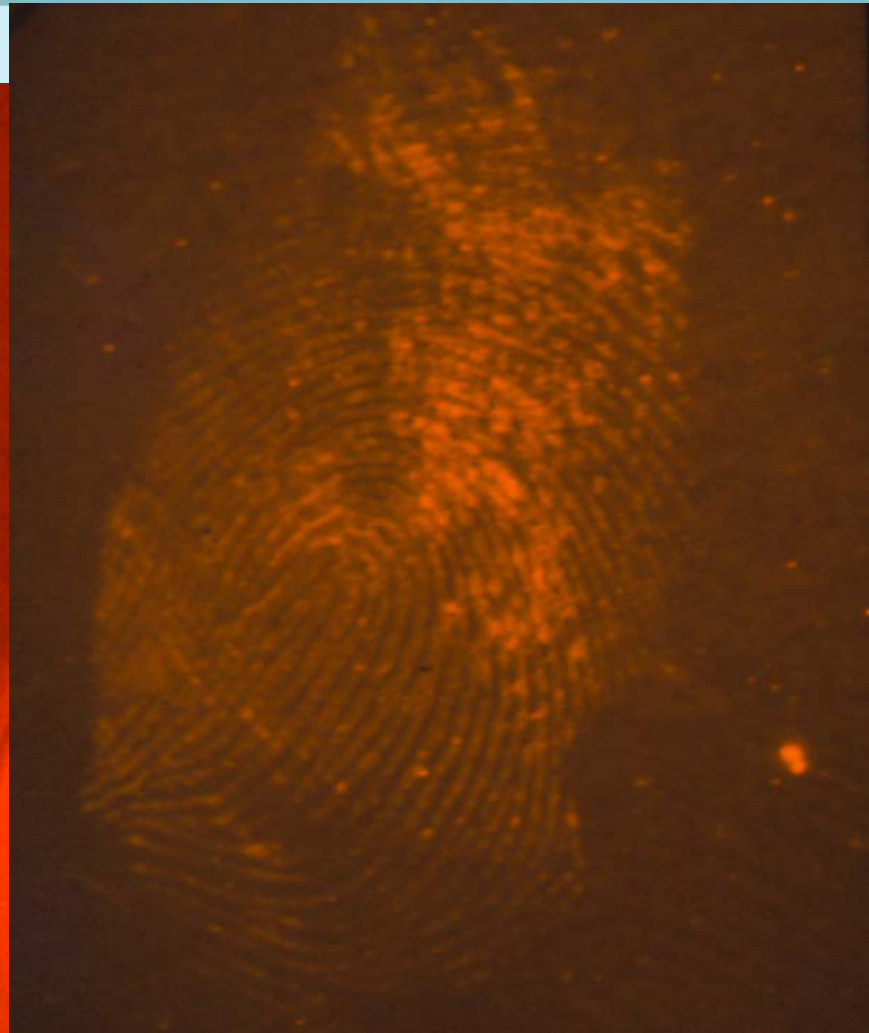
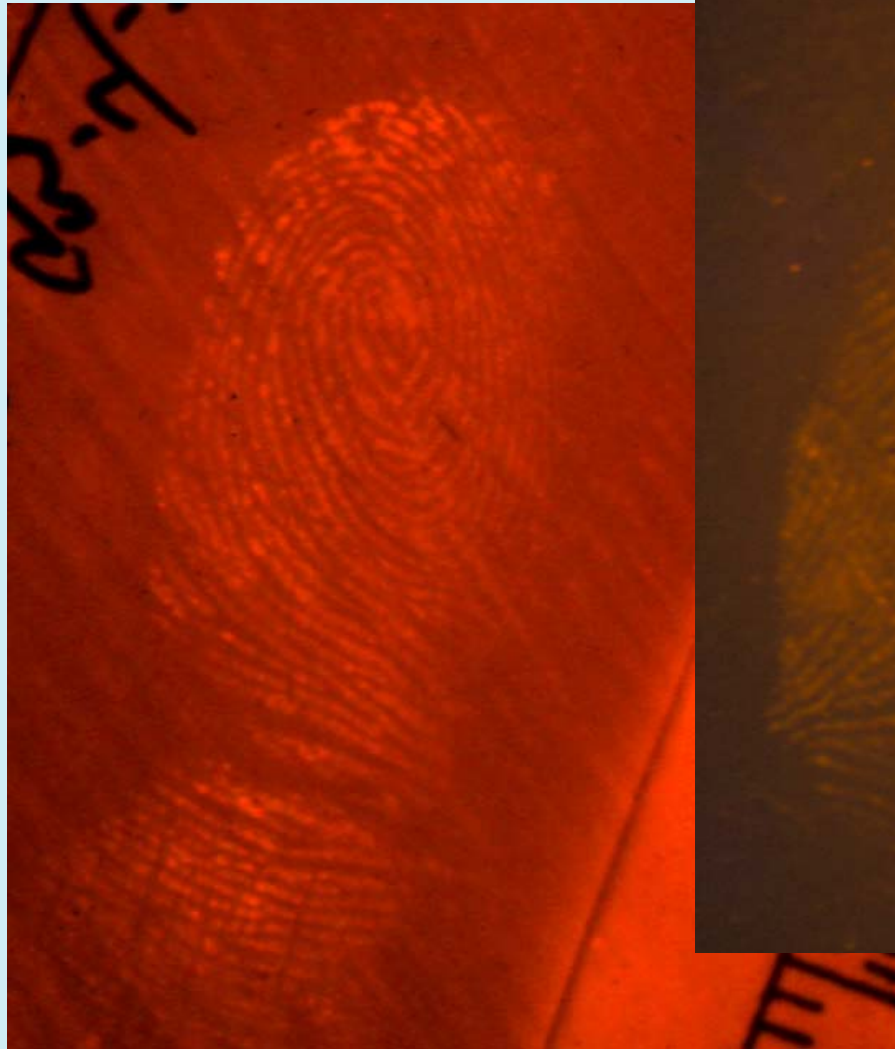
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1991 – 1992 Serial Killer

