



PhotoShop for Astro-Imagers

Larry Owens

What is PhotoShop?

- **Photoshop, Photoshop CS, CS2, CS3**

- Written nearly 17 years ago by Adobe
- Used in the professional “Pre-Press” industry

- **Image Enhancement**

- Re-sampling, color correction, sharpening, softening, adding text/graphics
- Tools for selecting very specific image areas for enhancement, much more

- **Third Party PhotoShop Enhancements**

- New tools can be added
- PhotoShop Plug-ins

- **PhotoShop Elements (PhotoShop on a Budget)**

- Most of the features of PhotoShop
- 8 Bit images



What is PhotoShop?

- **Photoshop, Photoshop CS, CS2, CS3**

- Written nearly 17 years ago by Adobe
- Used in the professional “Pre-Press” industry

- **Image Enhancement**

- Re-sampling, color correction, sharpening, softening, adding text/graphics
- Tools for selecting very specific image areas for enhancement, much more

- **Third Party PhotoShop Enhancements**

- New tools can be added
- PhotoShop Plug-ins

- **PhotoShop Elements (PhotoShop on a Budget)**

- Most of the features of PhotoShop
- 8 Bit images



Astro-Imaging & PhotoShop

•AstroImaging To-Do List

•Acquisition

•Processing

- Sharpen/soften specific areas
- Final color corrections
- Add text, camera, optics, times, central meridian, conditions

M71

M15

M2

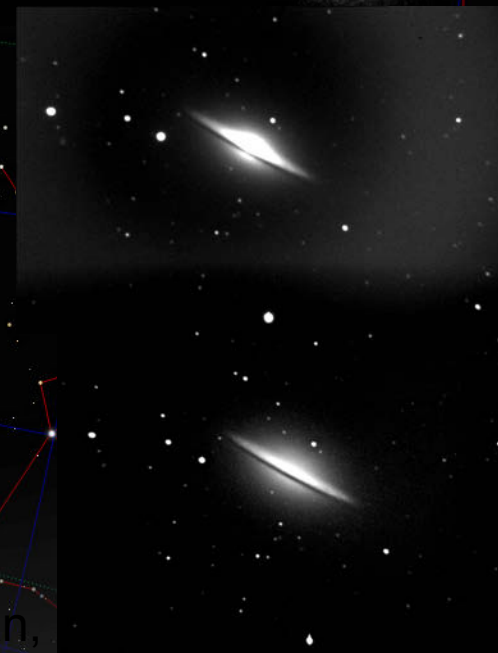
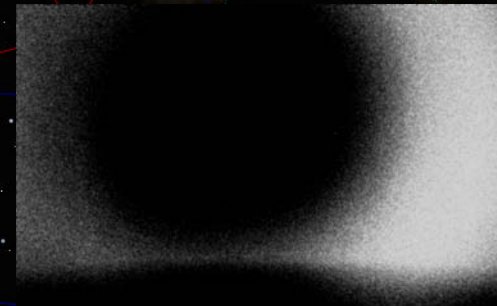
Mars

M72
M73

M30

M75

M55



Astro-Imaging & PhotoShop

•AstroImaging To-Do List

•Acquisition

- Flat fields
- Autoguiding
- Dark frames
- Light frames (L, RGB)
- Acquire .avi's (Lunar/Planetary)

•Processing

- Sharpen/soften specific areas
- Final color corrections
- Add text, camera, optics, times, central meridian, conditions

M71

M15

M2

Mars

M72
M73

M30

M75

M55

Astro-Imaging & PhotoShop

•AstroImaging To-Do List

•Acquisition

- Flat fields
- Autoguiding
- Dark frames
- Light frames (L, RGB)
- Acquire .avi's (Lunar/Planetary)

•Processing

- Calibrate with flats and darks
- Align & stack
- Color combine
- Refine the final image
 - Some areas too bright or dim
 - Imperfections in the image (noise)
 - Sharpen/soften specific areas
 - Final color corrections
 - Add text, camera, optics, times, central meridian, conditions

M71

M15

M2

Mars

M72
M73

M30

M75

M55

Astro-Imaging & PhotoShop

- ***Pick the Right Tool for the Job***

- MaximDL, CCD Stack, Registax, CCD Soft

- PhotoShop CS, PhotoShop Elements

M15

M75

M72

M71

M10

M15

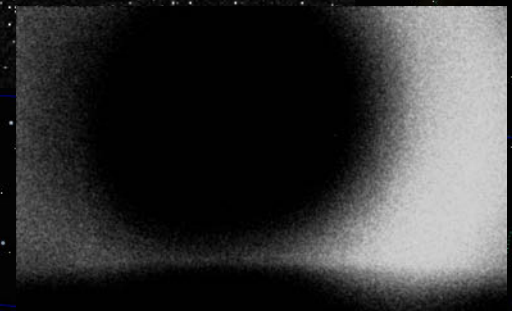
M2

Mars

Astro-Imaging & PhotoShop

• *Pick the Right Tool for the Job*

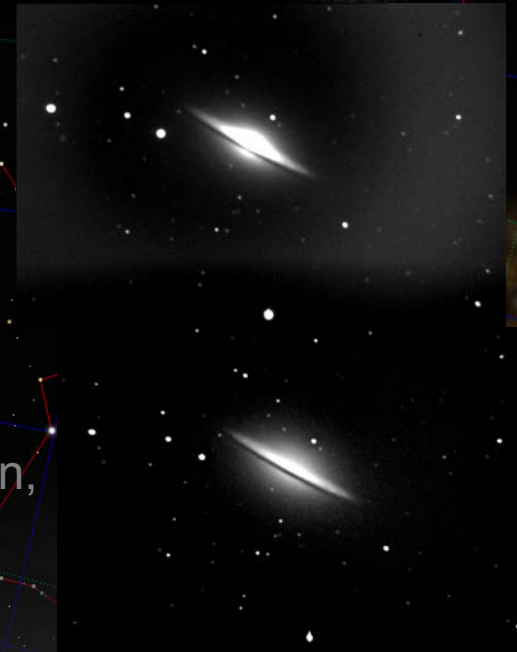
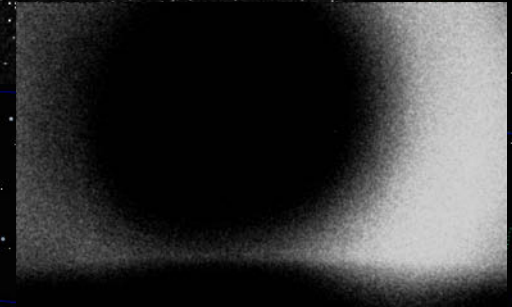
- MaximDL, CCD Stack, Registax, CCD Soft
 - Calibrate with flats and darks
 - Align & stack
 - Color combine (RGB or LRGB)
 - Initial refinements, sharpening, color correction
- PhotoShop CS, PhotoShop Elements



Astro-Imaging & PhotoShop

•Pick the Right Tool for the Job

- MaximDL, CCD Stack, Registax, CCD Soft
 - Calibrate with flats and darks
 - Align & stack
 - Color combine (RGB or LRGB)
 - Initial refinements, sharpening, color correction
- PhotoShop CS, PhotoShop Elements
 - Refine the final image
 - Some areas too bright/dim
 - Imperfections in the image (noise)
 - Luminance Layering (the L in LRGB)
 - Sharpen/soften specific areas
 - Final color corrections
 - Add text, camera, optics, times, central meridian, conditions



Astro-Imaging & PhotoShop

•Color Basics

- RGB (additive)
 - Red, Green, Blue
- LRGB
 - Luminance, Red, Green, Blue
- CYMK (subtractive)
 - Cyan, Magenta, Yellow, Black
- Color Correction
 - If an image is too YELLOW, what's the problem?



