

# Digital Image Processing

Third Edition

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MedData Interactive  
Upper Saddle

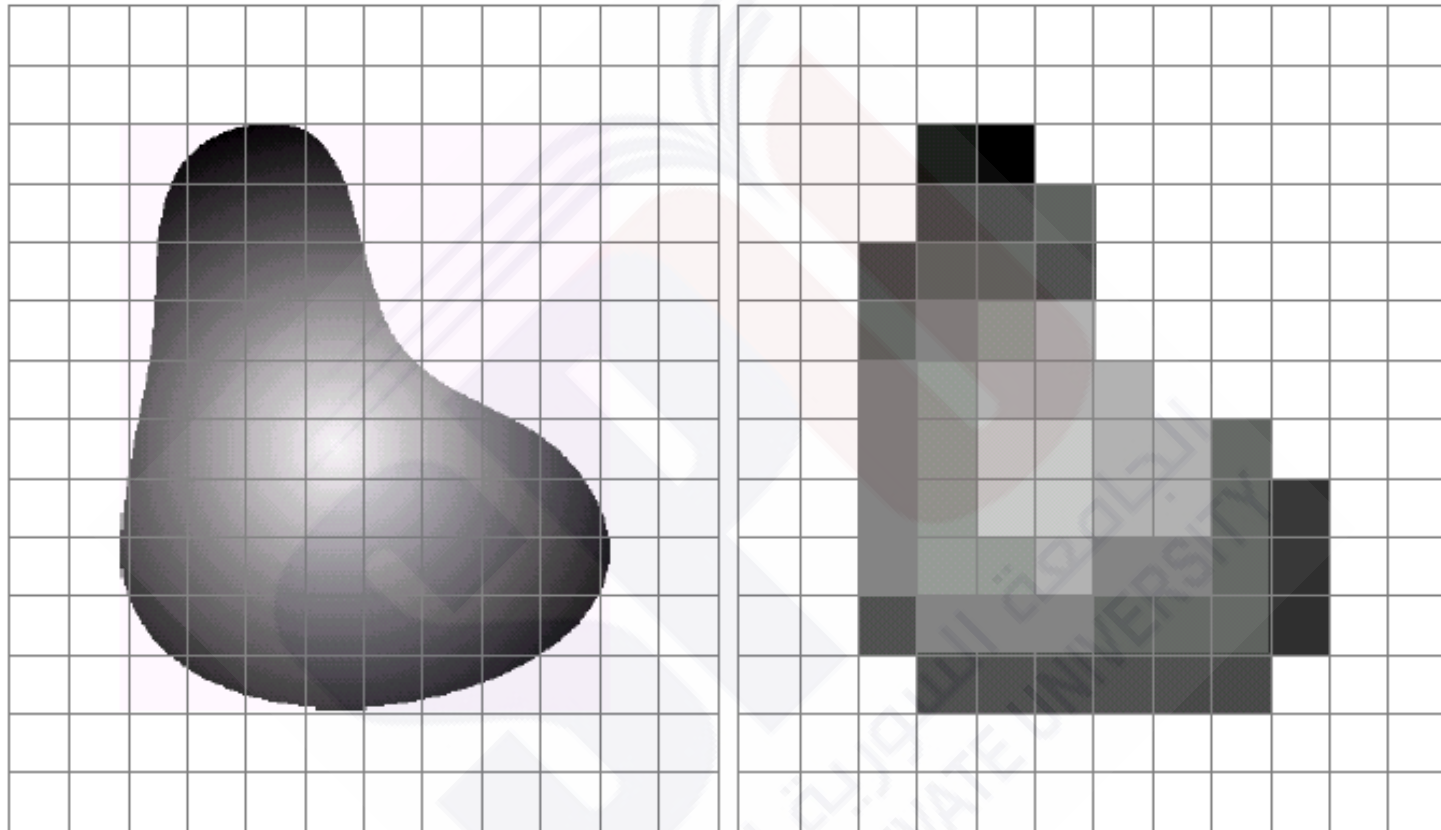
## WHAT IS AN IMAGE?

It is a two dimensional function  $f(x,y)$  where  $x$  and  $y$  are spatial coordinates and the amplitude of  $f$  at any position  $(x,y)$  is the intensity or gray level of the image at that point.

When  $x$ ,  $y$  and the amplitude values of  $f$  are all finite, discrete quantities, we call the image a ***digital image***.

A digital image is composed of a finite number of elements, each of which has a particular location and value. These elements are referred to as *picture elements*, *image elements*, *pels*, and *pixels*.

Pixel is the term most widely used to denote the elements of a digital.