- ❖ Residence examined by argon laser
- ❖ 40 untreated impressions located







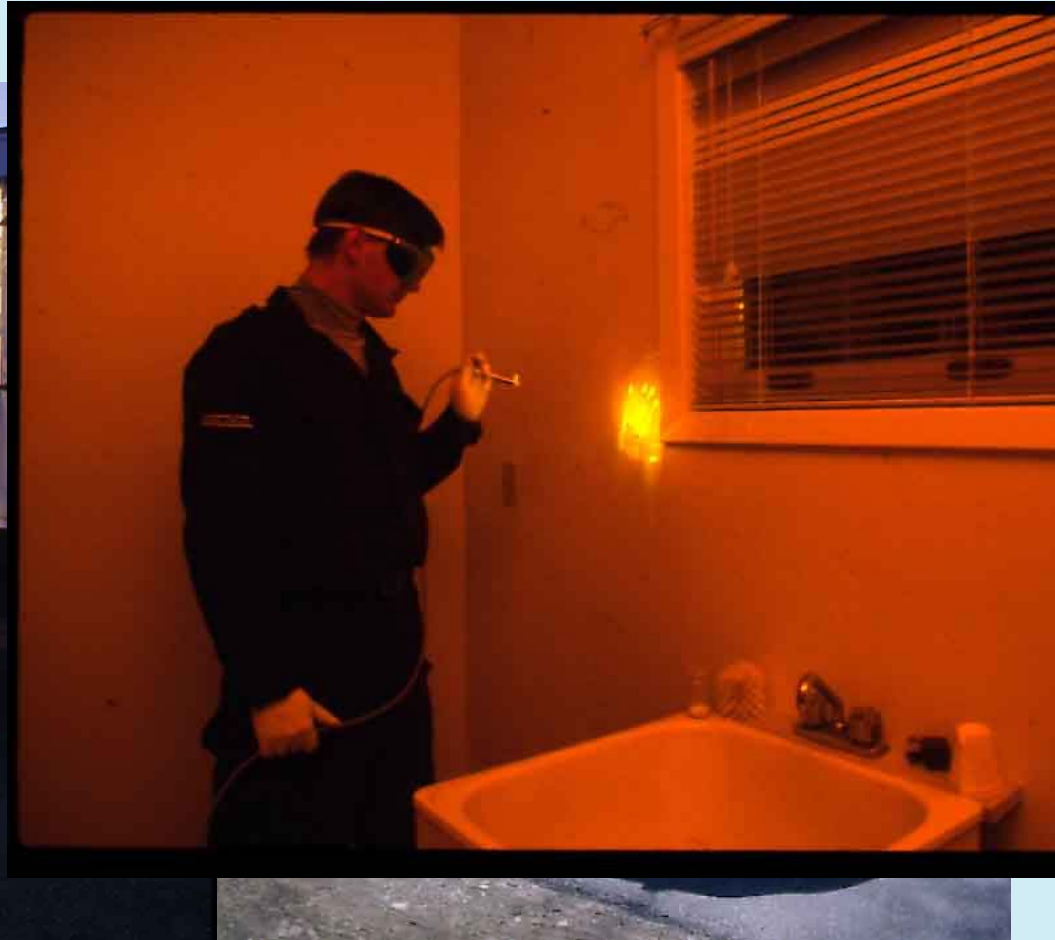
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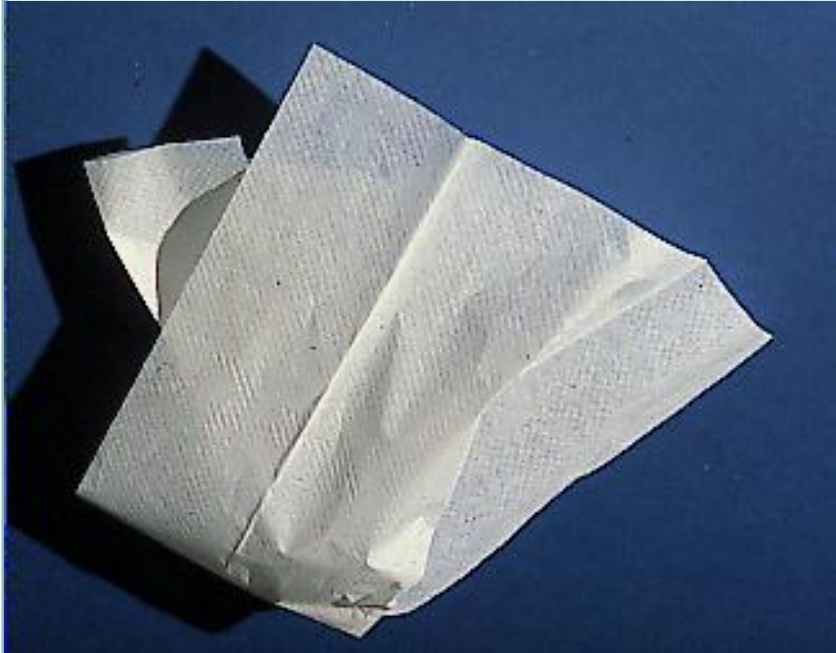
1990's

- ❖ Re-introduction of YAG laser
- ❖ Portable
- ❖ Durable
- ❖ 110 V
- ❖ 532nm emission
- ❖ Much better pulse rate
- ❖ Coherent speckle

Results – Laser Alone 1977 – 1995

Homicide

- ❖ Paper napkin found beside body
- ❖ Only physical evidence
- ❖ Laser examination
- ❖ One impression located
- ❖ Identified as accused
- ❖ Not detected by ninhydrin





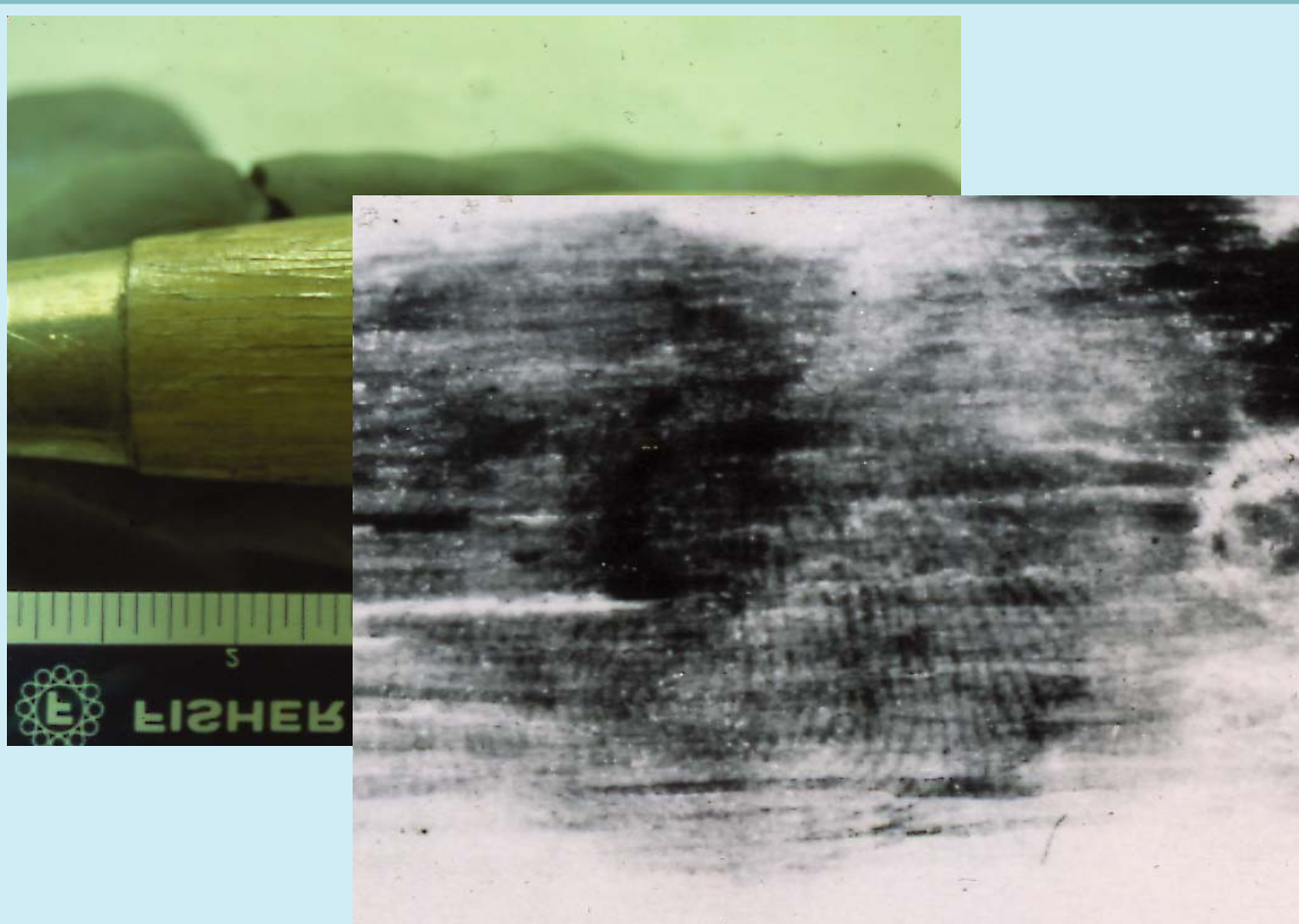
Valerian Trifa – 1984

- ❖ Subject accused of war crimes
- ❖ German archival documents
- ❖ Examined by laser
- ❖ Impression on postcard
 - Identified as subject
 - Recipient Heinrich Himmler
 - Print 42 years old

