



# SECURITY APPLICATIONS

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# INTRODUCTION

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- ✍ Need to encode information in a way that it will be immune to decoding by unauthorized person exists for 100 years.
- ✍ Why do we need document security?
  - ✍ All documents have intrinsic function granting their bearer certain rights
  - ✍ Example Credit cards, banknotes, passports, driving license, etc..
  - ✍ Hence these documents must be protected against the misuse of those rights by forgery, counterfeiting and fraudulent impersonation.



# INTRODUCTION

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- ✍ With rapid advances in technology, it is simple to reproduce money bills, bank notes, security documents, etc.
- ✍ Recent technological progress in computers, CCD tech., color printers and scanners makes forgery and counterfeit documents increasingly simple.
- ✍ How these documents are protected?
  - ✍ By adding security features to the document substrate, to the printing ink, to the printed design and as post printed features such as laminating foil, , foil print, DOVID such as holograms and ISIS such as optically variable ink.



# OPTICAL SECURITY TECHNIQUES

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- ✍ Commercially available opto-electronic devices, components and systems and their performance suggest that optical systems have significant potential for encryption security, verification and anti-counterfeiting application.
- ✍ Optical Systems can combat fraud which is a serious problem facing bank notes, business and consumers.
- ✍ Cryptography involves optical methods for security.
- ✍ Fibre optic transmission is used for secure data transmission



# INTRODUCTION

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## ✍ VARIOUS TOPICS DISCUSSED

### ✍ DIFFRACTIVE OPTICAL SECURITY TECHNIQUES

- ✍ Holograms
- ✍ Zero Order Diffraction Gratings

### ✍ OPTICAL CRYPTOGRAPHIC TECHNIQUES

- ✍ Opto electronic Methods
- ✍ Double Phase encoding

### ✍ FIBER OPTICS

### ✍ LASER SECURITY



# HOLOGRAMS

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- ✍ This has been a cornerstone of anti-counterfeiting for almost 20 years.
- ✍ What is a hologram?
  - ✍ Recording of 3-D or a kinetic image on a static 2-D surface
  - ✍ It is actually a series of very fine grooves- 1000s to every millimeter
  - ✍ These grooves bend and shape the light giving the impression of a 3-D or animated images when viewed at correct angle.
  - ✍ These are classified as Diffractive Optically Variable Image Devices (DOVID)



# HOLOGRAMS

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- ✍ High security value of Holograms is due to the inability to replicate them by computer scanning/altecation, color copies or standard printing equipment.
- ✍ They can be inspected by normal human person along with some special visual devices.



# ADVANTAGES OF HOLOGRAMS

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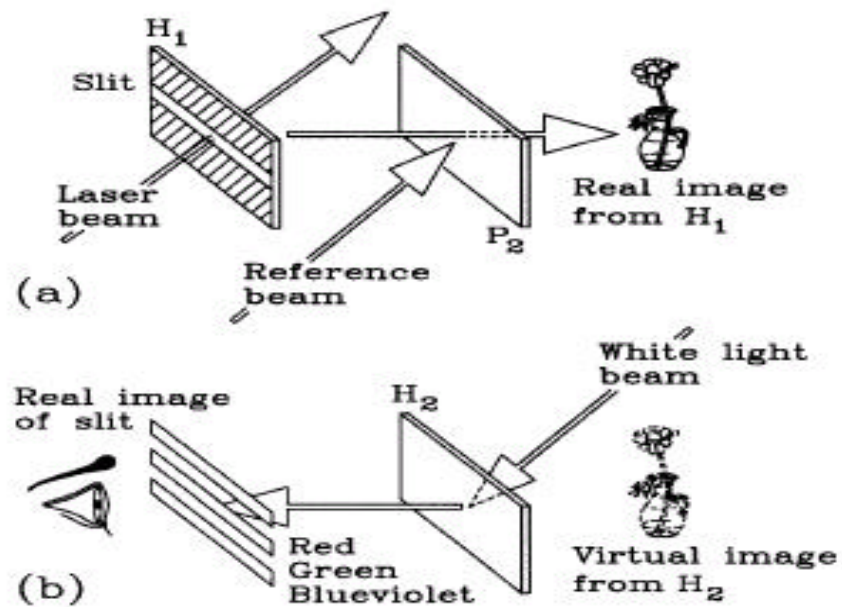
## ✍ MAIN SECURITY BENEFITS