**a b**

**FIGURE 2.17** (a) Continuous image projected onto a sensor array. (b) Result of image sampling and quantization.

# WHAT IS DIGITAL IMAGE PROCESSING?

- Low-level processes (**image processing** ) to reduce noise, contrast enhancement, and image sharpening. Both its inputs and outputs are images.
- Mid-level processing on images (**image analysis**) involves tasks such as segmentation (partitioning an image into regions or objects), description of those objects to reduce them to a form suitable for computer processing, and classification (recognition) of individual objects. its inputs generally are images, but its outputs are attributes extracted from those images
- higher-level processing (**artificial intelligence**) involves “making sense” of an ensemble of recognized objects,

## Fields that use digital image processing

- Medical images
- Industrial Applications
- Computer vision
- Robotics
- Security (face and recognition and)
- Earth observation from space
- Military
- Others

# Digital Image Sources

Cameras

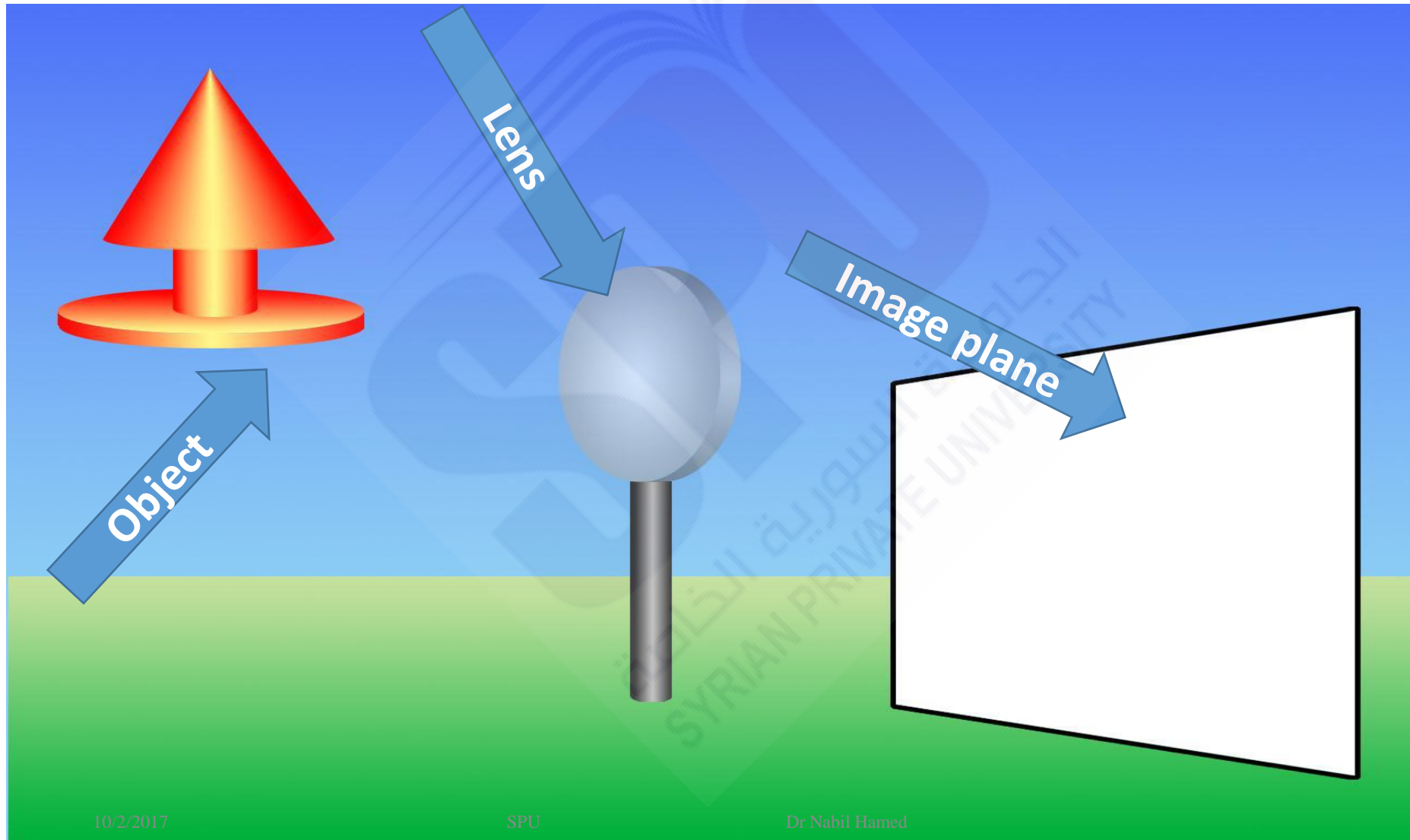
Scanner

Xray

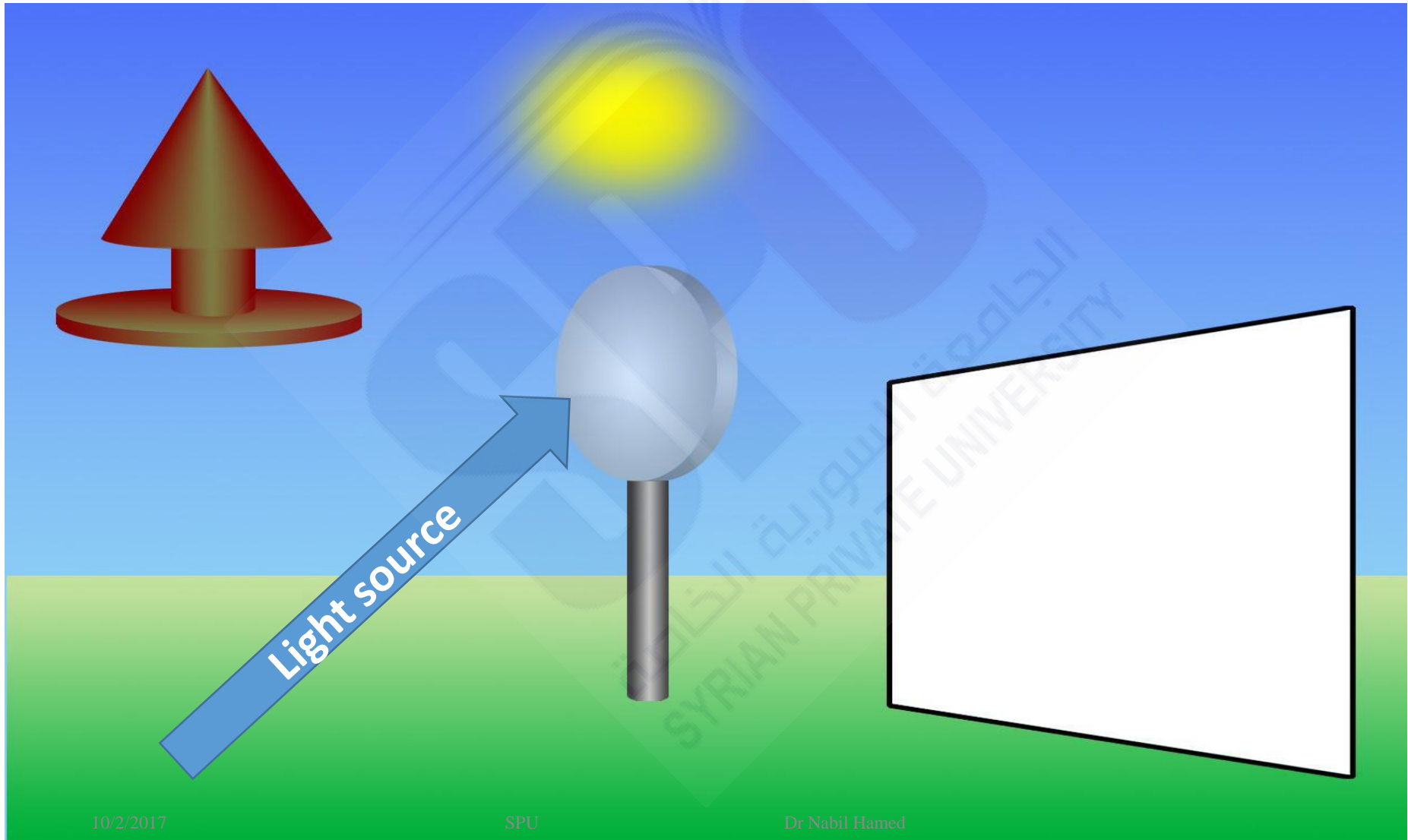