Fish Knife

- ❖ Varnished wooden handle
- ❖ Examined by powder – negative
- ❖ Examined by laser – impression found
- ❖ Identified as suspect

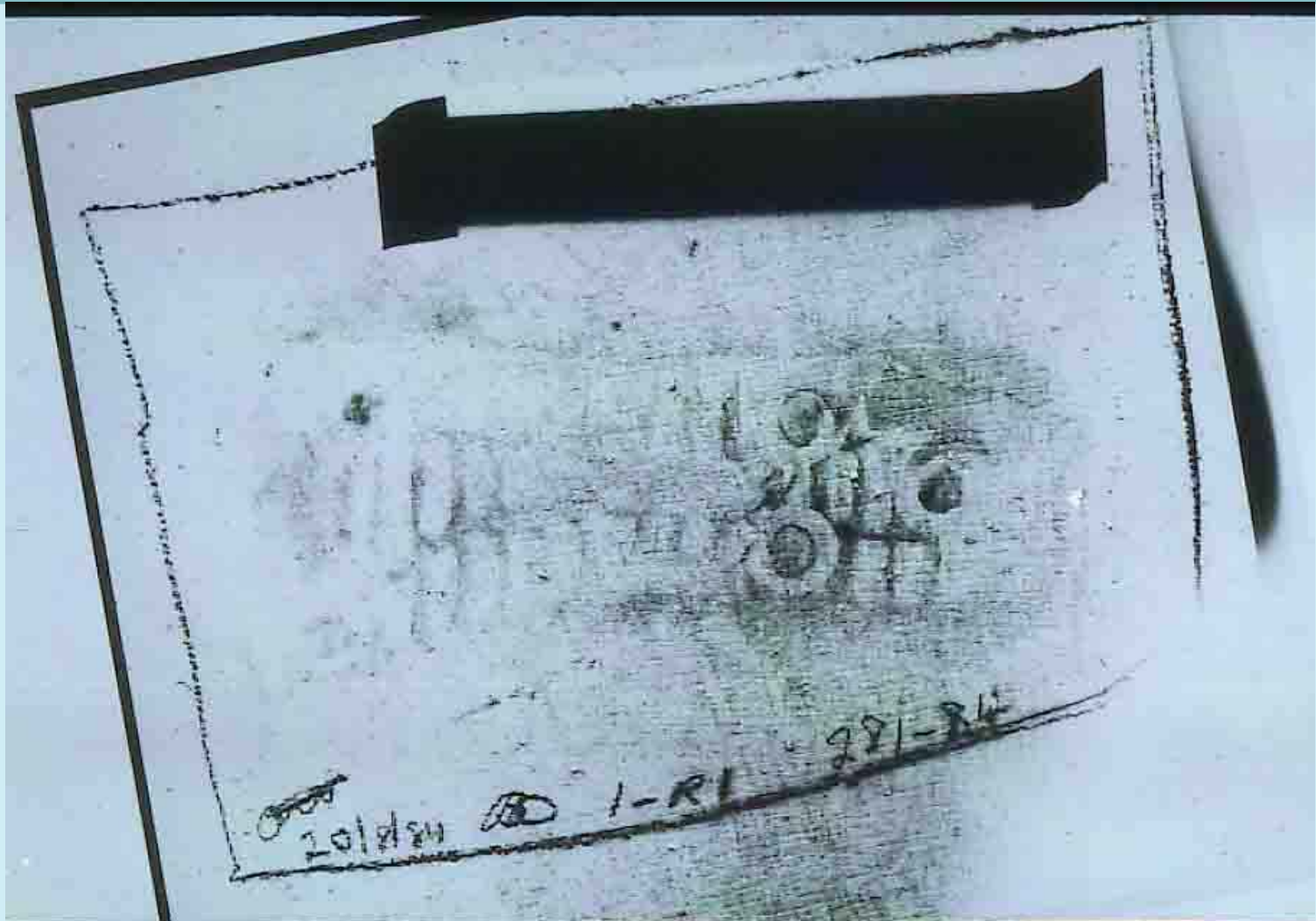






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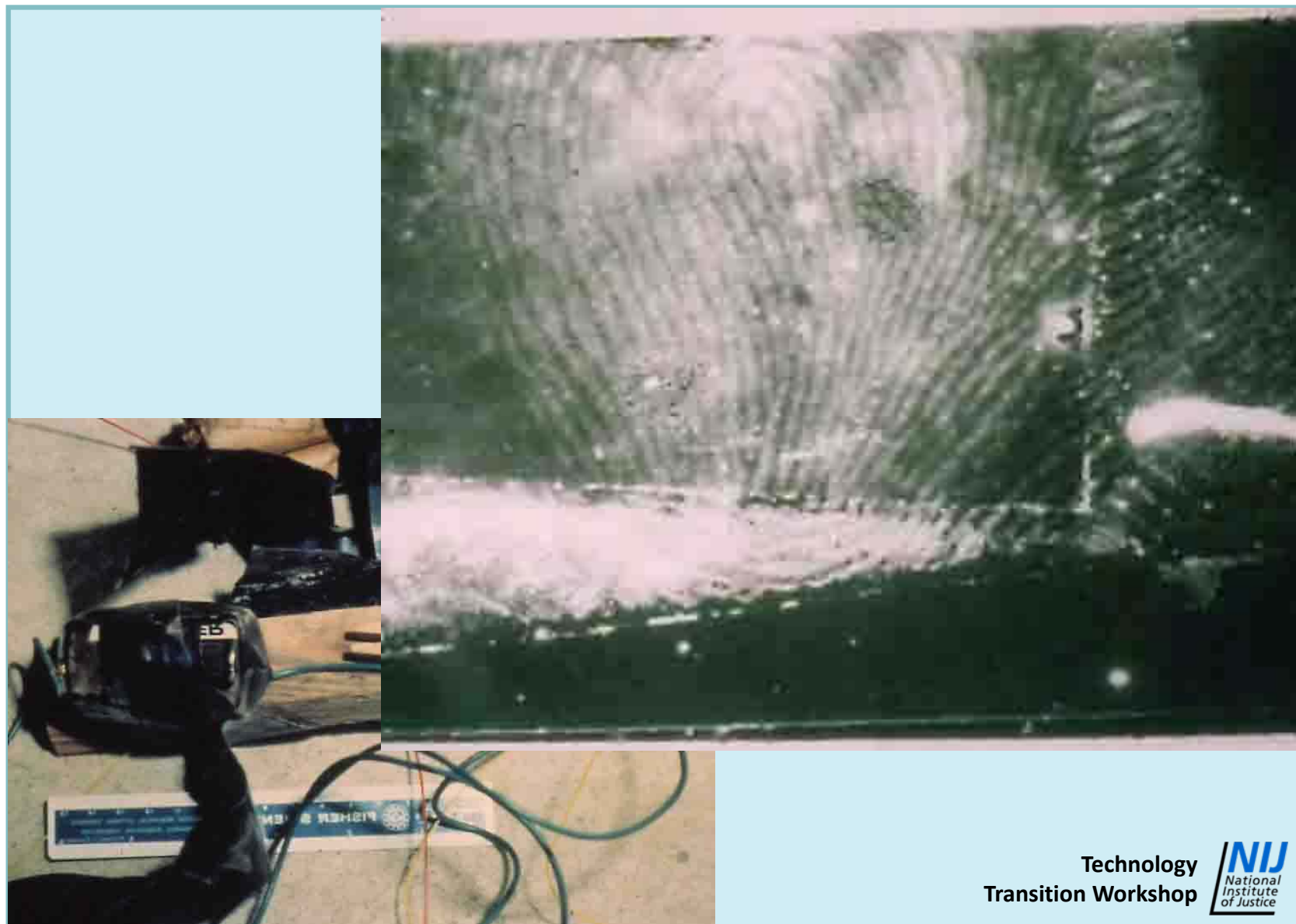