Astro-Imaging & PhotoShop

- **A bit about Bits, Bytes, Pixels, Mega-Bytes and Mega-Pixels**

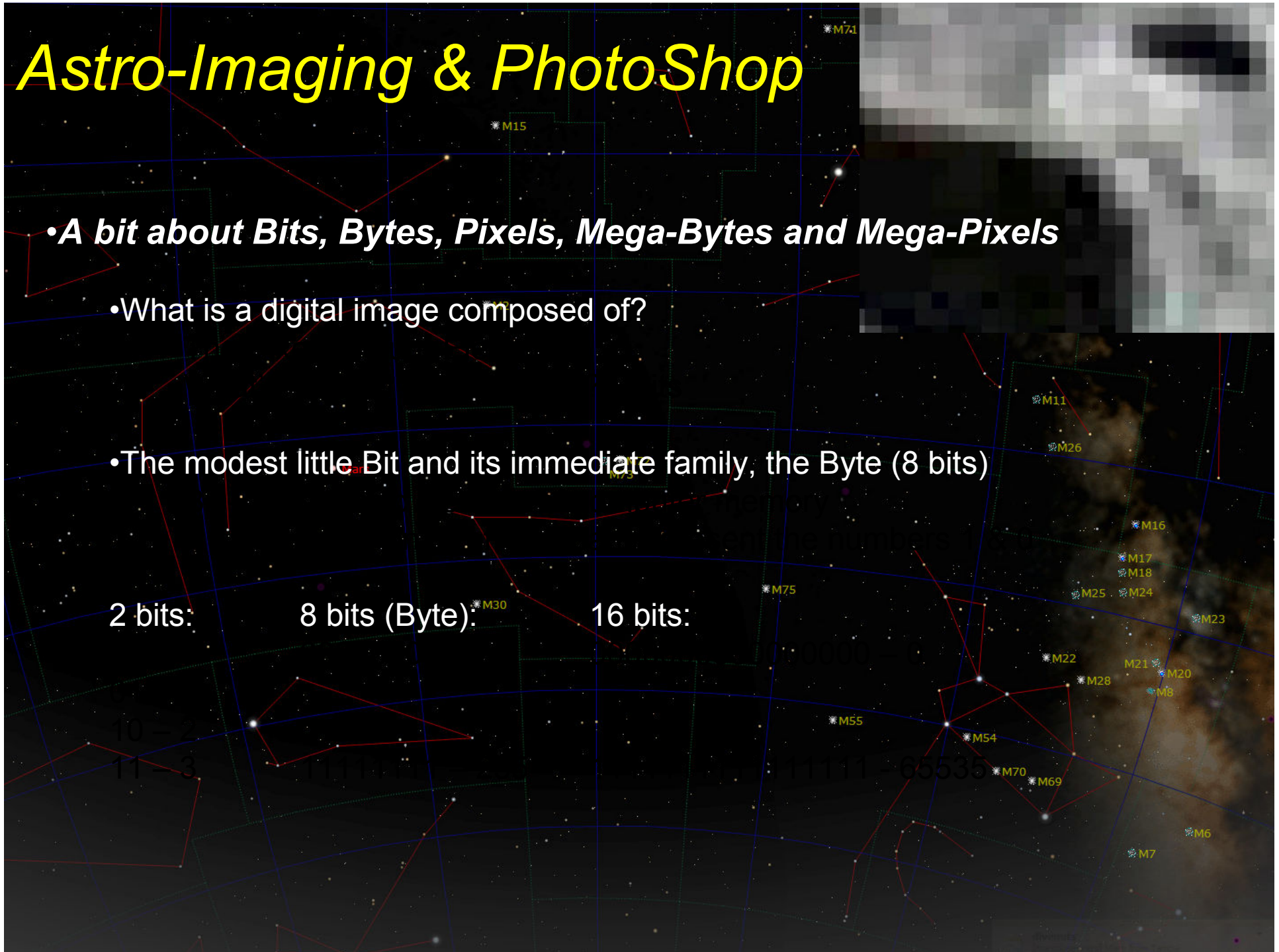
- What is a digital image composed of?

- The modest little Bit and its immediate family, the Byte (8 bits)

2 bits:

8 bits (Byte):

16 bits:



Astro-Imaging & PhotoShop

- **A bit about Bits, Bytes, Pixels, Mega-Bytes and Mega-Pixels**

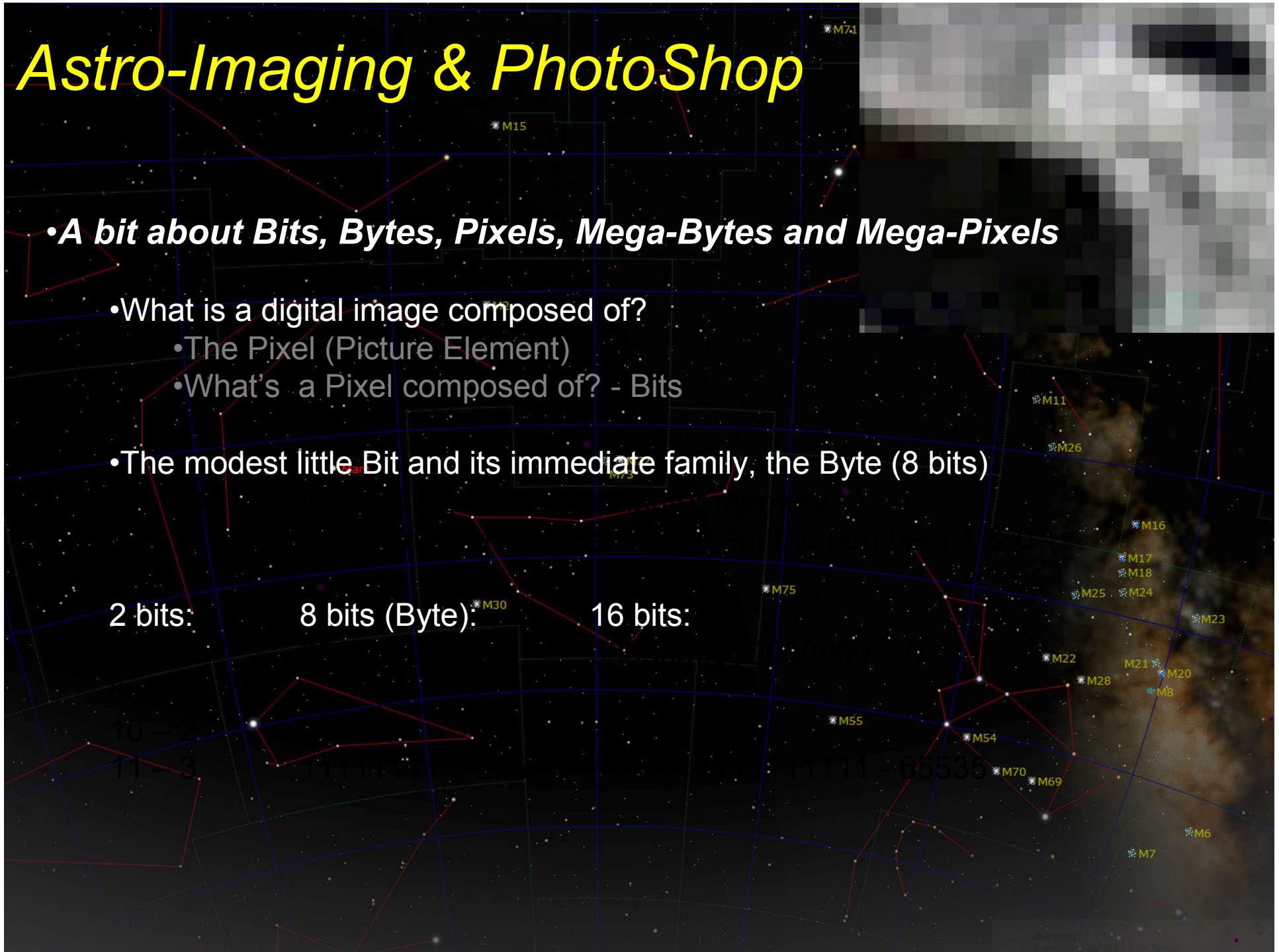
- What is a digital image composed of?
 - The Pixel (Picture Element)
 - What's a Pixel composed of? - Bits

- The modest little Bit and its immediate family, the Byte (8 bits)

2 bits:

8 bits (Byte):

16 bits:



Astro-Imaging & PhotoShop

•A bit about Bits, Bytes, Pixels, Mega-Bytes and Mega-Pixels

- What is a digital image composed of?
 - The Pixel (Picture Element)
 - What's a Pixel composed of? - Bits
- The modest little Bit and its immediate family, the Byte (8 bits)
 - Bit – most basic element of computer memory
 - It's either on or off and can represent the numbers 1 & 0

2 bits:

8 bits (Byte):

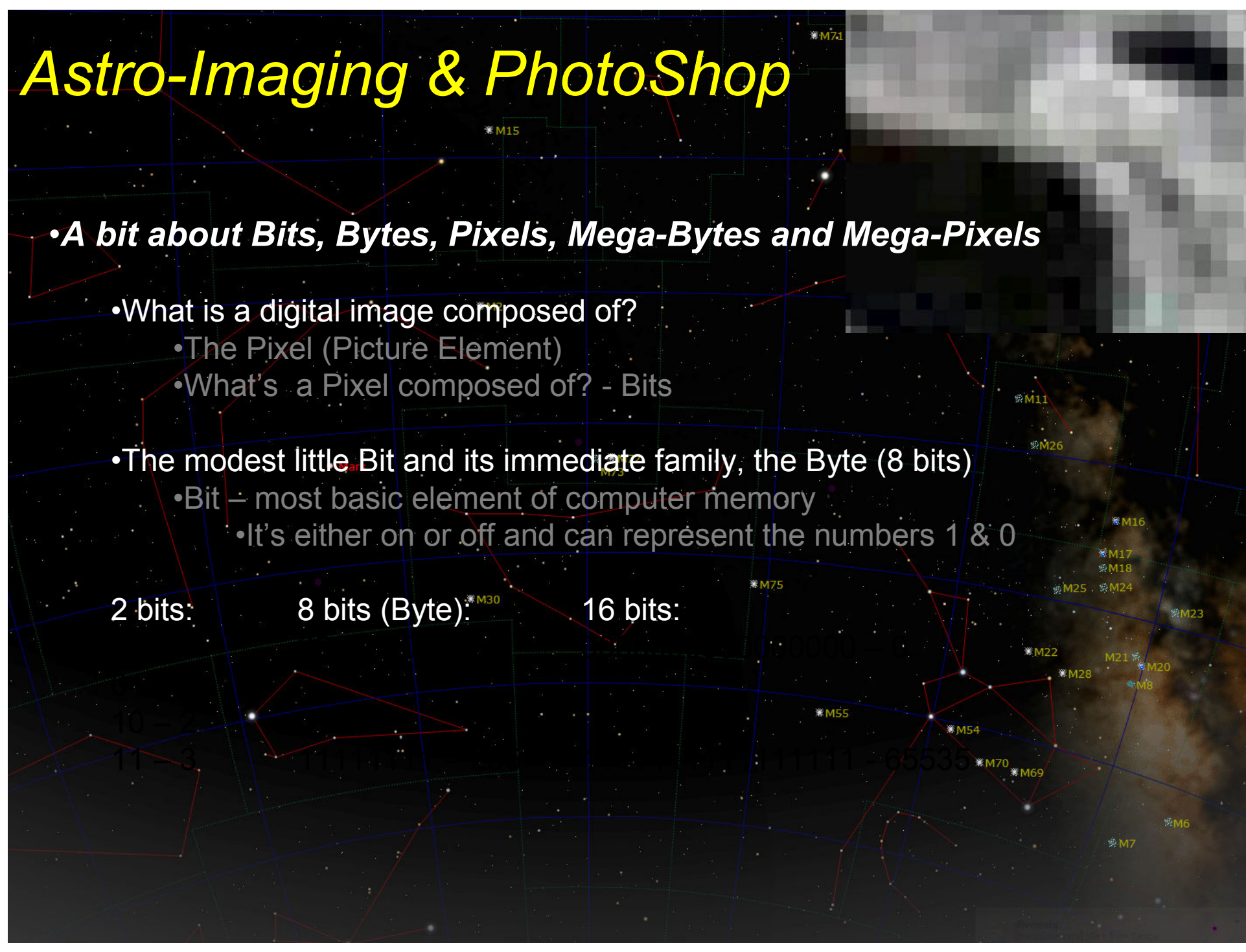
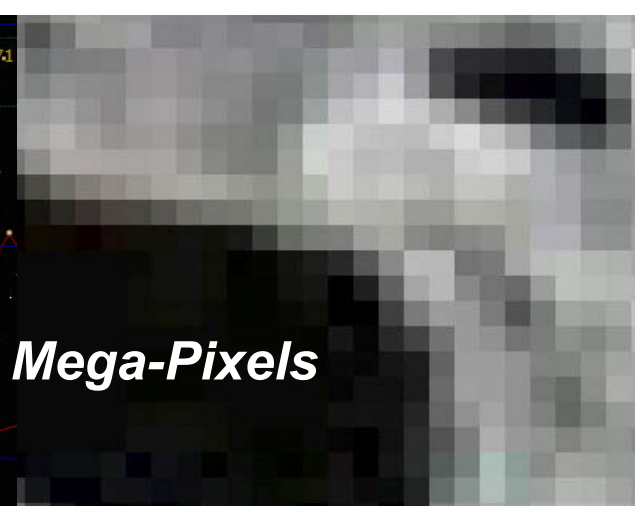
16 bits:

00 - 0
01 - 1
10 - 2
11 - 3

00000000 - 0
00000001 - 1
00000010 - 2
00000011 - 3
00000100 - 4
00000101 - 5
00000110 - 6
00000111 - 7
00001000 - 8
00001001 - 9
00001010 - 10
00001011 - 11
00001100 - 12
00001101 - 13
00001110 - 14
00001111 - 15
00010000 - 16
00010001 - 17
00010010 - 18
00010011 - 19
00010100 - 20
00010101 - 21
00010110 - 22
00010111 - 23
00011000 - 24
00011001 - 25
00011010 - 26
00011011 - 27
00011100 - 28
00011101 - 29
00011110 - 30
00011111 - 31
00100000 - 32
00100001 - 33
00100010 - 34
00100011 - 35
00100100 - 36
00100101 - 37
00100110 - 38
00100111 - 39
00101000 - 40
00101001 - 41
00101010 - 42
00101011 - 43
00101100 - 44
00101101 - 45
00101110 - 46
00101111 - 47
00110000 - 48
00110001 - 49
00110010 - 50
00110011 - 51
00110100 - 52
00110101 - 53
00110110 - 54
00110111 - 55
00111000 - 56
00111001 - 57
00111010 - 58
00111011 - 59
00111100 - 60
00111101 - 61
00111110 - 62
00111111 - 63
01000000 - 64
01000001 - 65
01000010 - 66
01000011 - 67
01000100 - 68
01000101 - 69
01000110 - 70
01000111 - 71
01001000 - 72
01001001 - 73
01001010 - 74
01001011 - 75
01001100 - 76
01001101 - 77
01001110 - 78
01001111 - 79
01010000 - 80
01010001 - 81
01010010 - 82
01010011 - 83
01010100 - 84
01010101 - 85
01010110 - 86
01010111 - 87
01011000 - 88
01011001 - 89
01011010 - 90
01011011 - 91
01011100 - 92
01011101 - 93
01011110 - 94
01011111 - 95
01100000 - 96
01100001 - 97
01100010 - 98
01100011 - 99
01100100 - 100
01100101 - 101
01100110 - 102
01100111 - 103
01101000 - 104
01101001 - 105
01101010 - 106
01101011 - 107
01101100 - 108
01101101 - 109
01101110 - 110
01101111 - 111
01110000 - 112
01110001 - 113
01110010 - 114
01110011 - 115
01110100 - 116
01110101 - 117
01110110 - 118
01110111 - 119
01111000 - 120
01111001 - 121
01111010 - 122
01111011 - 123
01111100 - 124
01111101 - 125
01111110 - 126
01111111 - 127
10000000 - 128
10000001 - 129
10000010 - 130
10000011 - 131
10000100 - 132
10000101 - 133
10000110 - 134
10000111 - 135
10001000 - 136
10001001 - 137
10001010 - 138
10001011 - 139
10001100 - 140
10001101 - 141
10001110 - 142
10001111 - 143
10010000 - 144
10010001 - 145
10010010 - 146
10010011 - 147
10010100 - 148
10010101 - 149
10010110 - 150
10010111 - 151
10011000 - 152
10011001 - 153
10011010 - 154
10011011 - 155
10011100 - 156
10011101 - 157
10011110 - 158
10011111 - 159
10100000 - 160
10100001 - 161
10100010 - 162
10100011 - 163
10100100 - 164
10100101 - 165
10100110 - 166
10100111 - 167
10101000 - 168
10101001 - 169
10101010 - 170
10101011 - 171
10101100 - 172
10101101 - 173
10101110 - 174
10101111 - 175
10110000 - 176
10110001 - 177
10110010 - 178
10110011 - 179
10110100 - 180
10110101 - 181
10110110 - 182
10110111 - 183
10111000 - 184
10111001 - 185
10111010 - 186
10111011 - 187
10111100 - 188
10111101 - 189
10111110 - 190
10111111 - 191
11000000 - 192
11000001 - 193
11000010 - 194
11000011 - 195
11000100 - 196
11000101 - 197
11000110 - 198
11000111 - 199
11001000 - 200
11001001 - 201
11001010 - 202
11001011 - 203
11001100 - 204
11001101 - 205
11001110 - 206
11001111 - 207
11010000 - 208
11010001 - 209
11010010 - 210
11010011 - 211
11010100 - 212
11010101 - 213
11010110 - 214
11010111 - 215
11011000 - 216
11011001 - 217
11011010 - 218
11011011 - 219
11011100 - 220
11011101 - 221
11011110 - 222
11011111 - 223
11100000 - 224
11100001 - 225
11100010 - 226
11100011 - 227
11100100 - 228
11100101 - 229
11100110 - 230
11100111 - 231
11101000 - 232
11101001 - 233
11101010 - 234
11101011 - 235
11101100 - 236
11101101 - 237
11101110 - 238
11101111 - 239
11110000 - 240
11110001 - 241
11110010 - 242
11110011 - 243
11110100 - 244
11110101 - 245
11110110 - 246
11110111 - 247
11111000 - 248
11111001 - 249
11111010 - 250
11111011 - 251
11111100 - 252
11111101 - 253
11111110 - 254
11111111 - 255

00000000 - 0

11111111 - 255



Astro-Imaging & PhotoShop

•A bit about Bits, Bytes, Pixels, Mega-Bytes and Mega-Pixels

- What is a digital image composed of?
 - The Pixel (Picture Element)
 - What's a Pixel composed of? - Bits
- The modest little Bit and its immediate family, the Byte (8 bits)
 - Bit – most basic element of computer memory
 - It's either on or off and can represent the numbers 1 & 0

2 bits:

00 – 0

01 – 1

10 – 2

11 – 3

8 bits (Byte):

