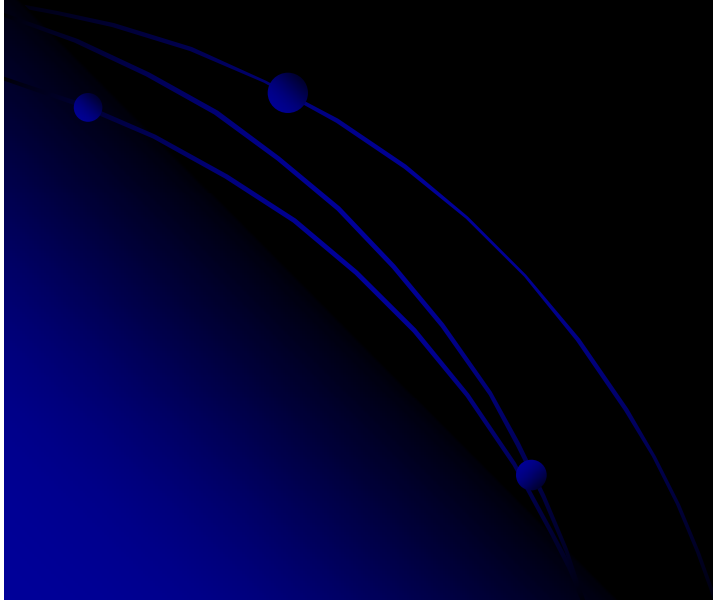
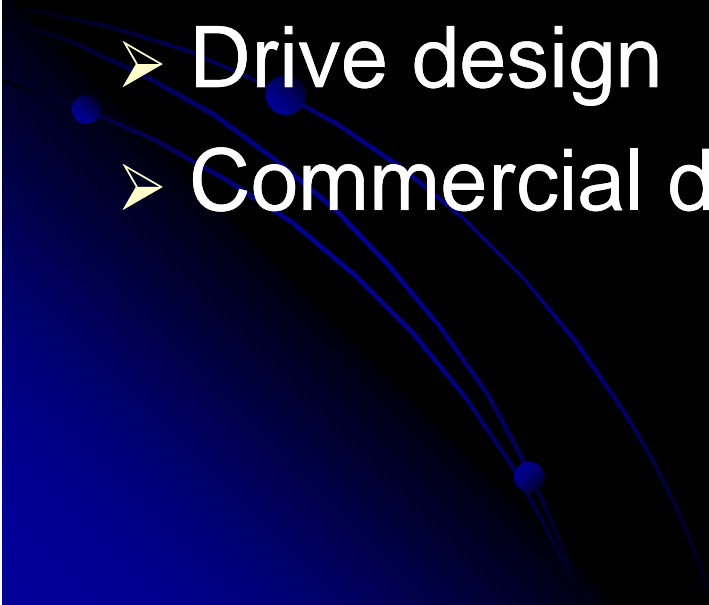


# 3D Optical Data Storage Technology



# Over view of the presentation

- History
  - Processes for creating written data
  - Processes for reading data
  - Media design
  - Drive design
  - Commercial development
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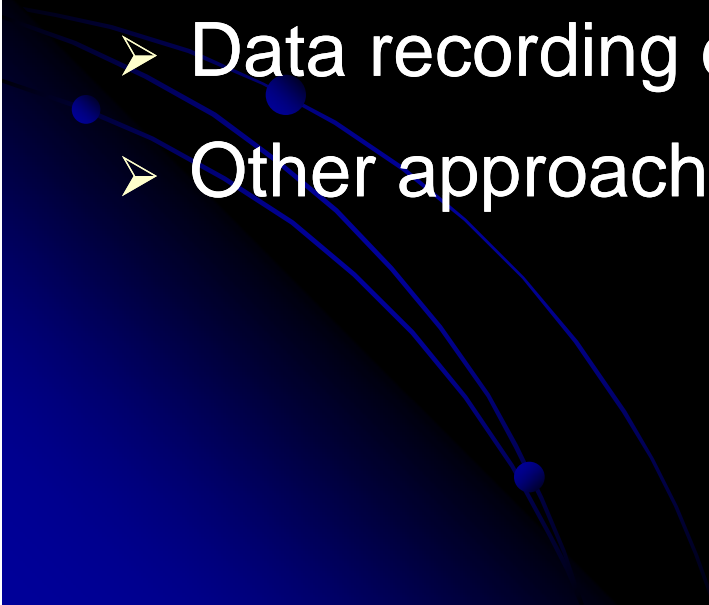
# HISTORY

- Back to the 1950s, Yehuda Hirsh berg developed the photo chromics and suggested their use in data storage.
- In the 1970s, Valeri demonstrated that this could be produced by two-photon excitation.
- Finally at the end of the 1980s Peter T. Rentzepis showed that photo chromism could lead to three-dimensional data storage.

Contd.

- Wide range of physical phenomena for data reading and recording have been investigated.
- Large numbers of chemical systems for the medium have been developed.
- Extensive work has been carried out in solving the problems associated with the optical systems required for the reading and recording of data.
- Currently, several groups remain working on solutions with various levels of development and interest in commercialization.