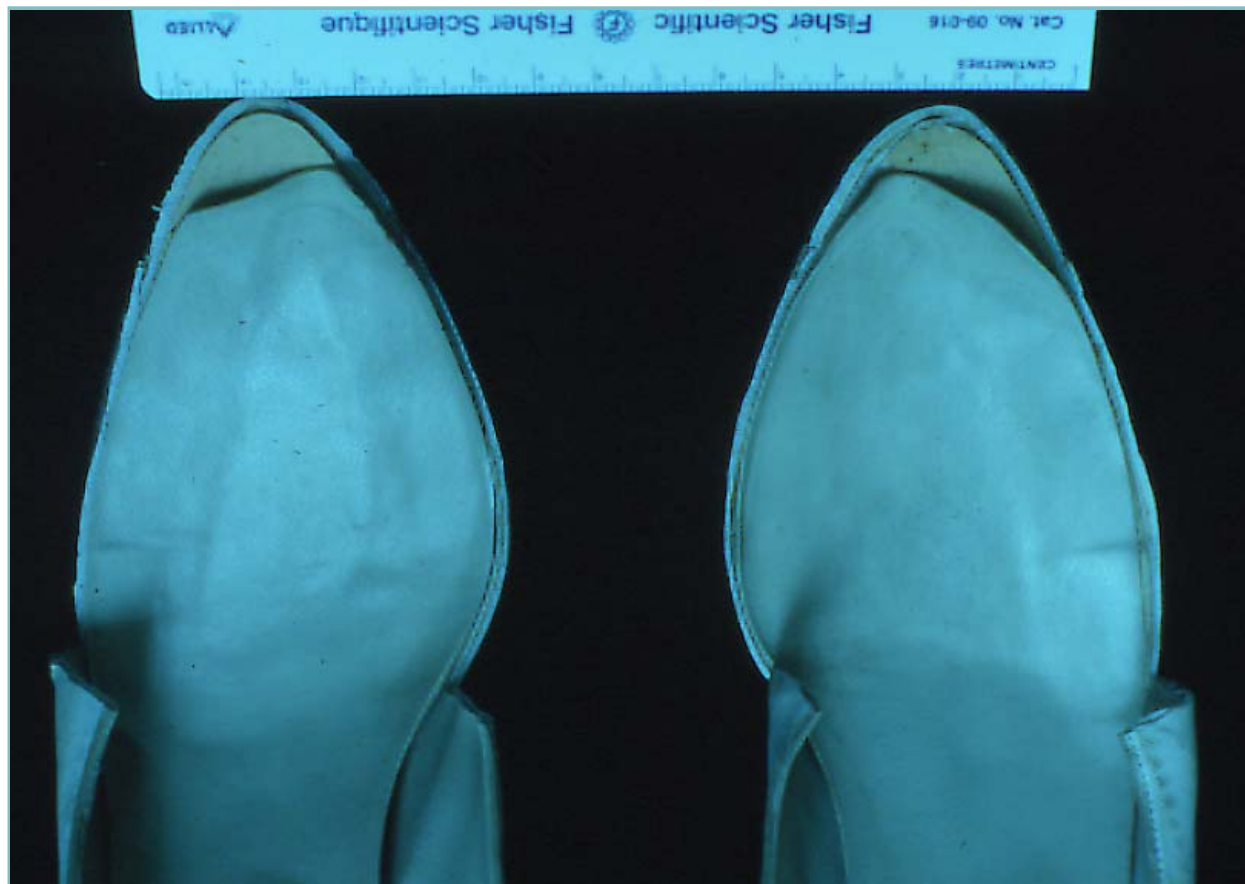


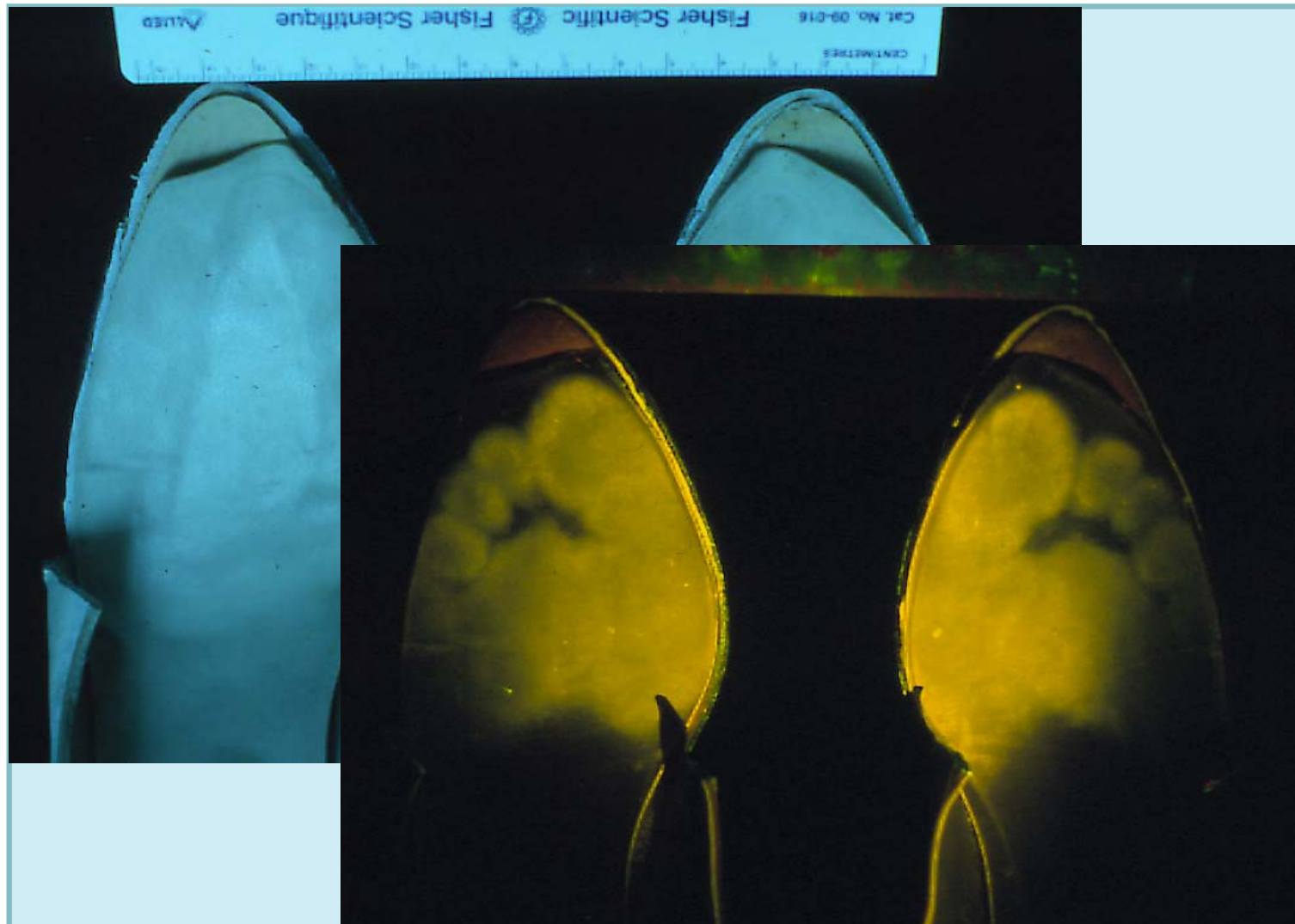
Improvised Explosive Device

- ❖ Failed to detonate
- ❖ Black electric tape
- ❖ Fingerprint detected by laser
- ❖ Identified as accused









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Alternatives

