

# Introductory Astronomy

Week 7: Galaxies

Clip 5: Bulge and Core

# Bulge and Core

- Hard to see **bulge** through gas and dust
- **Bar** structure verified only in past decade
- **Old** stars have high metallicity: enriched by early **SN** later diluted by fresh **infall**?
- **Ongoing** star formation
- Harder to see **core**
- **IR** shows dense central cluster including  $10^6 L_{\odot}$  **OB** stars
- **Wolf-Rayet** stars from **starburst**  $10^7$  y ago?
- Dense **molecular cloud** but no star formation?
- Supermassive black hole **quiescent**

# Credits

- Core Video: ESO/VVV Survey/D. Minniti/Nick Risinger (skysurvey.org) Music: Delmo -- Acoustic (disasterpeace.com)  
Acknowledgement: Ignacio Toledo, Martin Kornmesser  
<http://www.eso.org/public/videos/eso1242a/>

# Credits

- Multiwavelength Milky Way: NASA/GSFC [http://mwmw.gsfc.nasa.gov/mmw\\_product.html#slides](http://mwmw.gsfc.nasa.gov/mmw_product.html#slides)
- 21-cm Spectrum: J. Köppen, Strasbourg <http://astro.u-strasbg.fr/~koppen/Haystack/spectro.html>
- Milky Way Artist conception: NASA/JPL-Caltech/R. Hurt (SSC-Caltech)  
<http://www.spitzer.caltech.edu/images/1925-ssc2008-10b-A-Roadmap-to-the-Milky-Way-Annotated->
- M83 V: ESO <http://www.eso.org/public/images/eso0825a/>
- M83 IR: ESO/M. Gieles; Acknowledgement: Mischa Schirmer  
<http://www.eso.org/public/images/eso1020a/>
- MW Core Video: ESO/VVV Survey/D. Minniti/Nick Risinger (skysurvey.org); Music: Delmo -- Acoustic (disasterpeace.com); Acknowledgement: Ignacio Toledo, Martin Kornmesser  
<http://www.eso.org/public/videos/eso1242a/>
- MW Satellites: R. Powell <http://www.atlasoftheuniverse.com/sattelit.html>
- Magellanic Clouds: Courtesy Australian Astronomical Observatory, photograph by David Malin <http://www.aao.gov.au/images/captions/misc021.html>
- Leo I Dwarf: Courtesy Australian Astronomical Observatory, photograph by David Malin  
<http://www.aao.gov.au/images/captions/aat051.html>