- ✍ Visible recognition features
- ✍ Difficulty of Limitation
- ✍ Technology of production in availability
- ✍ Adaptable to swift change
- ✍ Capable of Development
- ✍ Easy and cost effective to apply to the card



# BASIC TECHNIQUE

## 🔗 Rainbow Holography





# Rainbow holograms

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- ✍ Key Benefit- Can be reconstructed under white light
- ✍ Transmission Hologram(H1) is first created
- ✍ Real image is written onto the second holographic plate.
- ✍ If this hologram is played back with white light, both images are reconstructed.
- ✍ When horizontally moved it will result in parallax-key feature of holograms.



# COPY RESISTANCE TECHNIQUES

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- ✍ Make it impossible to separate the hologram from its substrate
- ✍ Use of complicated images can make more difficult for a forger to reconstruct from scratch.
- ✍ Coated with reflective backing
  - ✍ When coated the viewer will either be able to see the substrate image or the hologram, but not the both
- ✍ Produce a fairly high quality image of the human face



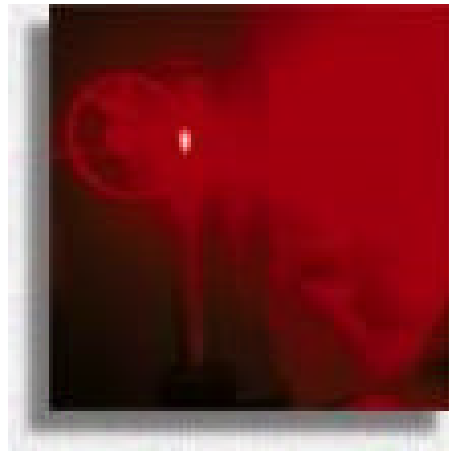
# CREDIT CARDS HOLOGRAMS

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- ✍ Holograms brought everyone's attention when Master Card started to use them to protect its credit cards from fraud in 1993
- ✍ Holograms applied to credit cards are manufactured by process of embossing.
- ✍ These are characterized by giving the impression of depth parallax when tilted in one plane and giving changing color when tilted in a plane at right angles.

# CREDIT CARD HOLOGRAMS

- ✍ Holographic image is recorded by means of either optically interference or electron lithography into a photoresist plate.
- ✍ Prevent internal scattering of light on the plate by special coating
- ✍ Duplicate this surface in durable material.



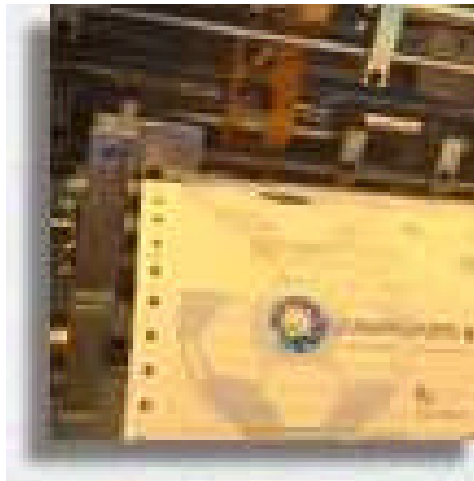
# CREDIT CARD HOLOGRAMS

- ✎ Nickel shim is grown from the master hologram-grandmother shim.
- ✎ Once grown it is peeled off from the photoresist, then copies of mother shims are produced from grandmother and daughter shims are grown from the mother



# CREDIT CARD HOLOGRAMS

- ✍ Daughter shims are fixed to a heater roller on the embossing machine
- ✍ Thin aluminized plastic film passes through a set of rollers and the holographic image is transferred or embossed into the plastic.