Sensors

Radars

# 1. Image Formation

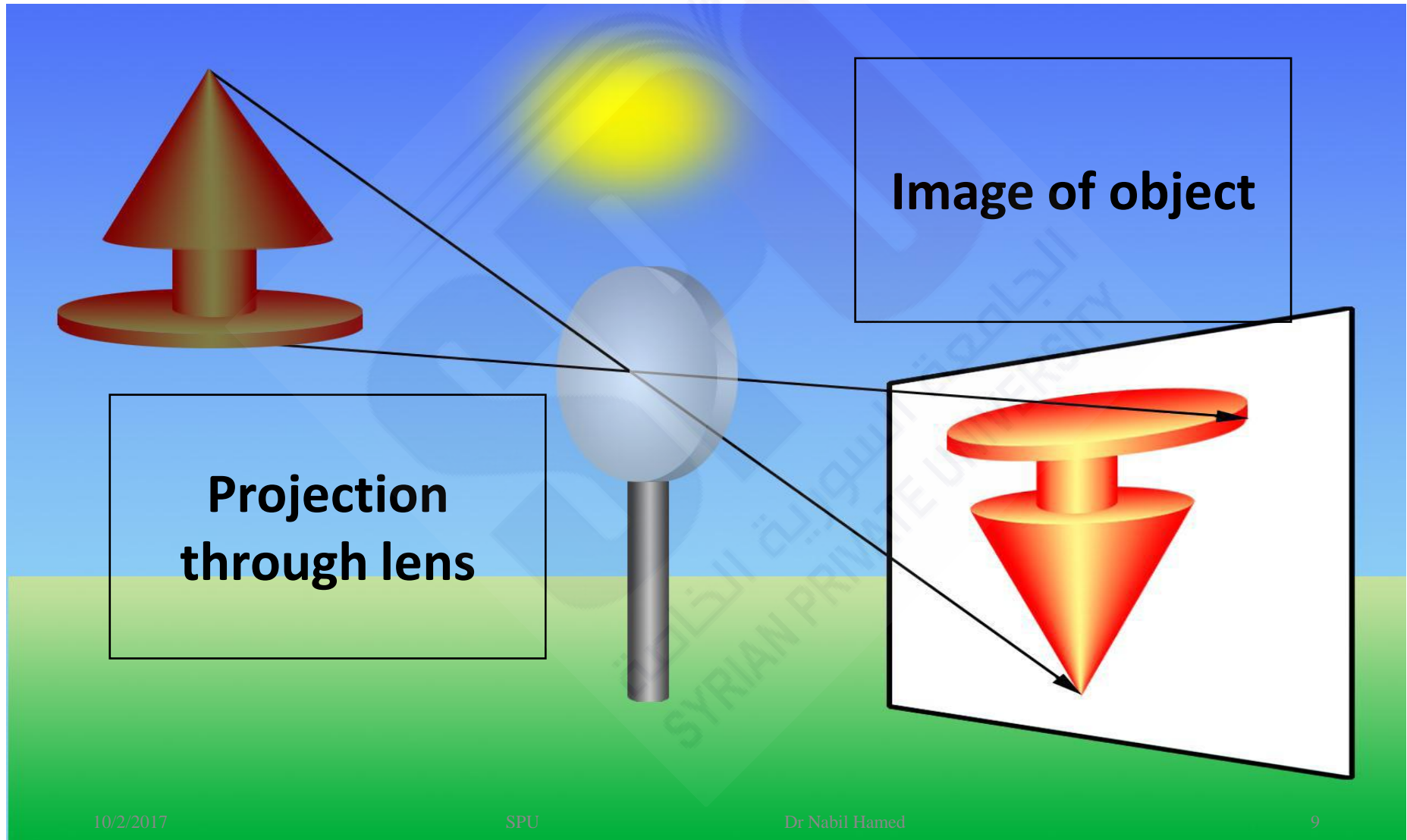


# 1. Image Formation

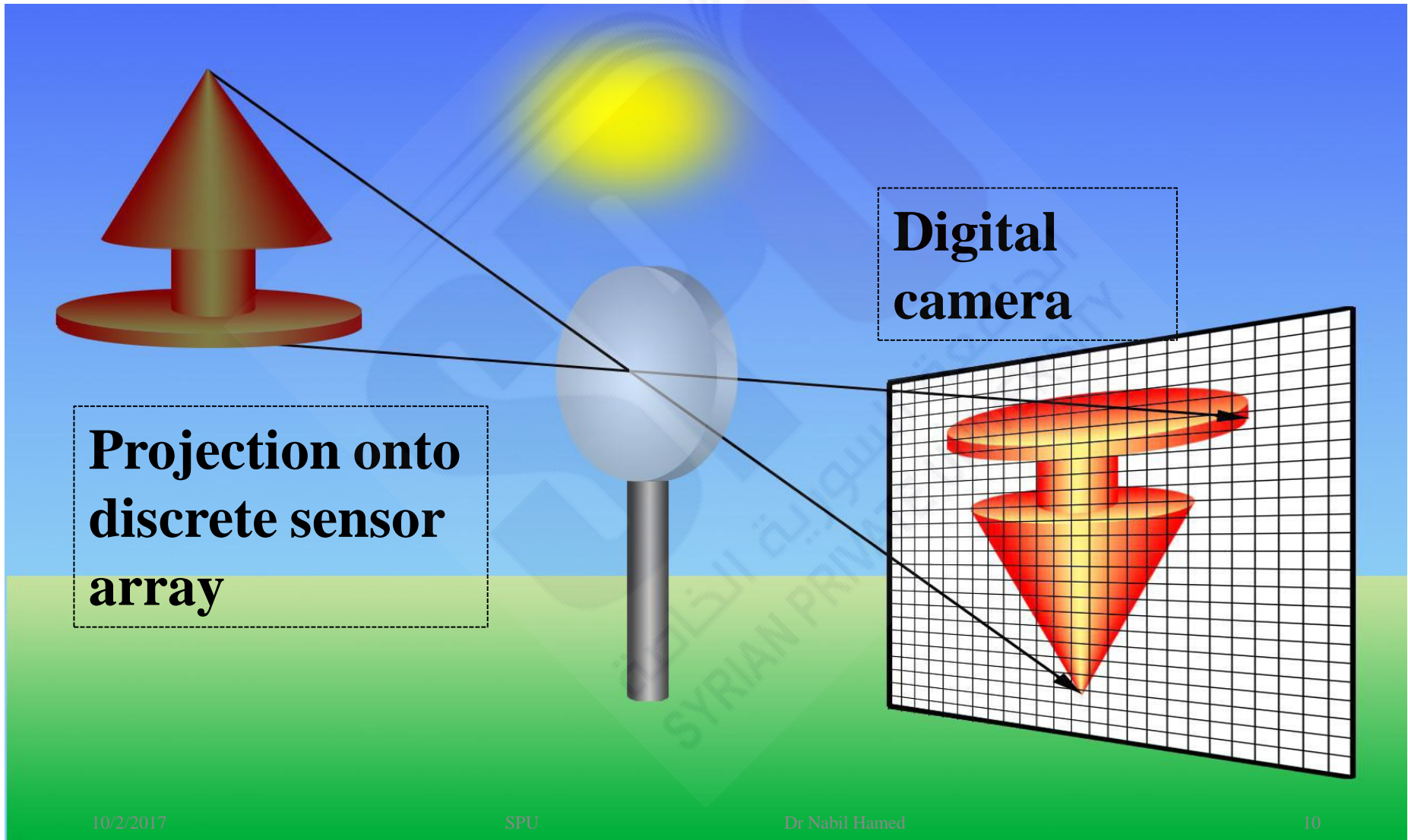




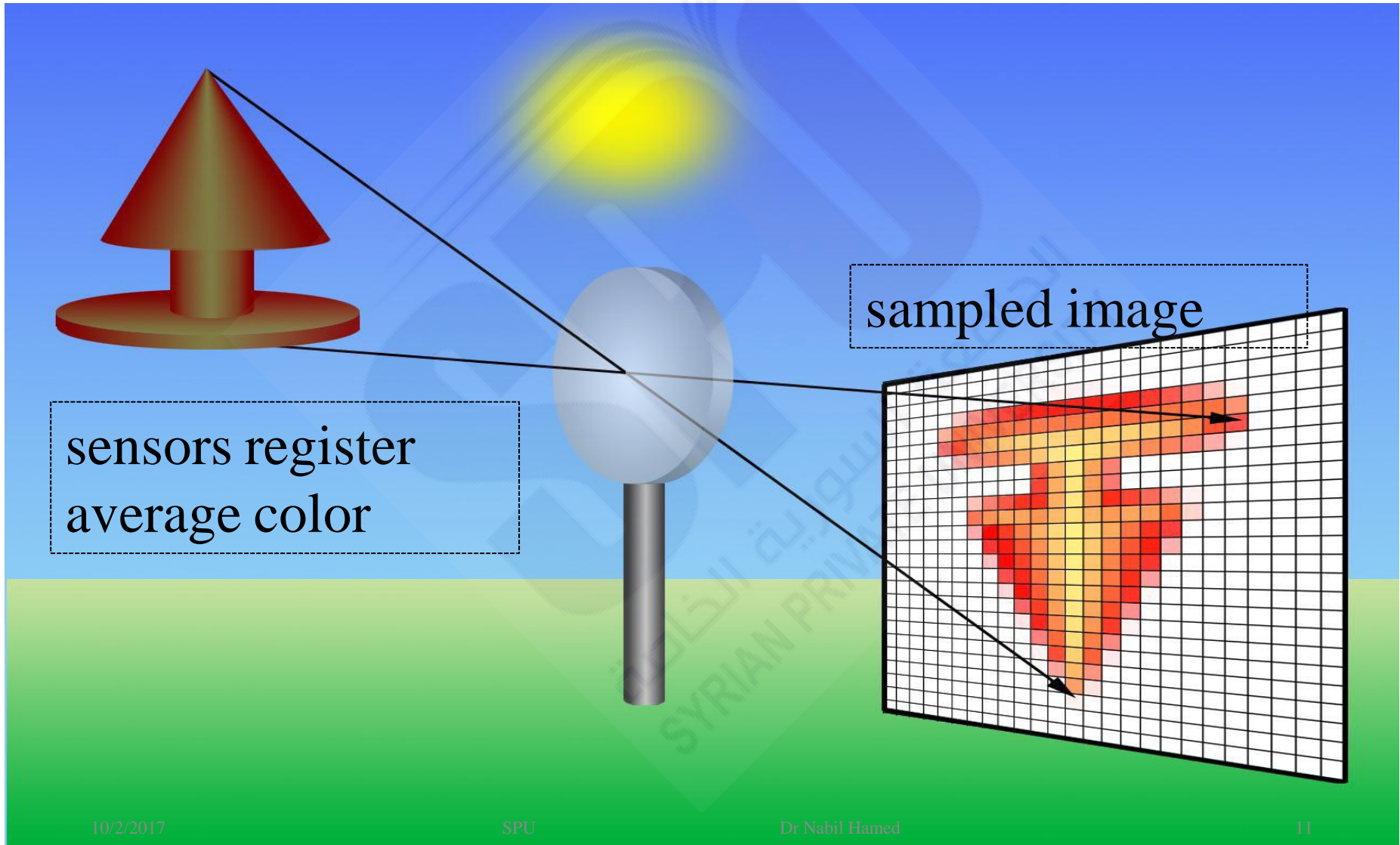
# 1. Image Formation



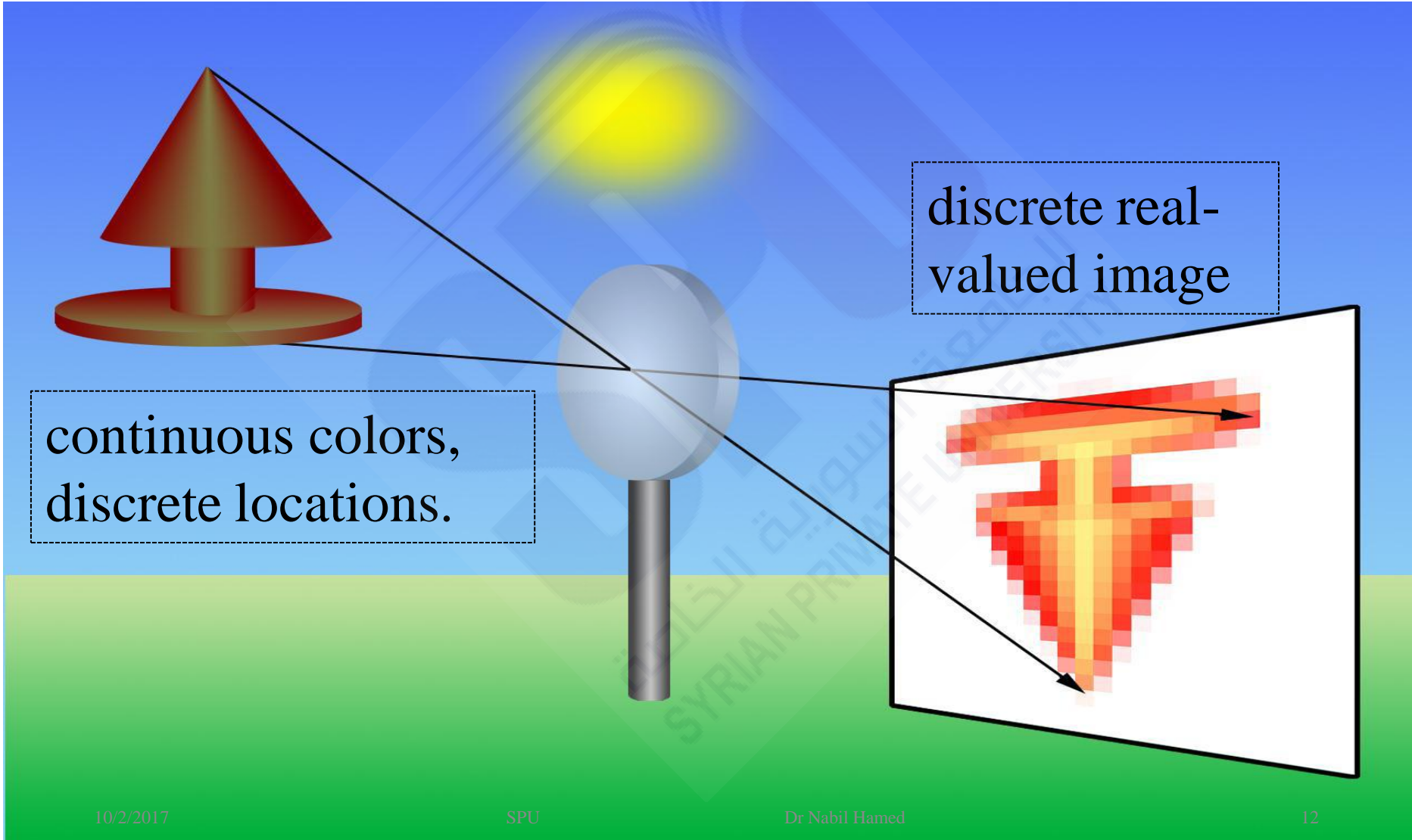
