

Galactic and Extragalactic Astronomy: an Introduction

William H. Waller Ph.D.

May 29, 2013 · *Galactic and Extragalactic Astronomy*

William H. Waller Ph.D.

Waller WH. Galactic and Extragalactic Astronomy: an Introduction: William H. Waller Ph.D.. The Galactic Inquirer. 2013 May 29 [last modified: 2015 Jul 31]. Edition 1.

Abstract

Amateur telescopes can reveal thousands of other galaxies in those sections of the sky that are sufficiently far from the Milky Way's congested disk. The digital images of elliptical, spiral, irregular, and interacting galaxies that these "citizen scientists" can now obtain surpass the best images obtained professionally just 25 years ago.

Introduction:

If you look skyward on a clear moonless night, you can immediately see that you and all of your fellow Earthlings live in a galaxian universe. Indeed, almost all of the celestial objects that you can see with your unaided eye reside within the Milky Way – our galactic home. From pin-point stars of multiple hues to hazy nebulae and silhouetting dust clouds, the myriad denizens of our Galaxy collectively trace a vast self-gravitating system that whirls about the supermassive black hole in its center while percolating in continual self-transformation.



Photomosaic of the entire sky at optical wavelengths showing the stellar and nebular disk of the Milky Way Galaxy across the middle, the Large and Small Magellanic Clouds to the lower right, and the Andromeda Galaxy which appears as a small lens-like object to the lower left. Image courtesy of Axel Mellinger (see http://home.arcor-online.de/axel.mellinger/mwpan_aitoff.html).

Just beyond the Milky Way, the Large and Small Magellanic Clouds can be readily spotted from the Earth's southern hemisphere. These companions (or victims) of the much larger Milky Way are but the biggest and brightest of the 15-odd galaxies that are currently known to be buzzing around us. Residents of Earth's northern hemisphere who can get away from sources of light pollution can enjoy naked-eye and binocular views of the more distant Andromeda Galaxy. Similar in girth to the ponderous Milky Way, the "Great Nebula in Andromeda" rules over its own bevy of dwarf satellites some 2.5 million light-years away from our home system.



Messier 81, also known as Bode's galaxy, is a nearly face-on classic spiral, located in the constellation Ursa Major. It is the largest of the eponymous group of 34 galaxies, with a diameter of 92,000 light years. At a distance of 12 million light years, M81 is one of the closest galaxies outside of the local group. The galaxy has a 70 million solar mass supermassive black hole at its center. Image courtesy of Mario Motta.



NGC4565, also known as the needle galaxy, is an edge-on galaxy in the constellation Coma Berenices. The galaxy has a clearly visible central bulge and dust lane, and is a favorite of amateur astronomers. NGC4565 lies about 40 million light years away, and spans some 100,000 light years across. Image courtesy of Mario Motta.



Messier 51, known as the Whirlpool galaxy for its obvious, clear spiral arms, is located about 23 million light years away, in the constellation Canes Venatici. It spans a distance of about 43,000 light years. M51 consists of a pair of interacting galaxies, with its companion NGC 5195. Image courtesy of Mario Motta

Amateur telescopes can reveal thousands of other galaxies in those sections of the sky that are sufficiently far from the Milky Way's congested disk. The digital images of elliptical, spiral, irregular, and interacting galaxies that these "citizen scientists" can now obtain surpass the best images obtained professionally just 25 years ago. Beginning in 1995, the Hubble Space Telescope was trained on seemingly empty patches of the sky for exceptionally long exposures lasting 10 or more hours each. The resulting Hubble Deep Fields in the northern and southern hemispheres and the more recent Hubble Ultra Deep Fields have shown galaxies upon galaxies to the edge of detectability.



Zoomed portions of the Hubble Ultra Deep Field showing galaxies of all kinds. The most distant galaxies appear very small, irregular, and red – their light waves having been stretched to red wavelengths by the expansion of the intervening universe. Image courtesy of Steven Beckwith (Space Telescope Science Institute), the Hubble Ultra-Deep Field Team, NASA and the European Space Agency (<http://hubblesite.org/newscenter/archive/releases/2004/07/image/c/>).

In these images, we can behold galaxies so distant that we see them as they were more than 10 billion years ago – shortly after they had formed from the chaos of the Hot Big Bang. Looking locally, we can see that our home galaxy has evolved to the point where sentient life has overrun the moist surface of one rocky planet that is in orbit around one particular but unremarkable star. We are left wondering how all this played out. Indeed, understanding the structure, content, and natural histories of these diverse realms has challenged our best astronomical minds while motivating the development of ever more powerful telescopes and sensitive instrumentation. In many ways, our galaxian adventures have just begun.

CALL FOR CONTRIBUTIONS:

One of the key missions of The Galactic Inquirer is to support publicly-accessible communications in galactic and extragalactic astronomy. We welcome non-technical articles, commentaries, profiles, and photo-essays that are well-crafted and engaging.

Submissions should be in Word 97-2003 (.doc) or later formats (.docx), and should contain from 500 to 2000 words. The latter requirement is to ensure that The Galactic Inquirer is much more than an aggregator of word “bites.” All photos and figures should include captions, credits, and associated permissions. Any references at the end of a contribution should help the general-interest reader make greater sense of the subject at hand. Articles in Scientific American and American Scientist can provide a helpful template for formatting your submission.

You can contact us using our Contact form, available in the main menu. All submissions should include the names and e-mail addresses of all authors along with a picture of the author(s). The author(s) should state their status as a student or professional as part of a 1-3 sentence biography.

All contributions will be vetted for appropriate content and edited for clarity. All contributions that are published in The Galactic Inquirer are the property of the author(s) and The Galactic Inquirer. Therefore, subsequent use of published contributions must follow “fair use” guidelines, including written permission from the author(s) and explicit attribution to the author(s) and The Galactic Inquirer.