# DIFFERENT CONCEPTS - HOLOGRAMS

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## ✍ SECURITY COMPONENTS

### ✍ OVERT DOVIDS-

- ✍ contains images that are viewable by anyone.
- ✍ Used for quality and authenticity.

### ✍ COVERT DOVIDS

- ✍ Can be read by machinery and can only be identified by trained eye.
- ✍ For very high security





# IMAGING TYPES

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## ✍ 3D HOLOGRAMS

- ✍ 1:1 ratio between the image size and the original object size
- ✍ Recorded from actual 3-D objects
- ✍ Example-VISA DOVE

## ✍ 2D/3D HOLOGRAMS

- ✍ Recorded from 2-D flat artwork
- ✍ Example Master Card Globe

## ✍ MUTIPLEX STEREOGRAMS

- ✍ Image data is derived from a series of hundred sequential frames of line or computed generated animation graphics.



# SECURITY LEVELS

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## ✍ HIGH SECURITY LEVEL

- ✍ Computer generated OVD using dotmatrix technology overlapped with holographic technologies provides high security level

## ✍ VERY HIGH SECURITY LEVEL

- ✍ Scrambled hidden information

## ✍ HIGHEST SECURITY LEVEL

- ✍ Using Correlators



# APPLICATIONS

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- ✍ Security, Passport, credit card, certificate, ticket (look at your bank card and you will see a hologram)
- ✍ Name brand protection, 3-D trademark, tag and sealing label (Example in COORS, PEPSI, etc..)
- ✍ Product packaging, enhancement and distribution (As in tooth paste packs)
- ✍ First DOVID in security application-1983-Master card

# USAGE OF HOLOGRAPHICS

## ✍ SECURITY HOT STAMP FOILS

- ✍ These are designed to protect credit cards, transaction cards, and paper based documents.



# USAGE OF HOLOGRAPHICS

✍ TAMPER APPARENT



✍ Holographic cards & Laminates



# DOVID IN PACKAGING

- ✎ Packaging material features a repeated design
- ✎ Example Pesi set a stand for the use of imaged holographic packaging.
- ✎ Many bottled beers and drinks have hologram image labels.
- ✎ Also holorams are present in toothpatse packs.





# ADVANCED DOVD

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## ✍ ELEXGRAM

- ✍ These are directly written groove structures produced by electron beam lithography
- ✍ Besides bewildering array of graphical and kinematical effects, these structures can render photographic images that will invert to a negative image when tilted.
- ✍ This is used in bank notes and high security documents
- ✍ single source origination- protected by military and bank standard security systems.



# EXELGRAM

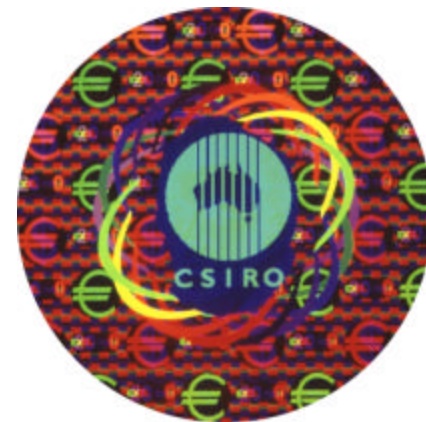
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## Key Feature

- ability to encode and reply high resolution grayscale information along each line scan of image.
- High resolution

## Figure

- OVD effects from from an ELGRAM anti counterfeiting device, photographed at 2 different angles of view.