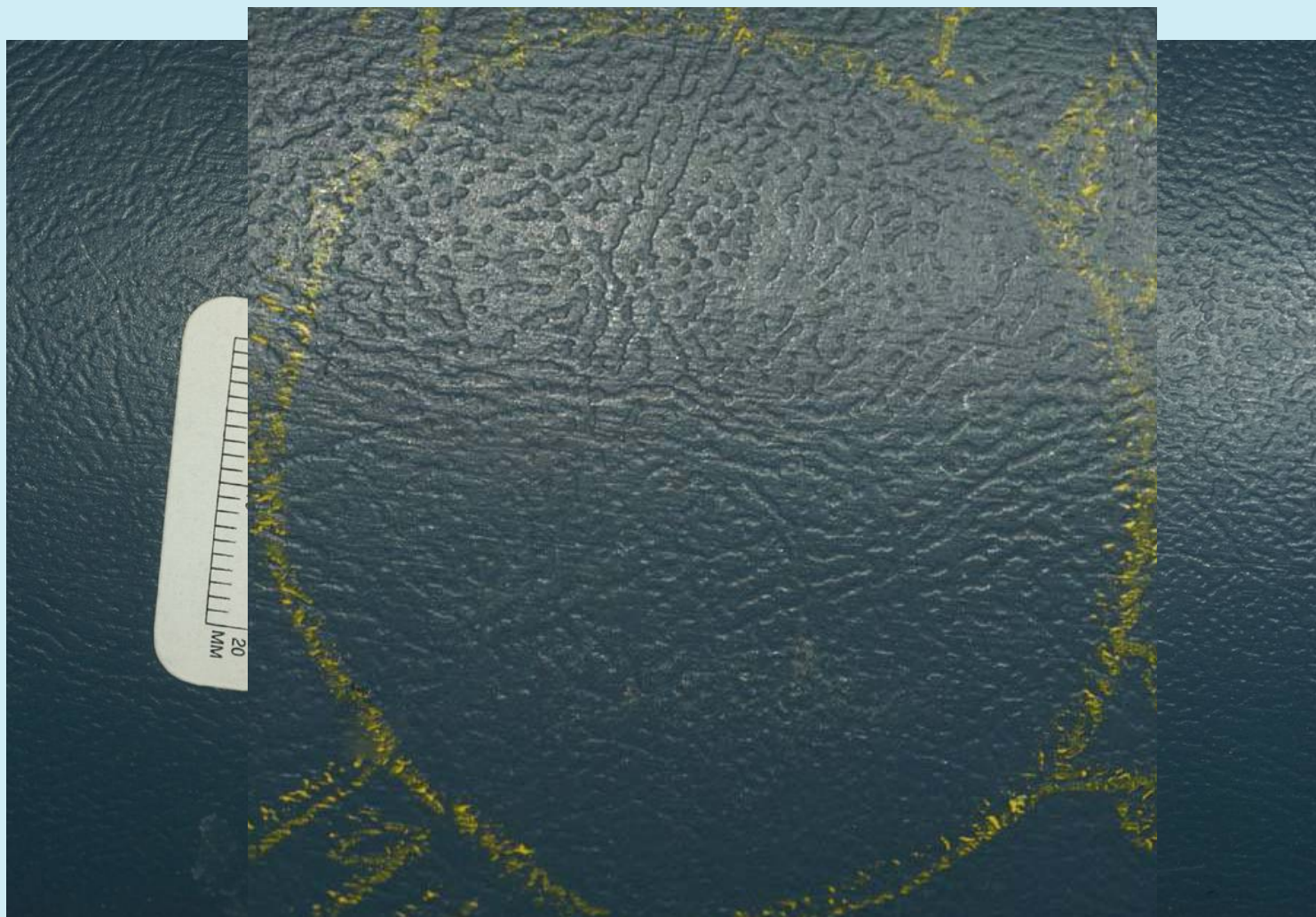
1976 – 1979

- ❖ No “alternatives” on horizon
- ❖ All results inherent fluorescence
- ❖ No chemical extensions
- ❖ Menzel – circa 1980 – CA/R6G
- ❖ Combo greater than the sum of parts
- ❖ Single biggest advance of last 20 years