# PROCESSES FOR CREATING WRITTEN DATA

- Writing by nonresonant multiphoton absorption.
  - Writing by sequential multiphoton absorption.
  - Micro holography
  - Data recording during manufacturing.
  - Other approaches to writing.
- 

# Writing by nonresonant multiphoton absorption:

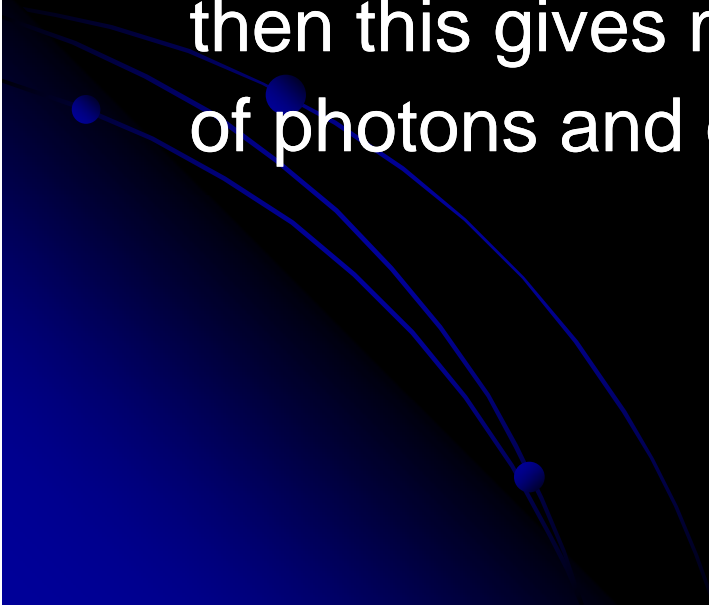
- Multiphoton absorption is capable of injecting into the media the significant energy required to electronically excite molecular species and cause chemical reactions.
- Two-photon absorption is the strongest multiphoton absorbance, but still it is a weak phenomenon, leading to low media sensitivity.
- Writing by 2-photon absorption can be achieved by focusing the writing laser on the point where the photochemical writing process is required.

contd.

- The wavelength of the writing laser is chosen such that it is not linearly absorbed by the medium.
- At the focal point 2-photon absorption becomes significant.
- Writing by 2-photon absorption can also be achieved by the action of two lasers in coincidence.

# Writing by sequential multiphoton absorption:

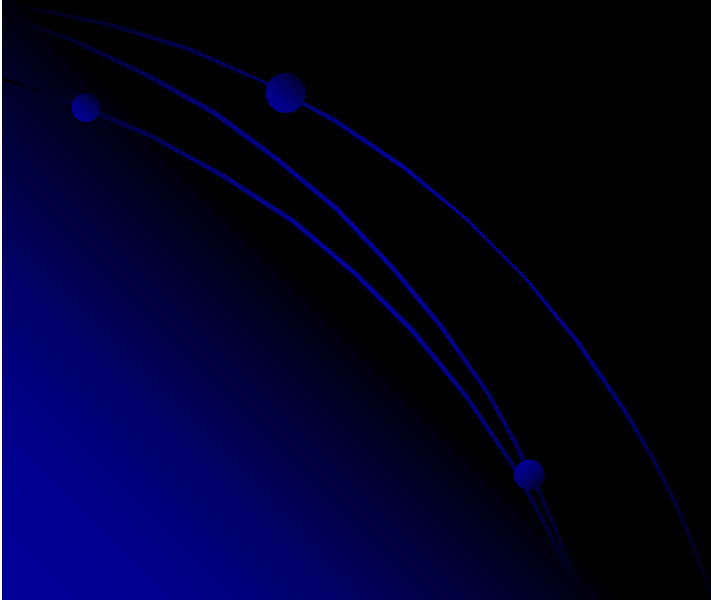
- Nonresonant two-photon absorption is weak since for excitation to take place, the two exciting photons must arrive at the same time.
- The chromophore has an energy level corresponding to the absorption of one photon then this gives more freedom in the arrival time of photons and gives a much higher sensitivity.