00000000 – 0

00000001 – 1

00000010 – 2

00000011 – 3

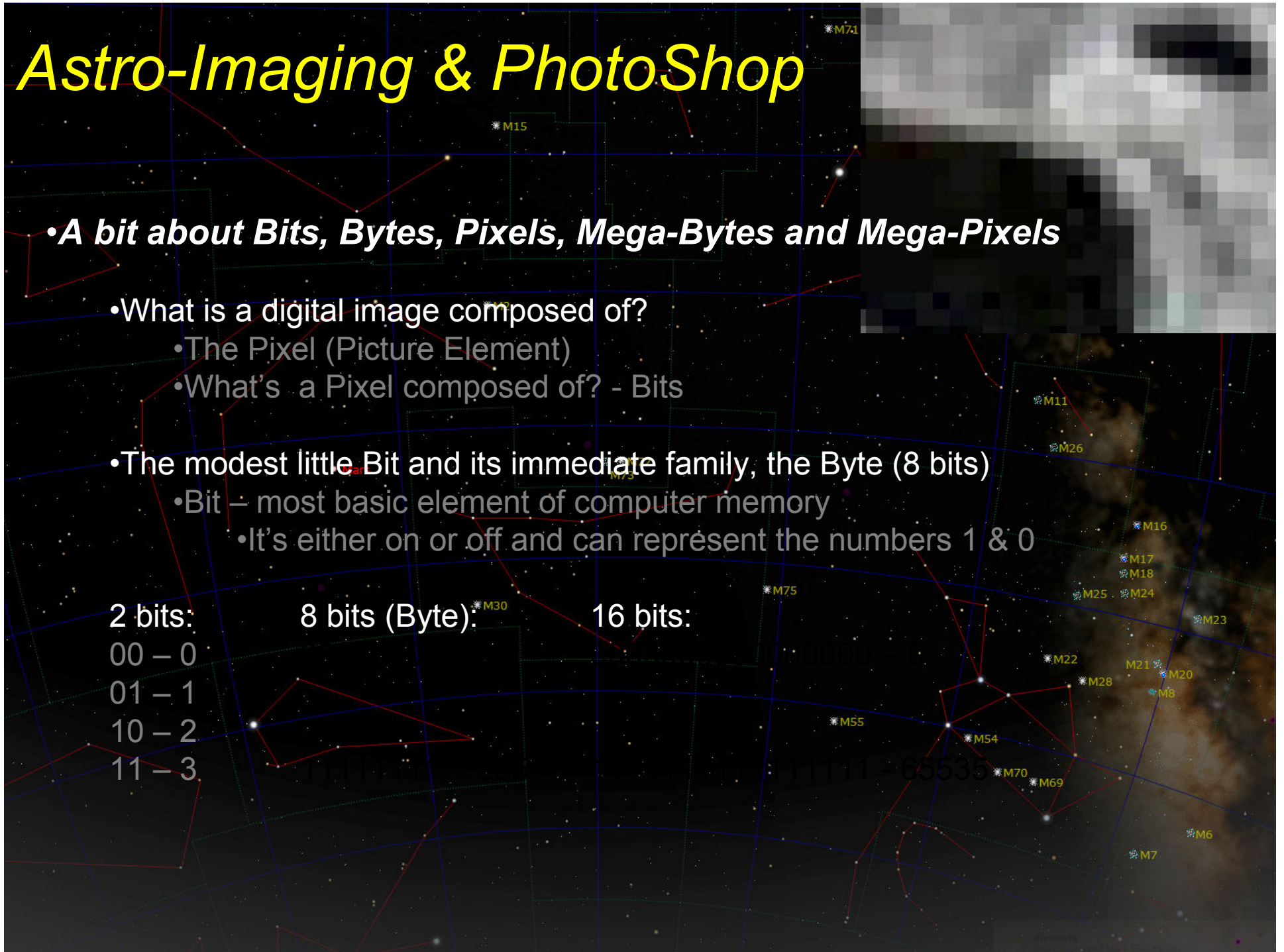
16 bits:

0000000000000000 – 0

0000000000000001 – 1

0000000000000010 – 2

0000000000000011 – 3



Astro-Imaging & PhotoShop

•A bit about Bits, Bytes, Pixels, Mega-Bytes and Mega-Pixels

- What is a digital image composed of?
 - The Pixel (Picture Element)
 - What's a Pixel composed of? - Bits
- The modest little Bit and its immediate family, the Byte (8 bits)
 - Bit – most basic element of computer memory
 - It's either on or off and can represent the numbers 1 & 0

2 bits:

00 – 0

01 – 1

10 – 2

11 – 3

8 bits (Byte):