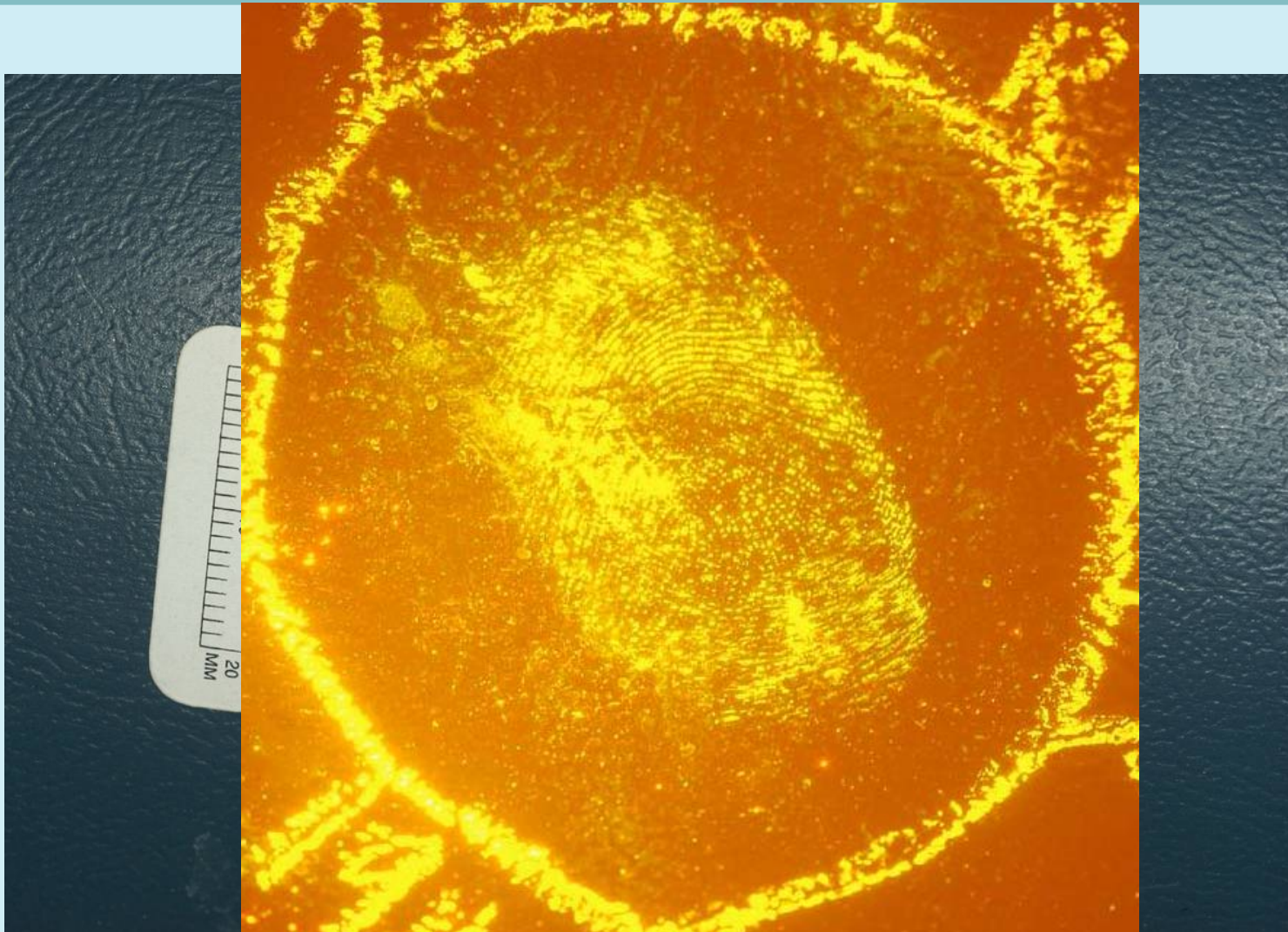
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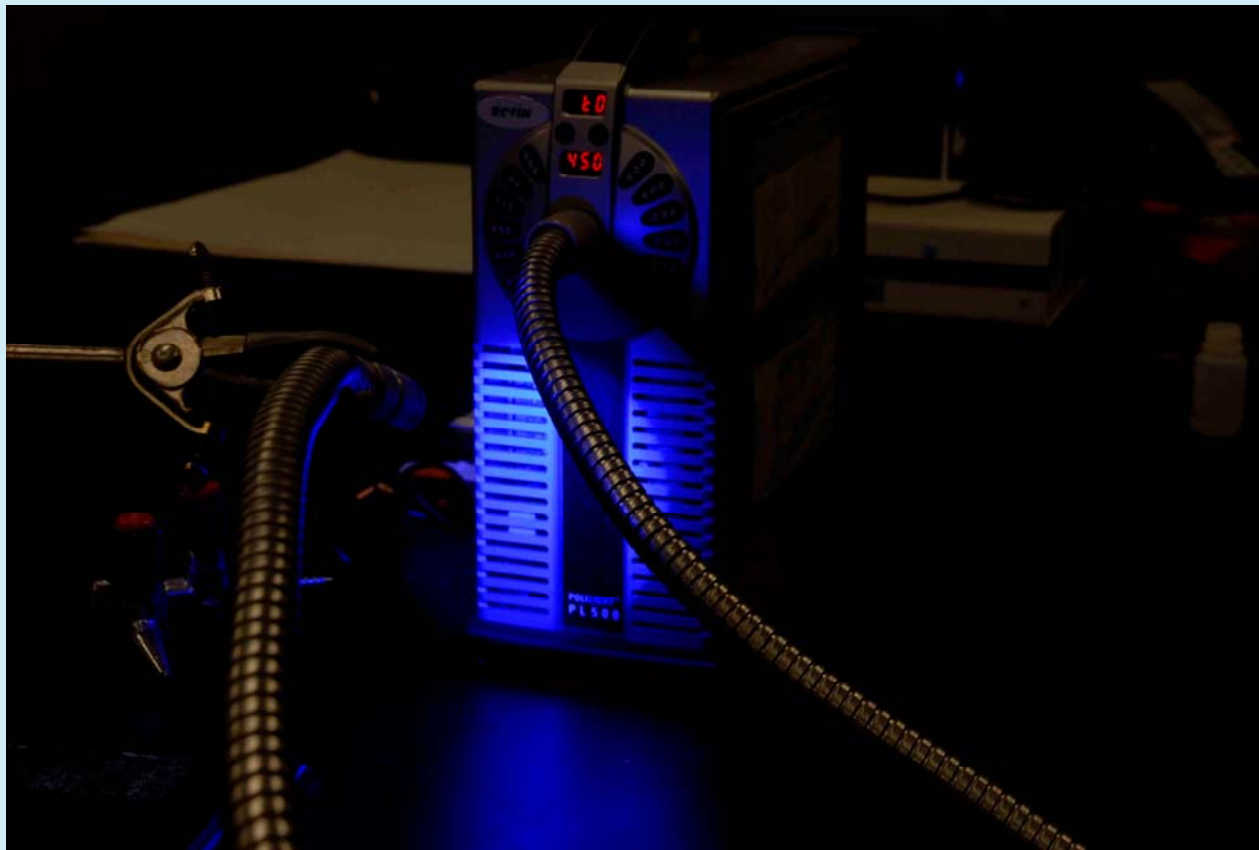
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Circa 1979 – 1980

- ❖ Appearance of first laser “alternatives”
 - Lumilite (Canada)
 - Polilight® (Australia)
 - Omnichrome (US)
- ❖ Primarily for CA/R6G
- ❖ No documented reporting of untreated fingerprint detection