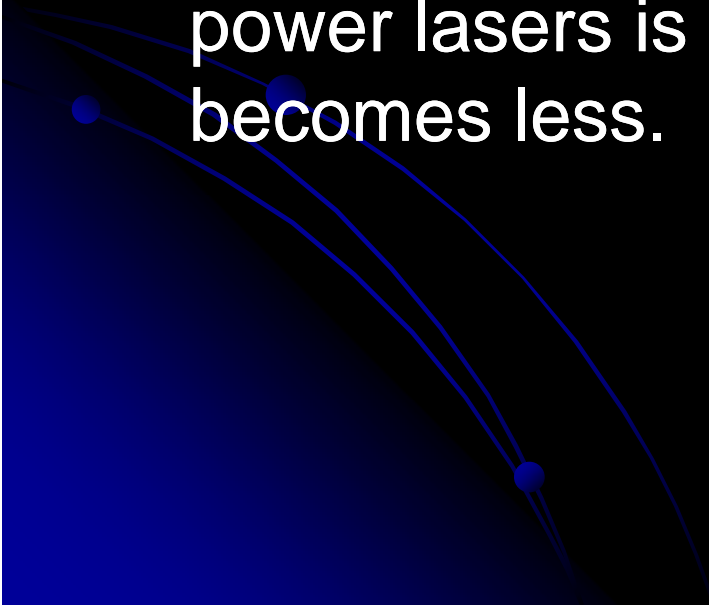


## Micro holography:

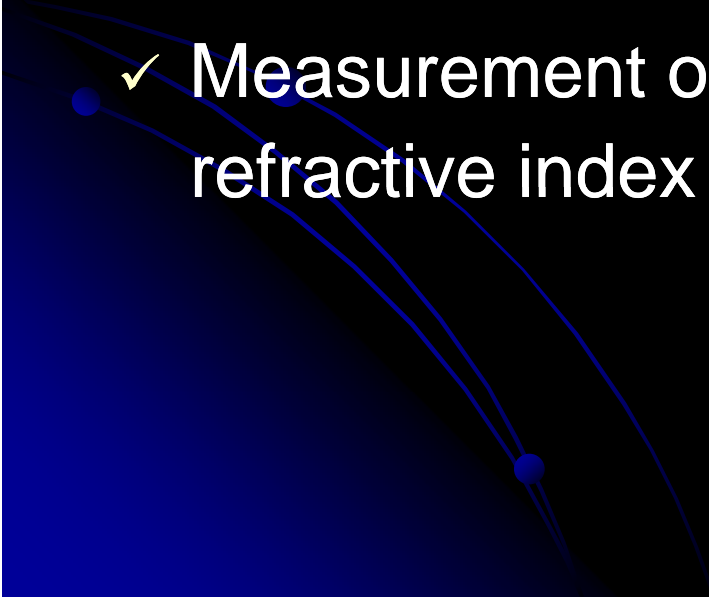
- The writing process may use the same kinds of media that are used in other types of holographic data storage.
- May use 2-photon processes to form the holograms.



# Data recording during manufacturing:

- Here data is created in the manufacturing of the media, as similar with most optical disc formats for commercial data distribution.
  - Data may be written by a nonlinear optical method, but in this case the use of very high power lasers is acceptable so media sensitivity becomes less.
- 

# Processes for reading data

- The nonlinearity of the light-matter interaction is used to obtain 3D resolution.
  - Reading methods include:
    - ✓ Two photon absorption.
    - ✓ Linear excitation of fluorescence.
    - ✓ Measurement of small differences in the refractive index between the two data states.
- 

# Media design

- The active part of 3D optical storage media is usually an organic polymer either doped or grafted with the photo chemically active species.
- Alternatively, crystalline and sol-gel materials have been used.



# Drive design

- There are a number of notable differences that must be taken into account when designing such a drive.
- **Laser:** 3D optical storage drives may require solid-state lasers.
- **Optical system:** In 3D optical data storage systems, several wavelengths (colors) of light are used.
- Therefore, with the high laser power, the optical system must combine and separate these different colors of light as required.

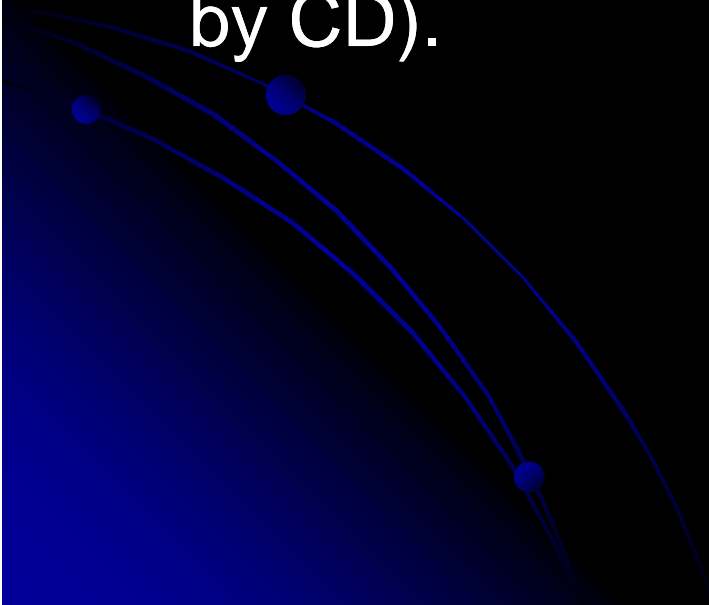
# Commercial development

- several companies have been set up to commercialize 3D optical data storage and some large corporations have also shown an interest in the technology.
  - However, it is not yet clear whether the technology will ever come to market in the presence of competition from others such as hard drives, flash storage, holographic storage and internet-based storage
- Examples of 3D optical data storage media:



# CONCLUSION

3D optical data storage is the form of optical data storage in which information can be recorded and/or read with three dimensional resolution (as opposed to the two dimensional resolution afforded, for example, by CD).



Thank You...