# 1. Image Formation



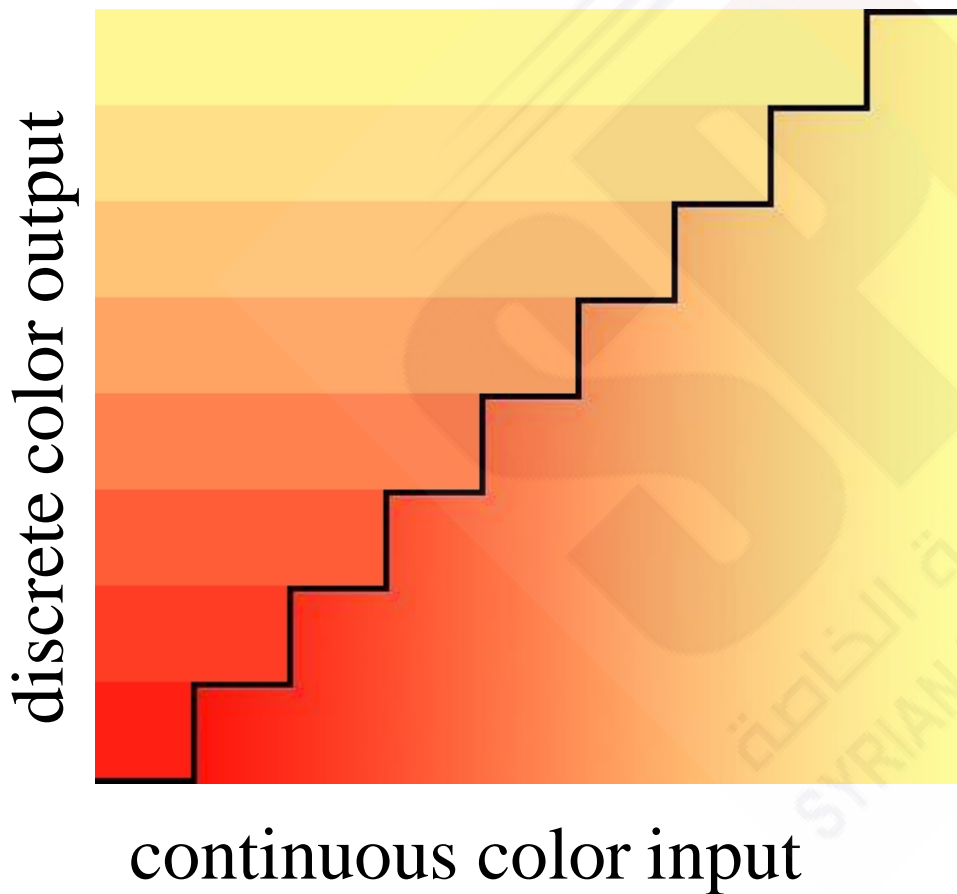
# 1. Image Formation



# 1. Image Formation

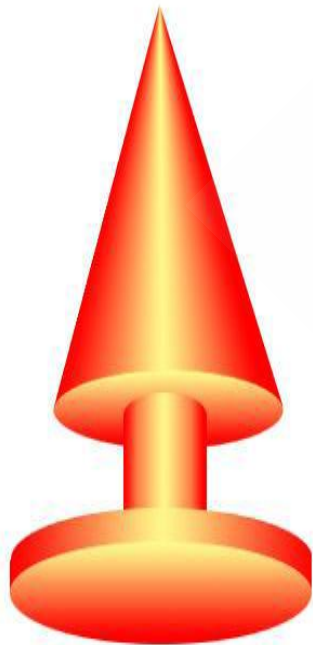


# 1. Image Formation (Quantization)

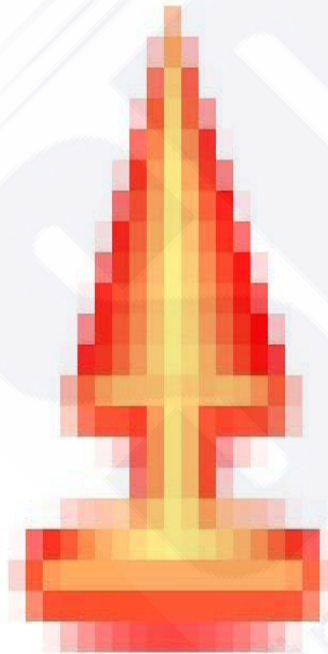


continuous colors  
mapped to a finite,  
discrete set of colors.