Polilight® PL-500



Polilight® PL-500

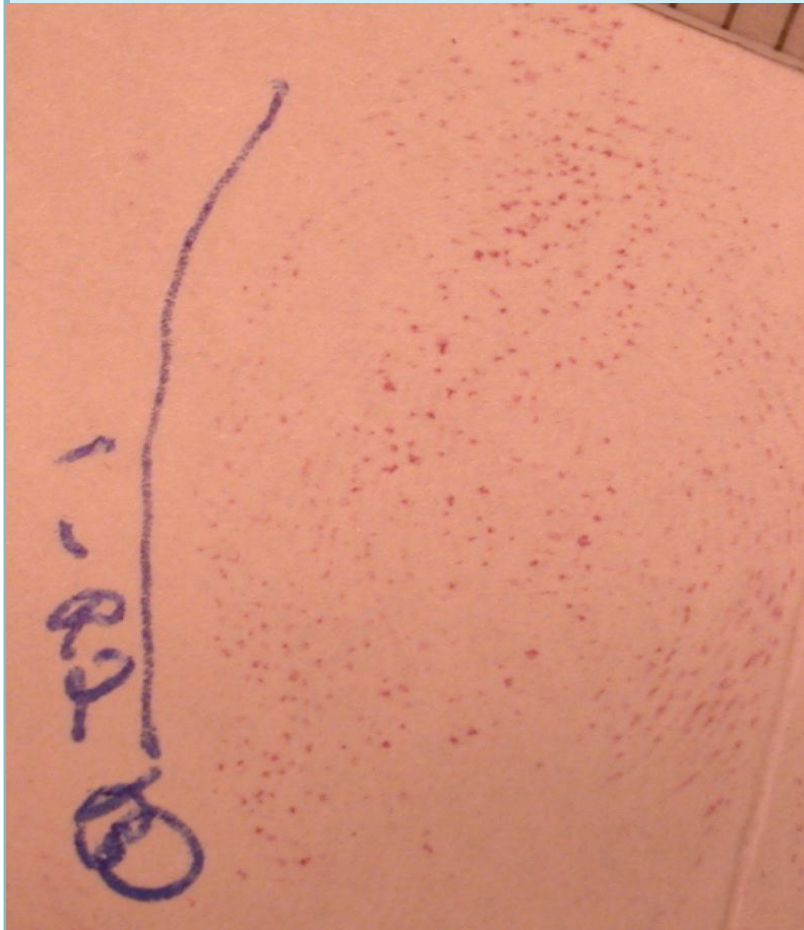


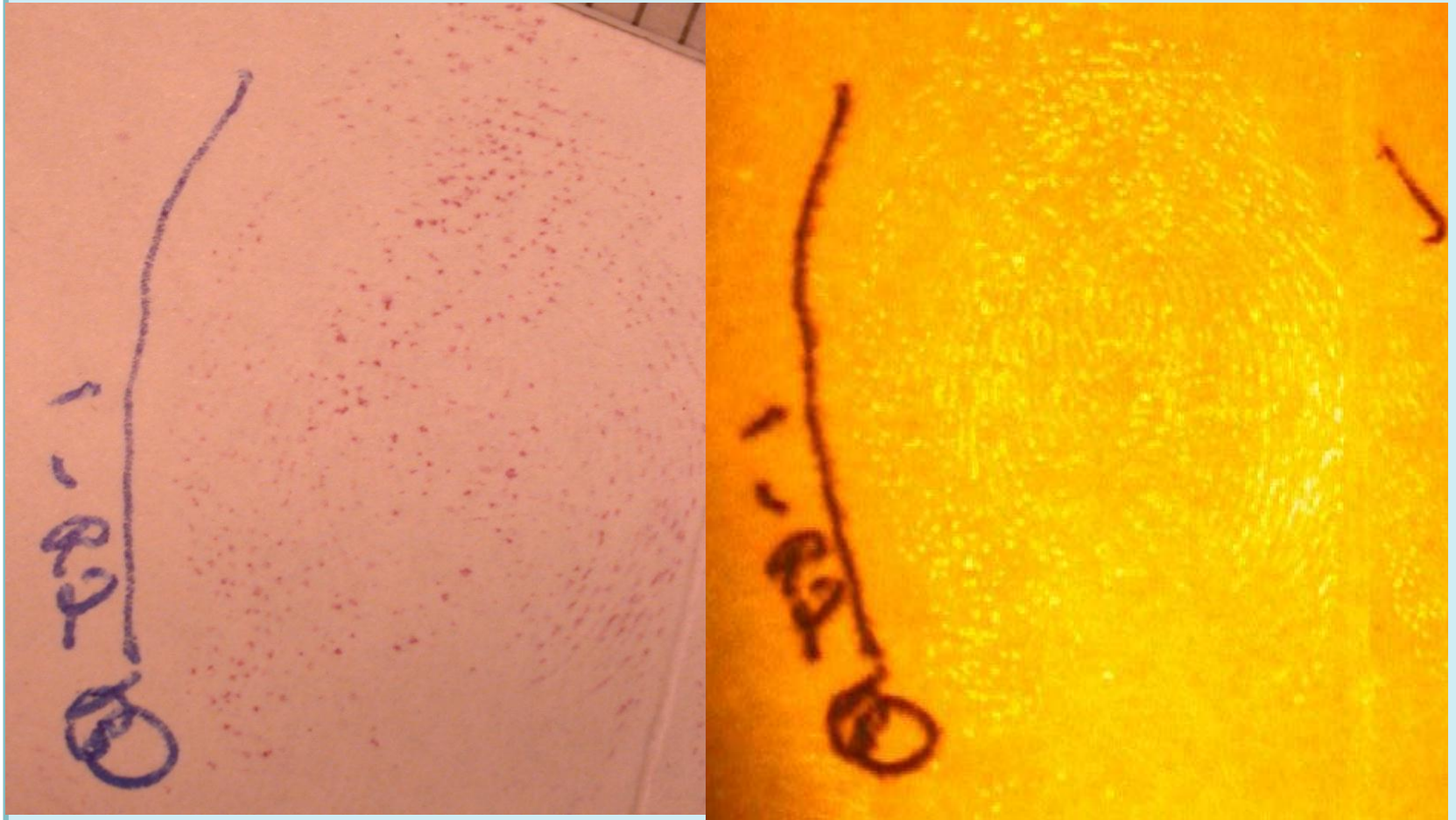
Alternate Light Sources

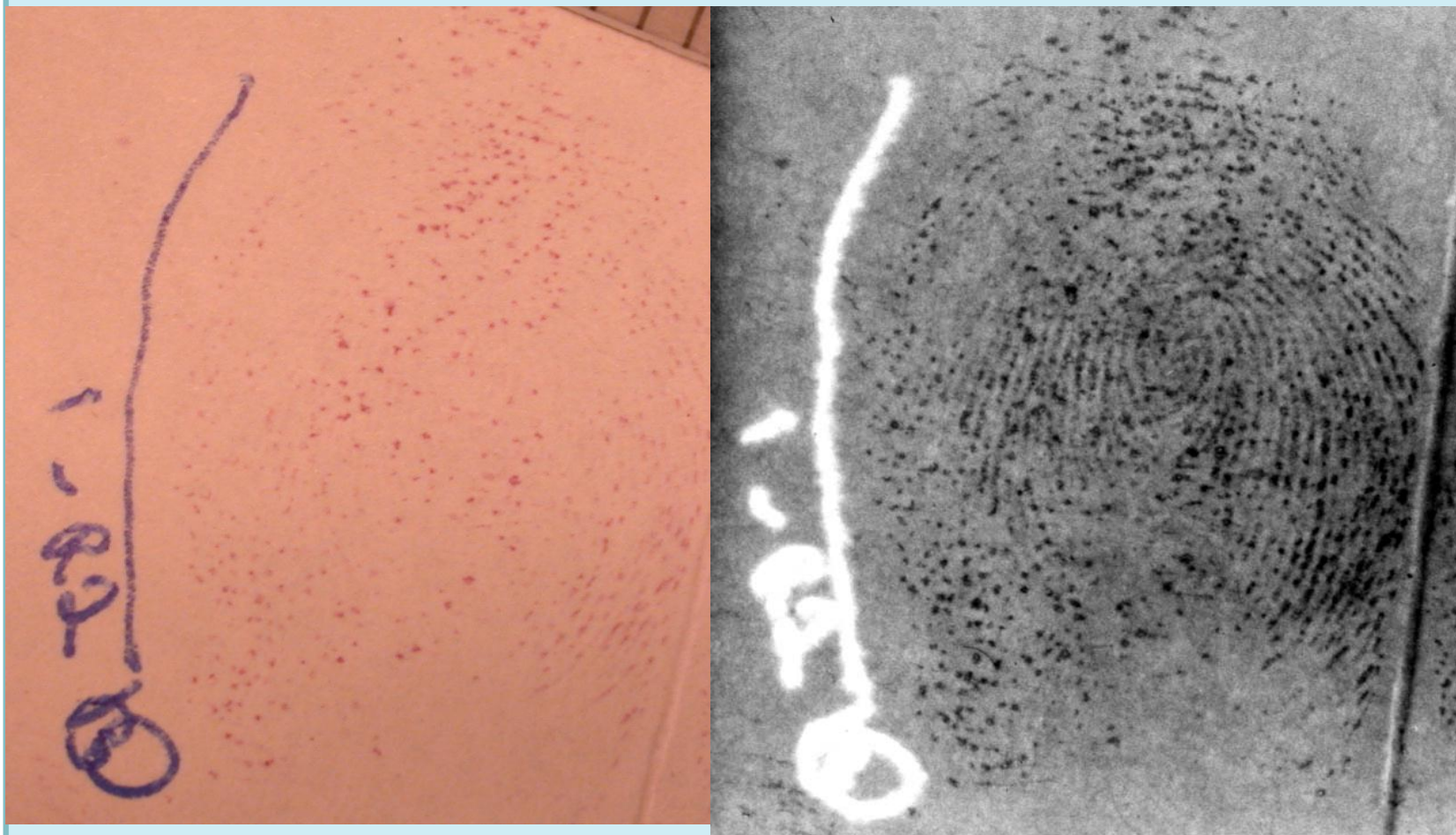
- ❖ Much cheaper than lasers
- ❖ Much safer than lasers for eyes
- ❖ Cheaper to run
- ❖ Air-cooled
- ❖ Portable
- ❖ Relatively low maintenance