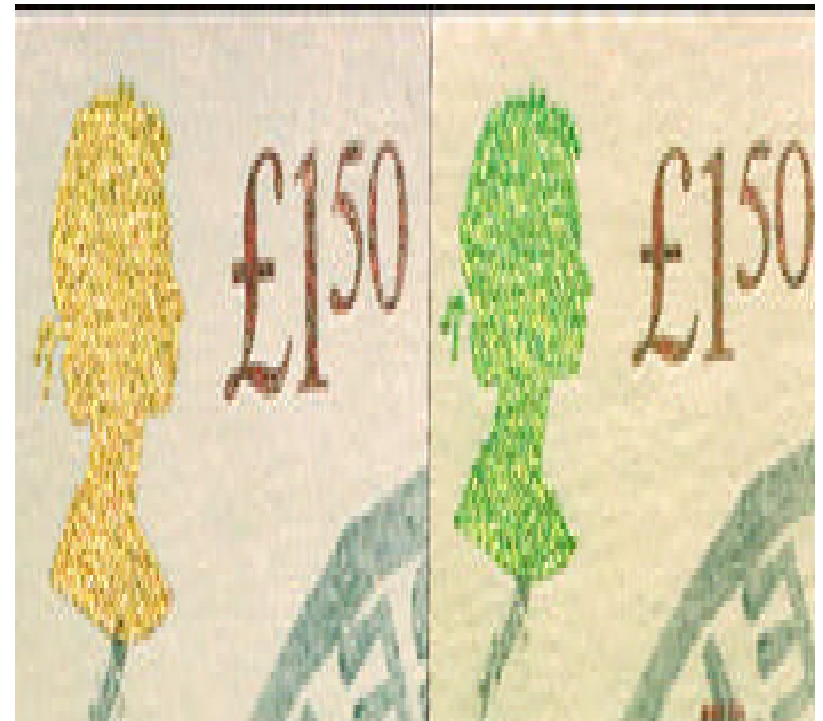
# HIGH SECURITY APPLICATIONS

✍ Some High Security applications



# OPTICALLY VARIABLE INK

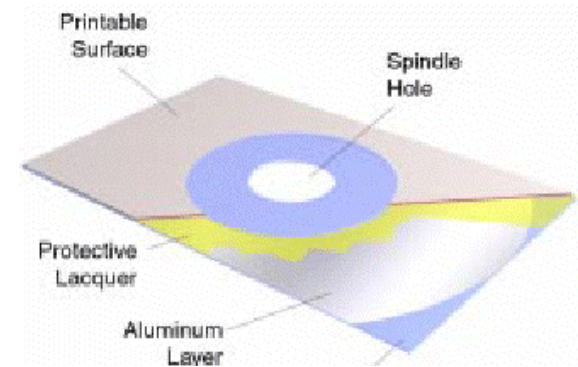
- ✍ Reserved for high security applications
- ✍ It is applied by either intaglio or silk screen printing techniques to produce interference layers within the printed service, resulting in iridescent patterns.



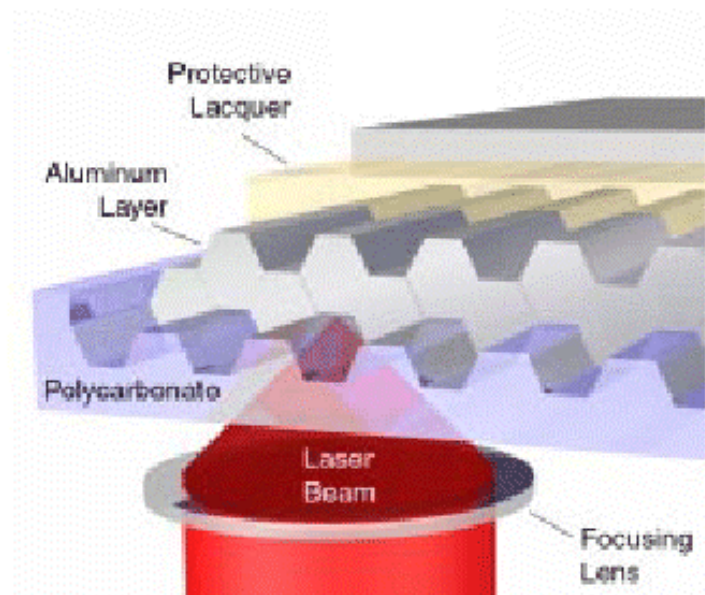
# OPTICAL CARDS

- ✍ Employ CD-ROM type of technology to store information
- ✍ Ideal carrier for fingerprints, logos, photographs
- ✍ Used in high security driver's licenses and access/entry cards
- ✍ Auto repair/warranty cards
- ✍ Secure bank debit cards, Immigrant ID cards

Optical Card Construction.