# 1. Image Formation (Sampling & Quantization)



Real image



Sampled



quantized

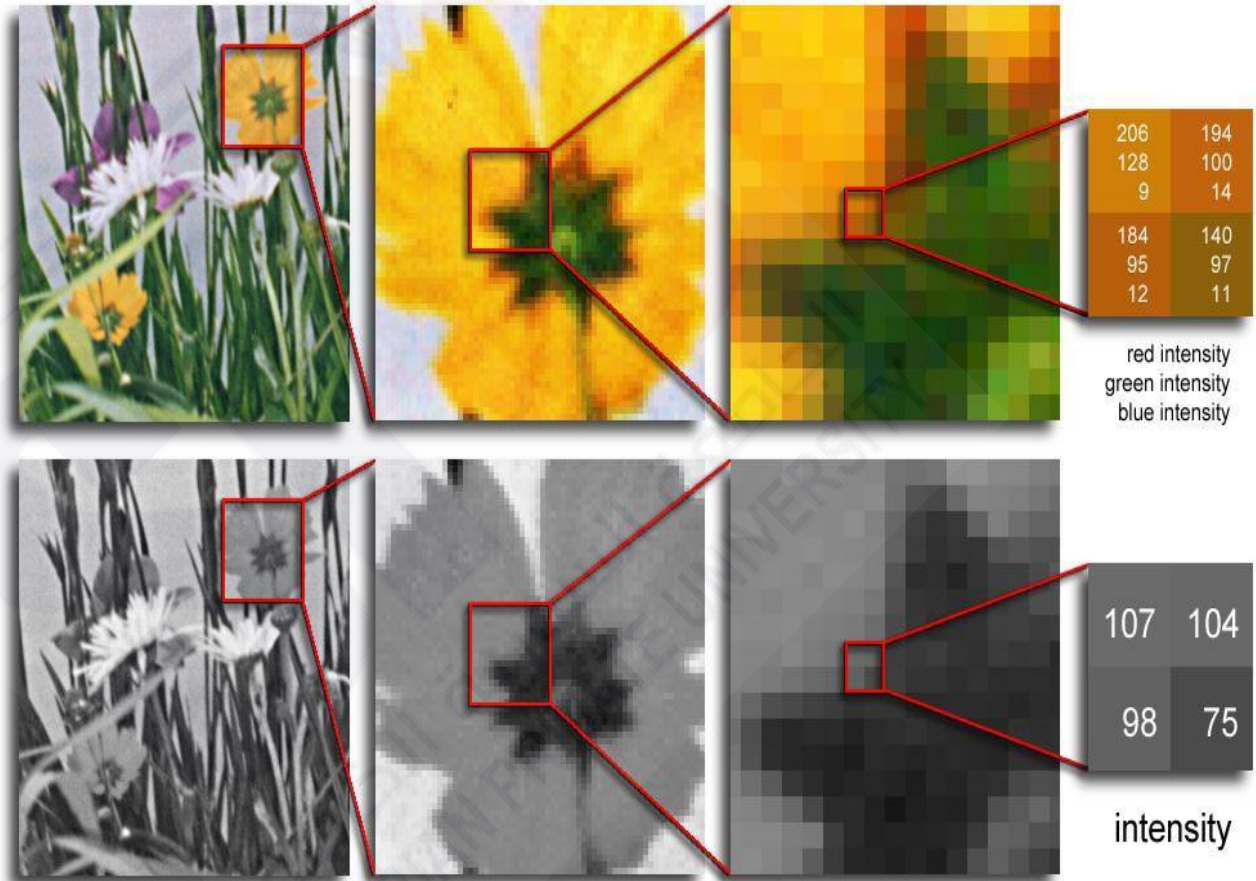


sampled &  
quantized

# 1. Image Formation (Digital Image)

- A grid of squares, each of which contains a single color

- each square is called a pixel (for *picture element*)



- Color images have 3 values per pixel; monochrome images have 1 value per pixel.

**END OF PRESENTATION**