Circa 1985

- ❖ Menzel – zinc chloride
- ❖ Post ninhydrin treatment
- ❖ Almog et al. – ninhydrin analogs
- ❖ 5 methylthion ninhydrin
- ❖ 5 methoxy-ninhydrin and others
- ❖ **All** with fluorescent properties







Focus Now on Developing Fluorescing Reagents

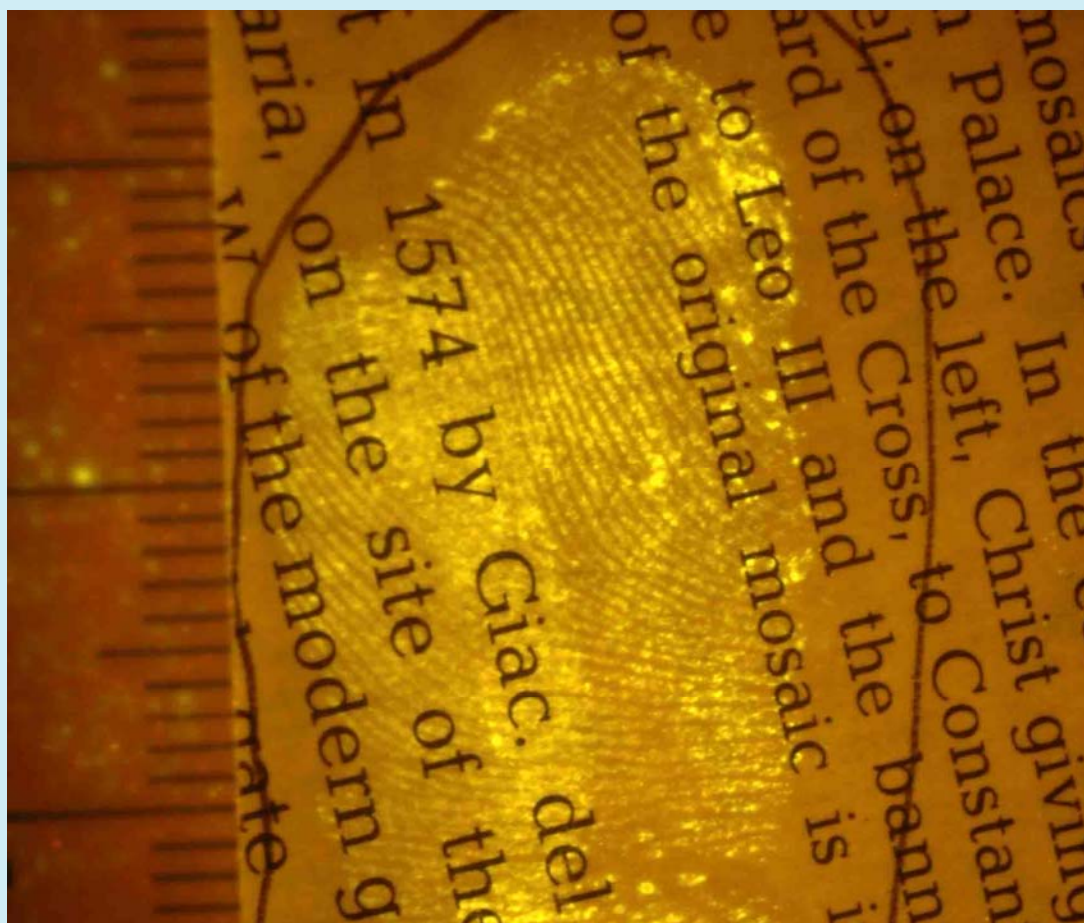
Circa 1990

- ❖ C.A. Pounds – DFO
- ❖ Fluorescing fingerprint reagent
- ❖ Excited by argon laser **or** “ALS”
- ❖ Ninhydrin post-DFO reveals more detail
- ❖ Perceived value of laser diminished



Circa 2000

- ❖ J. Almog, Israel Police Force
- ❖ Indanedione
- ❖ Ninhydrin analog
- ❖ Fluorescing fingerprint reagent
- ❖ Excited by argon laser **or** “ALS”



Circa 2000

- ❖ Introduction of LED lights
- ❖ Cheaper
- ❖ Cool, efficient
- ❖ Robust
- ❖ Very portable
- ❖ Spectral output similar to lamps



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Circa 2006 – Semiconductor Laser

- ❖ Introduction of Coherent® TracER™
- ❖ Optical pumped semiconductor laser
- ❖ 110 V power
- ❖ **Battery option – 2 hours of cord-free use**
- ❖ Cool, efficient
- ❖ Robust
- ❖ Very portable
- ❖ Output wavelength can be engineered
- ❖ Current version is 532nm
- ❖ **No coherent speckle**

Semiconductor Laser

- ❖ OPSC – Optically Pumped Semiconductor
- ❖ Lasing medium is semiconductor chip
- ❖ Output wavelength can be engineered
- ❖ Current version – 532nm



Photographs courtesy of Coherent Inc.



Photographs courtesy of Coherent Inc.



Photographs courtesy of Coherent Inc.

Pig Farm

- ❖ Serial killer
- ❖ Over 25 victims
- ❖ Farm examined by laser **and** FLS
- ❖ Palm print detected by FLS
- ❖ Identified as victim
- ❖ **Not detected by laser**

Filtered Lamps

- ❖ 1980 to present
- ❖ Lumilite – Canada
- ❖ Polilight®
- ❖ Omnichrome
- ❖ Spex CrimeScope®

- ❖ Cheaper!
- ❖ Lighter!
- ❖ More portable!
- ❖ More dependable!
- ❖ No speckle!

Questions?

Contact Information

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