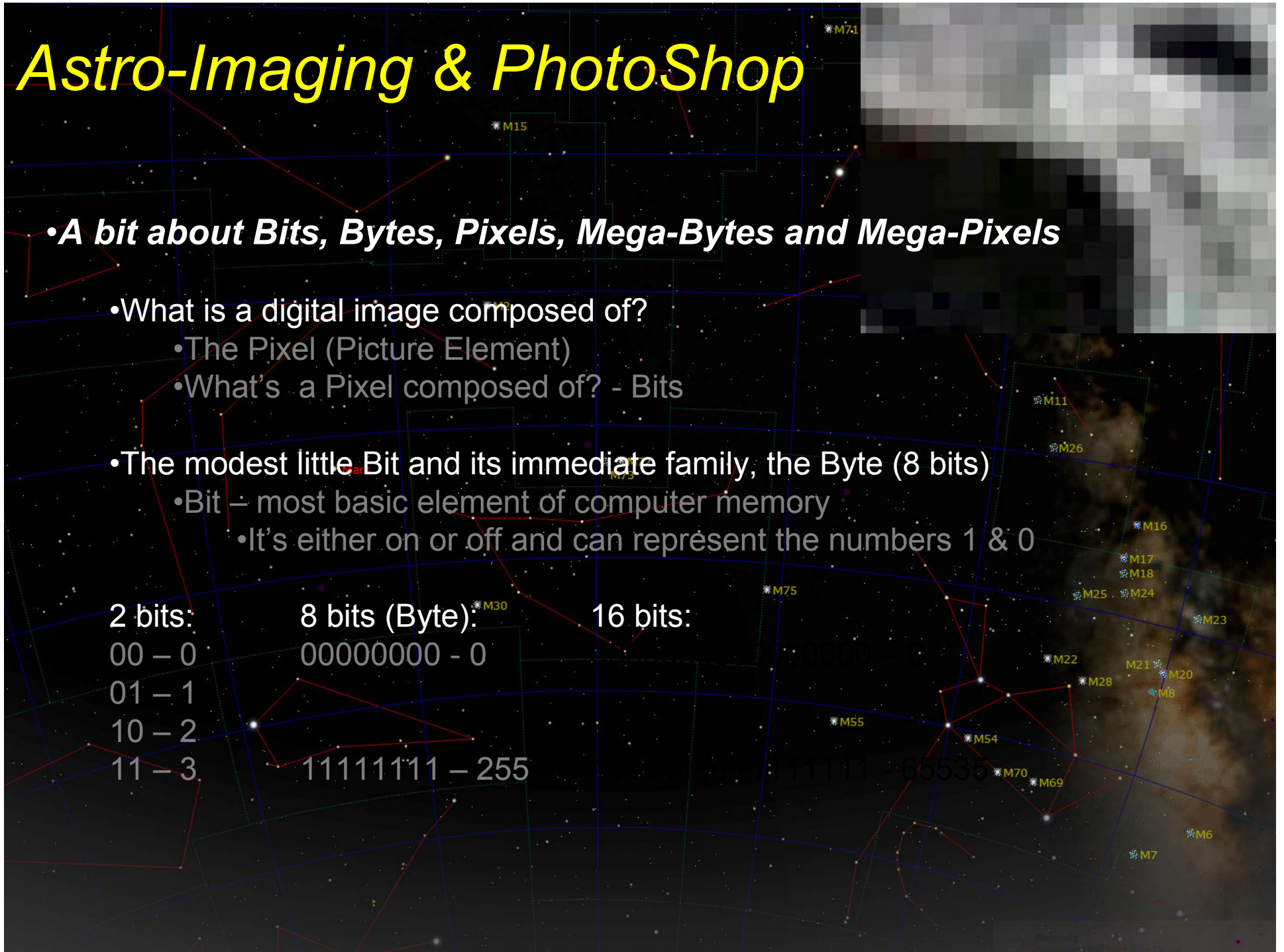
00000000 – 0

11111111 – 255

16 bits:

0000000000000000 – 0

1111111111111111 – 65535



Astro-Imaging & PhotoShop

•A bit about Bits, Bytes, Pixels, Mega-Bytes and Mega-Pixels

- What is a digital image composed of?
 - The Pixel (Picture Element)
 - What's a Pixel composed of? - Bits
- The modest little Bit and its immediate family, the Byte (8 bits)
 - Bit – most basic element of computer memory
 - It's either on or off and can represent the numbers 1 & 0

2 bits:

00 – 0

01 – 1

10 – 2

11 – 3

8 bits (Byte):

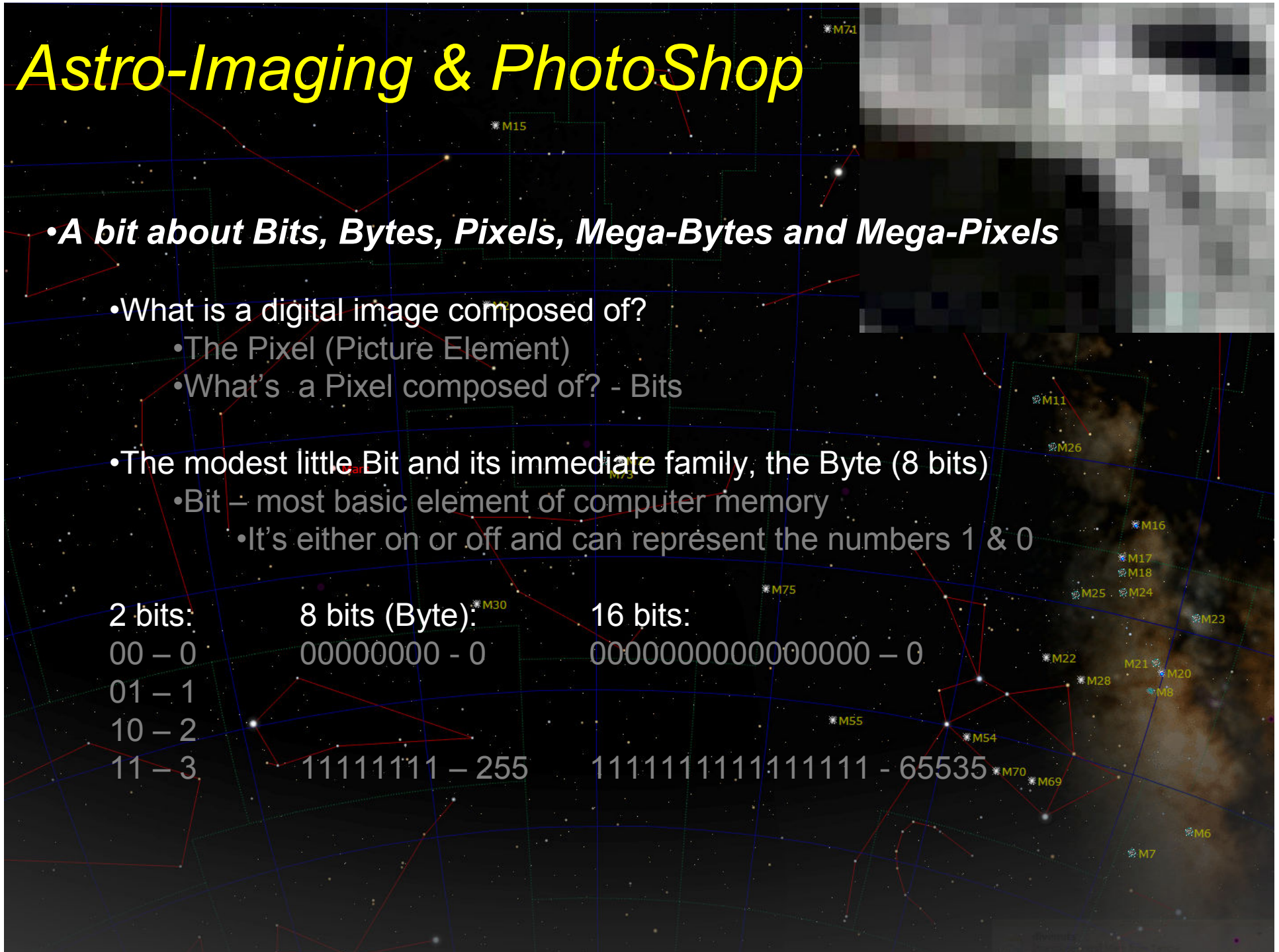
00000000 – 0

11111111 – 255

16 bits:

0000000000000000 – 0

1111111111111111 – 65535



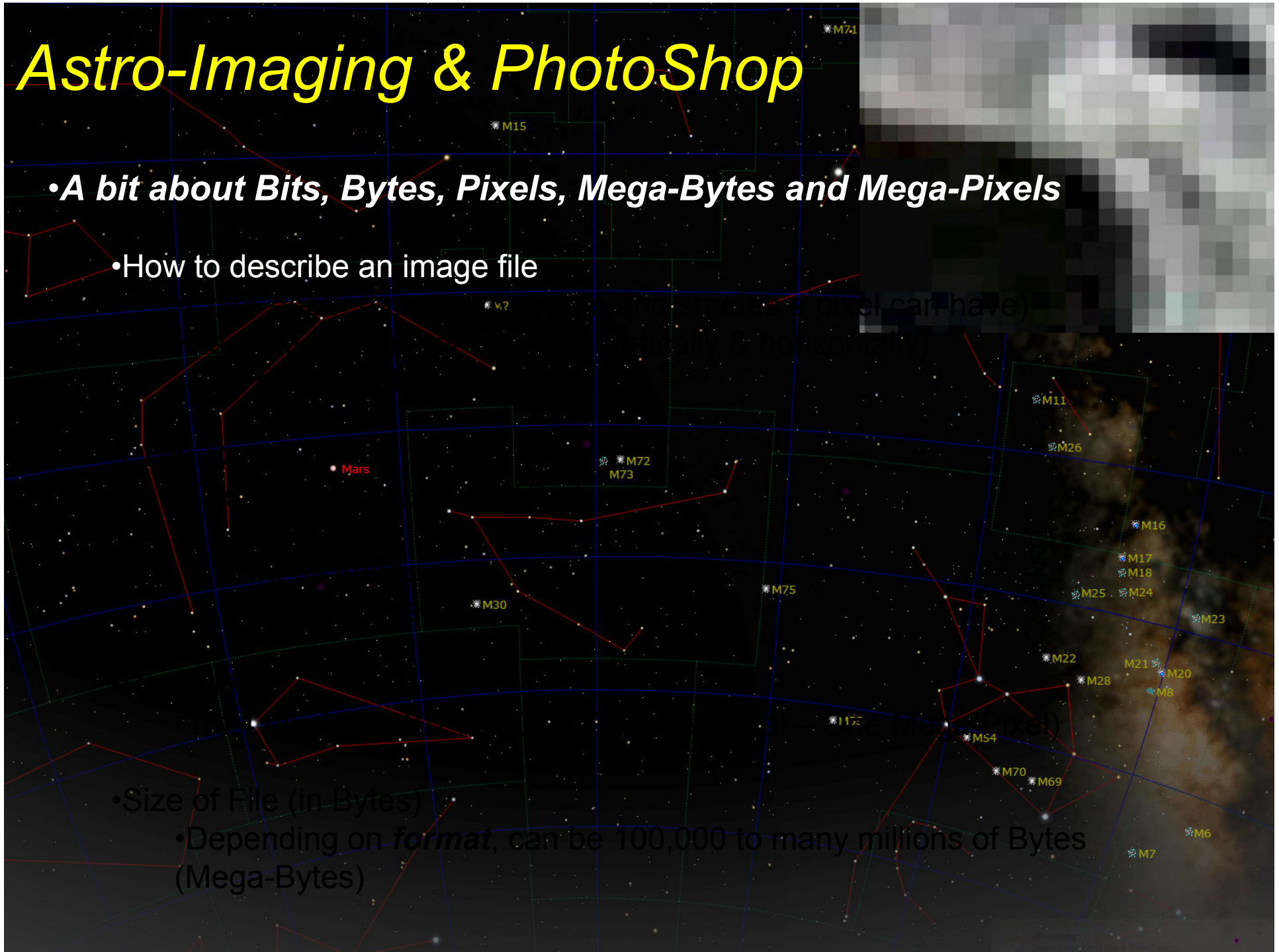
Astro-Imaging & PhotoShop

- A bit about *Bits, Bytes, Pixels, Mega-Bytes and Mega-Pixels*

- How to describe an image file

- Size of File (in Bytes)

- Depending on *format*, can be 100,000 to many millions of Bytes (Mega-Bytes)



Astro-Imaging & PhotoShop

- *A bit about Bits, Bytes, Pixels, Mega-Bytes and Mega-Pixels*

- How to describe an image file

- Color depth (how many colors and shades a pixel can have)
- Resolution (number of pixels vertically & horizontally)
- Size on disk (file size)

- Color Depth

- Resolution

- Size of File (in Bytes)

- Depending on *format*, can be 100,000 to many millions of Bytes (Mega-Bytes)

Astro-Imaging & PhotoShop

- **A bit about Bits, Bytes, Pixels, Mega-Bytes and Mega-Pixels**

- How to describe an image file

- Color depth (how many colors and shades a pixel can have)
- Resolution (number of pixels vertically & horizontally)
- Size on disk (file size)

- Color Depth

- The number of bits per Pixel

- 8 bit image
- 16 bit image
- 32 bit image

- Resolution

- Size of File (in Bytes)

- Depending on *format*, can be 100,000 to many millions of Bytes (Mega-Bytes)

Astro-Imaging & PhotoShop

- **A bit about Bits, Bytes, Pixels, Mega-Bytes and Mega-Pixels**

- How to describe an image file

- Color depth (how many colors and shades a pixel can have)
- Resolution (number of pixels vertically & horizontally)
- Size on disk (file size)

- Color Depth

- The number of bits per Pixel
 - 8 bit image
 - 16 bit image
 - 32 bit image

- Resolution

- 1024 pixels by 1024 (1,048,576 pixels total – One Mega-Pixel)

- Size of File (in Bytes)

- Depending on *format*, can be 100,000 to many millions of Bytes (Mega-Bytes)

Astro-Imaging & PhotoShop

- *A bit about Bits, Bytes, Pixels, Mega-Bytes and Mega-Pixels*

- How to describe an image file

- Color depth (how many colors and shades a pixel can have)
- Resolution (number of pixels vertically & horizontally)
- Size on disk (file size)

- Color Depth

- The number of bits per Pixel
 - 8 bit image
 - 16 bit image
 - 32 bit image

- Resolution

- 1024 pixels by 1024 (1,048,576 pixels total – One Mega-Pixel)

- Size of File (in Bytes)

- Depending on **format**, can be 100,000 to many millions of Bytes (Mega-Bytes)

Astro-Imaging & PhotoShop

•A bit about Bits, Bytes, Pixels, Mega-Bytes and Mega-Pixels

•Image file formats

- Jpeg – Joint Photographic Expert Group, 8 bit gray, 24 bit color
- Tiff – Tagged Image File Format; 8, 16, 32 gray, 64 bit color
- Bmp – Bit Map, 8 bit gray, 24 bit color
- Gif – Graphics Interchange Format, 8 bit gray, 24 bit color
- Png – Portable Network Graphics, 8, 16 gray, 48 bit color
- Fits – Flexible Image Transport System, 8, 16, 32, 64 bit gray + data

•FITS format used by NASA and professional astronomy community

- Format used with most serious CCD systems & software
- Requires a plug-in for use by PhotoShop
 - FITS Liberator – Free

Astro-Imaging & PhotoShop

• *Commonly used Features and Tools of PhotoShop*

• Basic image manipulation

- Image Size (Resampling) – What is Resampling?
- Rotate Canvas
- Crop
- Image Mode (8 bit, 16 bit, RGB Color, Grayscale, etc)

• Image Refinement

- Levels
- Curves
- Color Balance
- Brightness/Contrast
- Hue/Saturation
- Selective Color (modify specific colors only)