Encoding an Optical Card.





# ZERO ORDER DIFFRACTION MICROGRATINGS

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- ✍ Has a very pronounced reflectance peak in the red portion of the spectrum at normal incidence.
- ✍ Peak will split and shift linearly with angle of incidence, leaving visible range at  $30^\circ$
- ✍ Light polarized parallel to the gratings will have a different reflectance than light polarized perpendicular to the gratings-peaking in the green portion of the spectrum
- ✍ Can be made out of plastics , hence can be embedded within a security device during manufacturing process.

# ZERO ORDER DIFFRACTION MICROGRATINGS

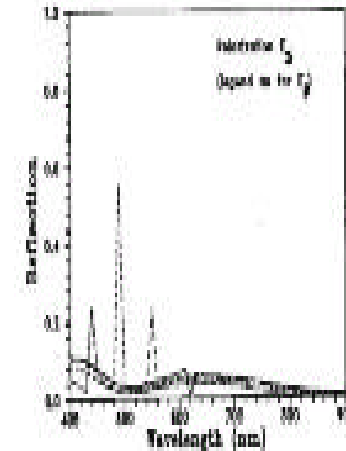
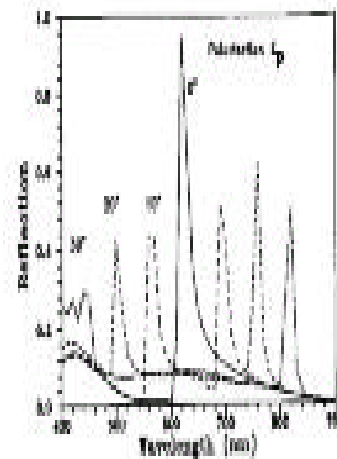
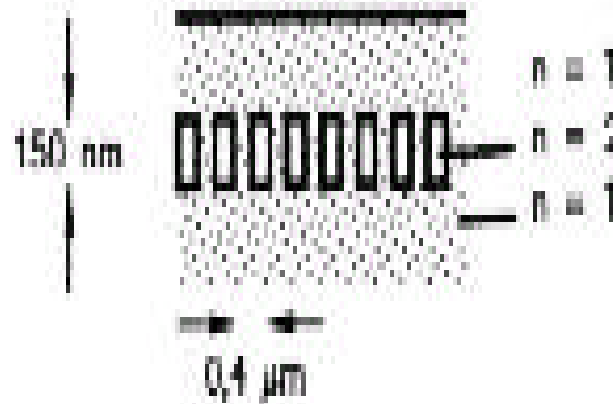


Figure 4: Reflectance for parallel ( $E_{\parallel}$ ) and perpendicularly ( $E_{\perp}$ ) polarized light



# ADVANTAGES

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- ✍ The manufacturing capability necessary to make the structure is very expensive -far more than to duplicate holograms.
- ✍ It is embedded within the security device
- ✍ Very well suited for machine verification
- ✍ Also will not suffer from overlapping first orders that tend to blur hologram images.



# FIBER OPTICS

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- ✍ Using fiber optics provide a secure data transmission
- ✍ Unlike copper-based cables, fiber optic cables do not radiate any signals which may be received by unauthorized parties
- ✍ Important-easy detection of tapping and so it is advantageous for banks and security applications



# CAN A FIBER BE TAPPED?

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- ✍ If a fiber were bent to tap the light, the other frequencies would attenuate a larger amount allowing the primary channel to see the tap.
- ✍ There are many arguments saying that fiber can be tapped
- ✍ But tapping is very difficult








