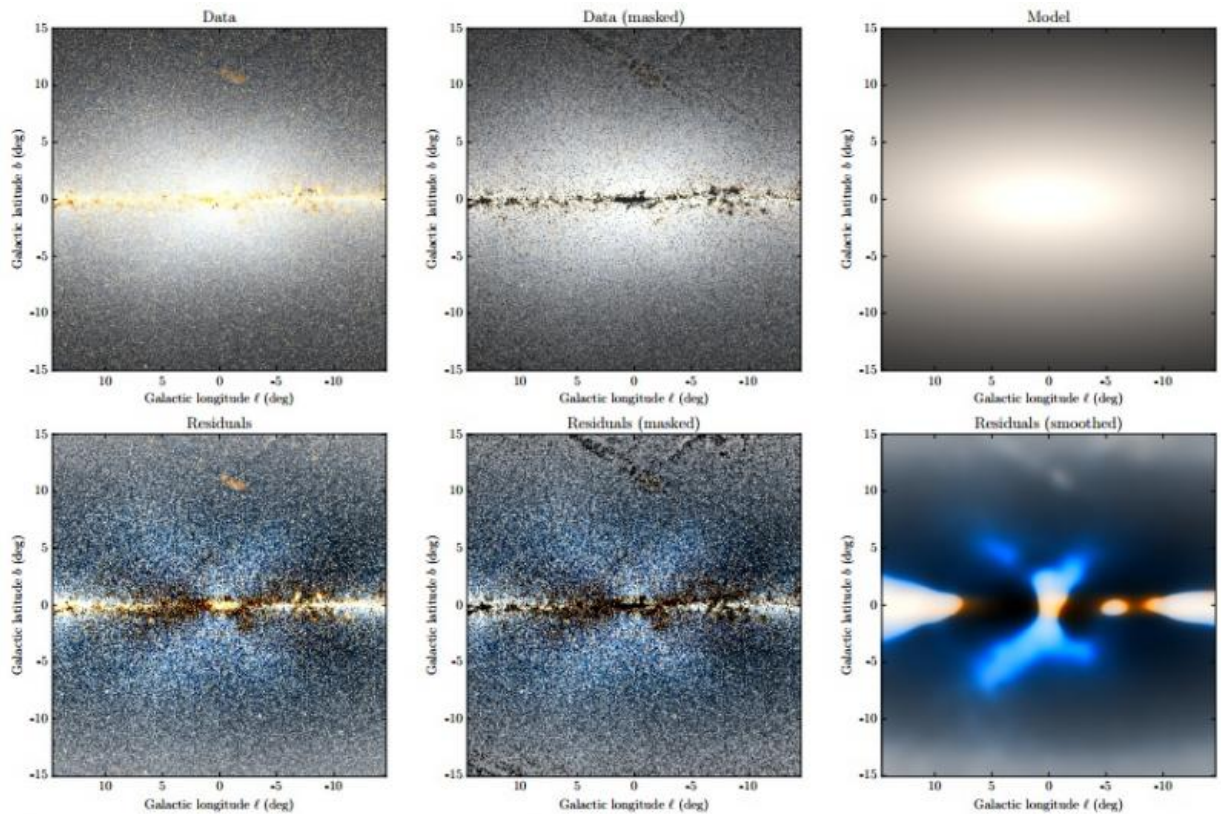


# WISE reveals the X-shaped bulge of our galaxy

March 3 2016, by Tomasz Nowakowski



The WISE W1 and W2 image fit by a simple exponential disk model, making the X structure more apparent. Top-left: Data. Top-middle: Data, masking out the top and bottom 5 percent of pixels based on W1 – W2 color, as well as pixels with negative flux. The diagonal structure at the top of the image is due to scattered light from the Moon in the unWISE coadds. Top-right: Exponential disk model fit. Bottom-left: Residuals (data minus model). Bottom-middle: Masked residuals. Bottom-right: 50-pixel median filter of masked residuals (median of unmasked pixels). Credit: Melissa Ness/Dustin Lang, 2016.



Using a set of coadded images taken by NASA's Wide-field Infrared Survey Explorer (WISE), astronomers from the Max Planck Institute for Astronomy in Germany and the University of Toronto in Canada, have provided new insights on the morphology and structure of the bulge of our home galaxy, the Milky Way. They revealed the X-shaped nature of the bulge, which could have important implications for the understanding of the formation history of our galaxy. The findings are presented in a [research paper](#) published online on Feb. 29 on the arXiv server.

WISE is an infrared-wavelength astronomical space telescope launched in December 2009 that completed a full sky photometric survey using four bands in the mid-infrared at 3.4, 4.6, 12 and 22  $\mu\text{m}$  wavelength range bands over 10 months. It scanned the entire sky twice, snapping pictures of nearly billion objects, including remote galaxies, stars and asteroids. Data from WISE has been released to the public and include processed, contrast-enhanced pictures grouped in a catalog called "unWISE." This set offers coadded images using enhancement technology that does not degrade the resolution of the photo.

Melissa Ness and Dustin Lang, the paper's co-authors, claim that the Milky Way [bulge](#) is irrefutably morphologically X-shaped. According to the paper, this peculiar shape was revealed by the 'split in the red clump' from star counts along the line of sight toward the bulge. When the scientists studied contrast enhanced, zoomed-in versions of the images provided by WISE, they spotted the X-shaped light profile of the bulge and its extent across the photo.

"No additional unsharp masking or equivalent techniques have been used to enhance these data. The bulge in the central region shows a clear X-shaped morphology," the researchers wrote in the paper.



By looking at the images from the "unWISE" catalog, they found that the arms of the X-shaped feature are asymmetrical around the minor axis and appear larger at left than at right. The bulge is oriented at about 27 degrees with respect to the line of sight, with the nearest side at positive longitudes.

Previous studies have questioned the X-shaped nature of this feature, arguing that the 'split in the red clump' may be due to different stellar populations, in an old classical spheroidal bulge. Now, the new findings confirm this peculiar shape, similar to that seen in the unsharp masked images of other barred spiral galaxies.

The spatial mapping presented in the research could provide a useful guide for current and future spectroscopic surveys such as APOGEE (APO Galactic Evolution Experiment), slated to map over 100,000 red giant stars across the full range of the Milky Way's galactic bulge, bar, disk, and halo. It could be also helpful for bulge programs associated with the GALactic Archaeology with HERMES (GALAH) survey, an ambitious project to observe a million stars in our galaxy.

"These data can be used to guide stellar target selection, where examining the spectroscopic ages and metallicities of stars in the arms of the X-shape will be necessary to understand the formation of the bulge and constrain the formation processes relevant in the Milky Way," the astronomers concluded.

**More information:** [arxiv.org/pdf/1603.00026.pdf](https://arxiv.org/pdf/1603.00026.pdf)

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