Basics of the Magnification Ratio.

*The magnification ratio* is the ratio of the subject size on the sensor plane to the actual subject size.

Simply put – if the sensor of my camera is **23.6mm** across... and I take a photo that covers ~**2.3mm** horizontally on a ruler...

...in order to calculate the approximate magnification, that would be **23.6 divided by 2.3**

...which equals ~**10.26**

...therefore, I would have taken a roughly **10.26:1** magnification image. Example below:
Basic Things to Consider

• *Depth of field* – As a general rule, the higher the magnification you are working at - the shallower your depth of field will be. A smaller aperture will combat this – but narrower apertures will eventually lead to diffraction.

Habronattus sp. – Santa Rita Mtns. AZ
1) **Extension** – *Add distance between your sensor and lens.*

**Examples?** – Extension tubes/Bellows/Pringles Can.

**Pros:** CHEAP. Simple. Easy to find. Powerful. No glass = no loss of image quality. *Audience?*

**Cons:** Occasionally cumbersome. Loss of control with basic tubes. Annoying to swap on and off quickly or change magnification easily with tubes. Bellows are often HUGE. *Audience?*

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**Extension Tube Set (60mm Length)**
Usual Reverse-Lens Macro Setup

- DSLR Body
- Reversing Ring
- Extension Tubes
- 50mm Lens (Reversed)
Things to consider with extension:

• Simply extending the distance between your camera’s sensor and the focusing element is one of the simplest and most cost effective means of increasing your magnification. Not to mention it retains the most of the initial image quality of the lens being used.

• The greater the distance between lens and sensor - the greater the magnification, the closer the focusing distance, and consequently – the darker the image at the given aperture... often making focusing quite difficult.

Phidippus putnami (Female) Jumping Spider

Focus stack of 4 images taken at about 5:1 with the 28mm reversed on extension tubes at f/8
Minimizing Internal Reflections and Glare with Cheap Tubes.

The glossy finish within this cheap set was causing internal light reflections with my bright flash so close to the front element of the lens. I created a matte surface for the interior – drastically improving contrast.

Matte black EVA Foam Sheet
2) **Dedicated Lenses** – Lenses manufactured specifically for close-up photography.

**Examples**? – Canon MP-E 65mm 1-5x, Canon 100mm, etc...


**Cons**: Pricy. Expensive. Costly. You pay for the magnification. **Audience**?

1970’s **Vivitar** 55mm f/2.8 Macro for Pentax

1:1 for 45 bucks!
3) **Reversing** – Turn your lens around. Magnification!

**Examples**? – Rings that thread onto the filter thread of your lens – allowing you to mount it backwards.

**Pros:** CHEAP. Simple. Easy to find. Capable of great magnification in a small space. *Audience?*

**Cons:** Potentially dangerous to your lens. Loss of ALL lens control. Heavy lenses = no. Ugly. *Audience?*

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**Takumar Bayonet 28mm f/2.8**  
**SMC Pentax-M 50mm f/1.7**

*Macro Reversing Ring (Pentax K-Mount)*
Usual Reverse-Lens Macro Setup

- DSLR Body
- Reversing Ring
- Extension Tubes
- 50mm Lens (Reversed)
Pentax-M f/2 50mm lens (reversed) + 30mm Extension Tubes
2 shots stacked @ f/11 (Full Frame)
Takumar 28mm f/2.8 (reversed) + Extension Tubes
Single Shot @ f/11 (Full Frame)
<table>
<thead>
<tr>
<th>Lens:</th>
<th>Magnification: (Horizontal Frame Coverage in ~mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50mm</td>
<td>220 mm</td>
</tr>
<tr>
<td>50mm (reversed)</td>
<td>45 mm</td>
</tr>
<tr>
<td>28mm</td>
<td>174 mm</td>
</tr>
<tr>
<td>28mm (reversed)</td>
<td>12 mm</td>
</tr>
<tr>
<td>50mm w/60mm of ext</td>
<td>20 mm</td>
</tr>
<tr>
<td>50mm w/60mm of ext (reversed)</td>
<td>13 mm</td>
</tr>
<tr>
<td>28mm w/60mm of ext</td>
<td>Not Possible</td>
</tr>
<tr>
<td>28mm w/60mm of ext (reversed)</td>
<td>5.5 mm</td>
</tr>
<tr>
<td>50mm w/120mm of ext</td>
<td>10mm</td>
</tr>
<tr>
<td>50mm w/120mm of ext (reversed)</td>
<td>8mm</td>
</tr>
<tr>
<td>28mm w/120mm of ext (reversed)</td>
<td>4mm</td>
</tr>
<tr>
<td><strong>Telephoto:</strong></td>
<td></td>
</tr>
<tr>
<td>200mm</td>
<td>230mm</td>
</tr>
<tr>
<td>200mm w/60mm of ext</td>
<td>55mm</td>
</tr>
<tr>
<td>200mm w/120mm of ext</td>
<td>33mm</td>
</tr>
</tbody>
</table>
Additional methods...

- **Close-up filters** — An auxiliary lens applied in front of your existing lens. More Magnification!
  
  **Examples?** — Threads onto the filter thread of your lens – decreasing focusing distance.
  
  **Pros:** Don’t have to remove lens. Easy. With telephoto lenses – provides more mag than tubes. *Audience?*
  
  **Cons:** Minimal gain with low focal length lenses. More glass = bad. More expensive than tubes. *Audience?*

- **Stacking Lenses/Microscope Objectives/Misc** —
  
  **Examples?** — Reverse a lens to a tele/zoom. Mount a microscope objective to a tele/zoom. *Teleconverters!*
  
  **Pros:** Utilize equipment you may already have. Can be cheap. High magnifications. *Audience?*
  
  **Cons:** More glass = bad. Chromatic aberration. Heavy. Ugly. *Audience?*
Pentax Body

Reversed Lens on Extension Tubes

Flash with Homemade Diffuser

Flash Cable

Flash Bracket w/ Ball Head
SMC Pentax-M 50mm f/2.0 (reversed on extension tubes)
2 Shots Focus-Stacked @ f/11(cropped)
Pentax 50mm f/1.7
Single Shot @ f/1.7 (Cropped)
Pentax Takumar 50mm f/1.4 (reversed)

2 Shots Focus-Stacked @ f/16 (stitched panorama)
Pentax 50mm f/1.7 (reversed) + Extension Tubes
Single Shot @ f/16 (Full Frame)
Takumar 28mm f/2.8 (reversed)
2 Shots Focus-Stacked @ f/8 (cropped)
Takumar 28mm f/2.8 (reversed) + Extension Tubes
4 Shots Focus-Stacked @ f/8 (cropped)
ASANUMA 200mm f/3.5 + Extension Tubes
Single Shot @ f/5.6 (Cropped)
Pentax 28mm f/3.5 + JC PENNEY Fisheye Adapter
10x Nikon Microscope Objective
SEM Image of Salticid Facial Scales