# OTICAL CRYPTOGRAPHIC TECHNIQUES

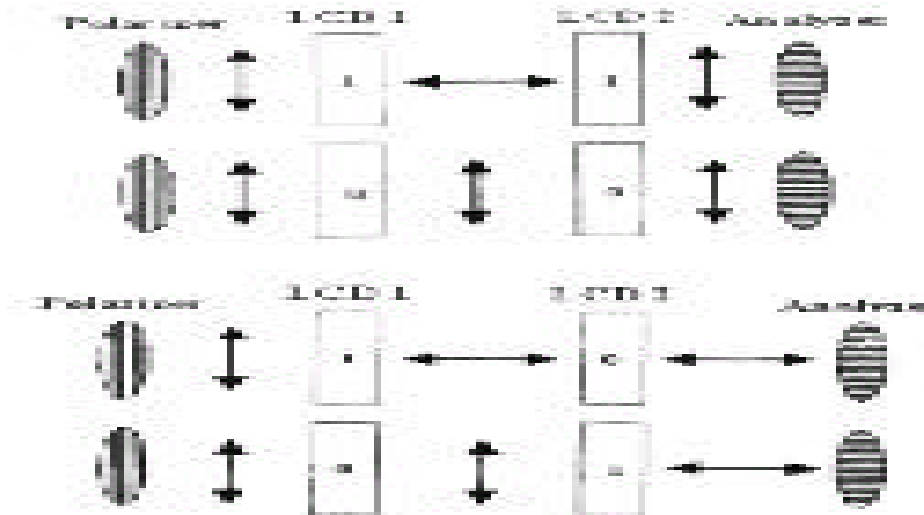
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## OPTOELECTRONIC METHODS

-  Cryptographic algorithms implemented optoelectronically is well resistant to the attack of unauthorized person
-  A simple two input XOR gate can be implemented using polarizers and two liquid crystal displays
-  Similar logic gates used for encryption can be implemented optically

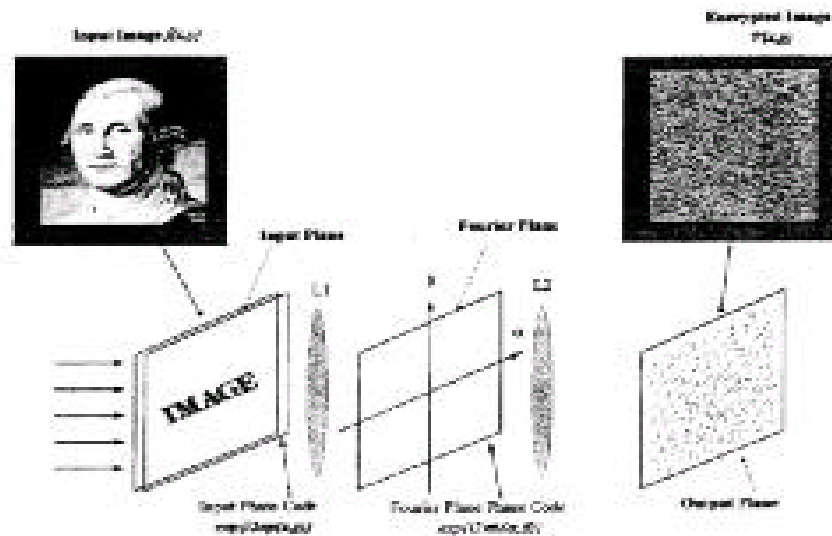
# OPTOELECTRONIC METHODS

- Optoelectronically implemented cryptography-
  - can be run in parallel
  - Cost effective