Astro-Imaging & PhotoShop

• *Commonly used Features and Tools of PhotoShop*

• Layers and Channels

- Layers used to place several images or text together
- Can move, rotate, resize, and refine Layers independently
- Layers can have different modes (Luminance, Difference, etc)
- Channels are layers for basic colors of image (RGB, CYMK)
- Channels appear as grayscale (black/white)
- Channels can be refined independently

• Selections and Masks

- Can select circular, rectangular, polygon or free form areas
- When selection is active, only that area is refined
- Selection area can be "Feathered"
- Selected areas can be copied, placed in same or other images

Astro-Imaging & PhotoShop

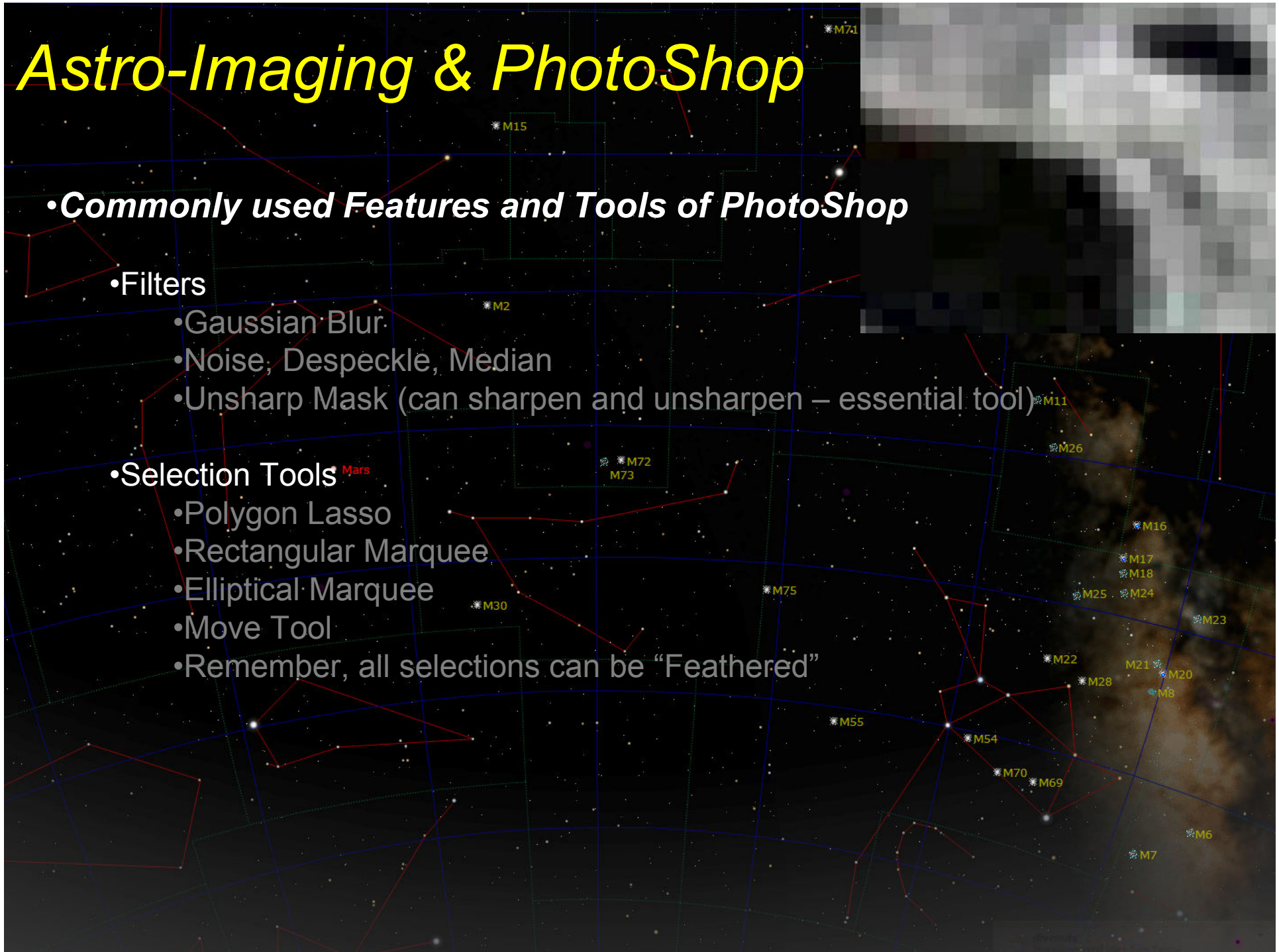
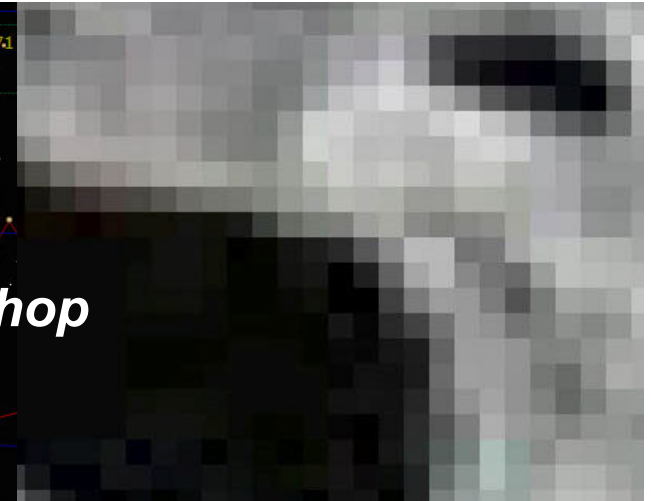
•Commonly used Features and Tools of PhotoShop

•Filters

- Gaussian Blur
- Noise, Despeckle, Median
- Unsharp Mask (can sharpen and unsharpen – essential tool)

•Selection Tools

- Polygon Lasso
- Rectangular Marquee
- Elliptical Marquee
- Move Tool
- Remember, all selections can be “Feathered”



Astro-Imaging & PhotoShop

• *Commonly used Features and Tools of PhotoShop*

• Text, Lines and Arrows

- Use the Horizontal Type Tool for Text
- Line Tool, allows control over color, width, arrows
- Selection tools allow rotation, resizing

• Windows for Information, Access to Channels/Layers

• Info Window

- Shows pixel coordinate
- Size of selection area
- Important to judge how much to “feather” a selection

• Channels window

- Allows selection and refinement of individual color channels

• Layers window

- Allows selections of layers and how they affect other layers
- Use this window to Luminance Layer astro-images

Astro-Imaging & PhotoShop

•PhotoShop Plug-ins

- FITS Liberator

- Used by NASA, Free
- Allows import of FITS, some extra tools

- Starizona (<http://starizona.com>)

- Zone Mask
- Levelizer

- PhotoShop Elements

- Paul Shipley tools (<http://member.melbpc.org.au/~pshipley/>)

Processing Examples

SUNSET ALERT: 8:34 PM