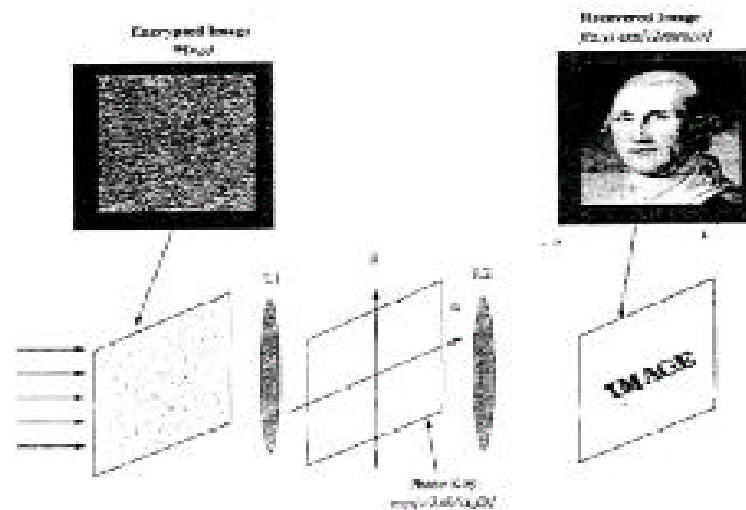
# DOUBLE PHASE ENCODING

- Simplest and most useful classical processor based encryption scheme



# Double Phase Encoding

- Decryption is the inverse operation





# Double Phase Encoding

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- ✍ Useful feature – the encrypted image can be directly written into a holographic memory
- ✍ Multiple overlapping of images can be done with a different key used for each
- ✍ Overall security of this method is poor due to attack based on its linearity

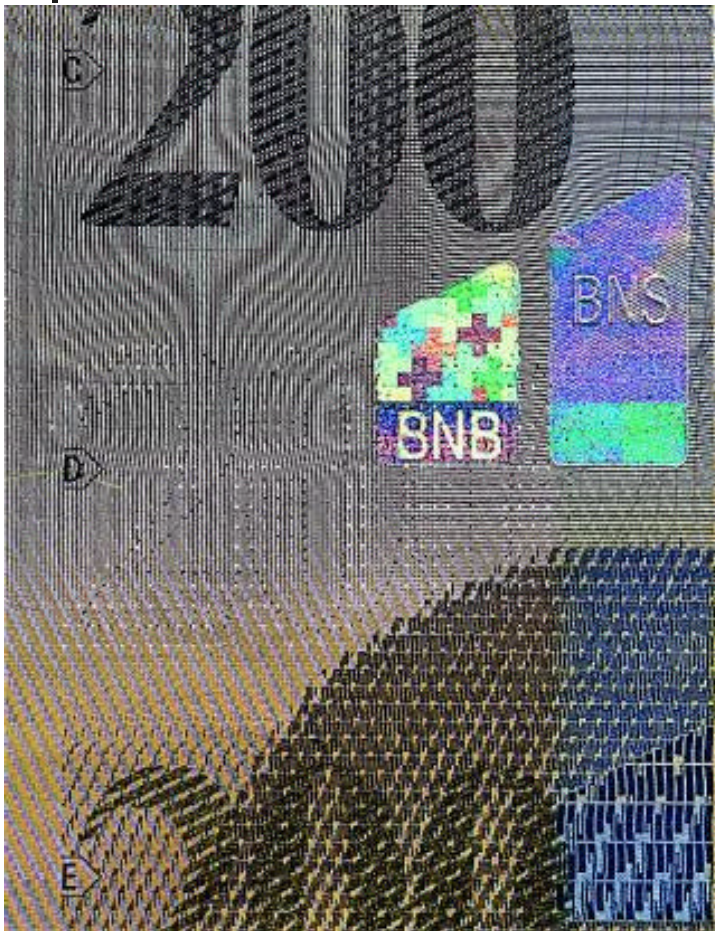


# LASER SECURITY

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- ✍ IAI has introduced a new laser technology
- ✍ Physical characteristics of laser beam enable introduction of unique security features into security documents, allowing easy authentication
- ✍ High level of protection makes attempts to counterfeit or forge security documents a futile activity

# APPLICATIONS





# CONCLUSION

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## ✍️ TOPICS NOT COVERED

- ✍️ Optical detection of random features for high security applications
- ✍️ Kinegrams and pixelgrams
- ✍️ Stenography
- ✍️ Intagilo printing





# CONCLUSION

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- ✍ Day by day technology is improving and many new security products are coming
- ✍ Many advancements have been made in security applications
- ✍ Counterfeit detecting Equipments are also available in large numbers and many companies produce them.



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# DISCUSSIONS

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THANK YOU