



Do you know where this picture was taken? Answer next issue...

### Upcoming in the PULSAR:

**4<sup>th</sup> Quarter: High Energy Environments.** There are places in this universe where energy rules - rippling, crackling, sparkling energy. High energy environments can also make some of the most aesthetically pleasing pictures....

**1<sup>st</sup> Quarter 2007: Nebula.** Whether it blows up or squishes down, a star always ends in some way that makes for good art.

**2<sup>nd</sup> Quarter 2007: Multi-star systems.** Many star systems in the universe have multiple stars in them. In fact, there are more multi-star systems than there are single sun systems. What does yours look like?

Pulsar is published four times a year as part of the membership benefits from dues paid. All contents are copyright of the IAAA except where noted. Individual artists retain copyright to works contributed to this publication. Submissions may be sent to "pulsar-editor@iaaa.org"



INTERNATIONAL ASSOCIATION OF ASTRONOMICAL ARTISTS

#### BOARD OF TRUSTEES

Kara Szathmáry, Chair  
Dan Durda  
Gary Harwood  
B.E. Johnson  
Jon Ramer  
Roy Scarfo  
Dirk Terrell

#### PRESIDENT

Kara Szathmáry,

#### VICE PRESIDENT

Dirk Terrell

#### VICE PRESIDENT, EUROPE

David A. Hardy

#### TREASURER

Beth Avary

#### MEMBERSHIP SECRETARY

Joy Day

#### IT DIRECTOR

BE Johnson

#### PULSAR PRODUCED BY

Jon Ramer, Joy Day, BE Johnson

#### DIRECTOR OF EXHIBITIONS

Joy Day

#### DIRECTOR OF FELLOWS

David A. Hardy

#### IAAA POINTS OF CONTACT

##### MEMBERSHIPS:

Joy Day  
PO Box 3939  
Carmel-by-the-Sea, CA 93921, USA  
Tel: (1) 831-659-4950  
e-mail: membership@iaaa.org  
Annual rates by member type: \$40, \$45, or \$50.  
Make all payments to "IAAA"

##### VICE PRESIDENT, EUROPE and UK SUBSCRIPTIONS:

David A. Hardy  
99 Southam Road, Hall Green  
Birmingham, W. Midlands  
B28 0AB, England  
Tel: (44) 121 777 1802  
Fax: (44) 121 777 2792  
e-mail: vp-europe@iaaa.org  
Annual rates by member type: 26, 28, or 30 GB  
pounds. Make all payments out to "IAAA"

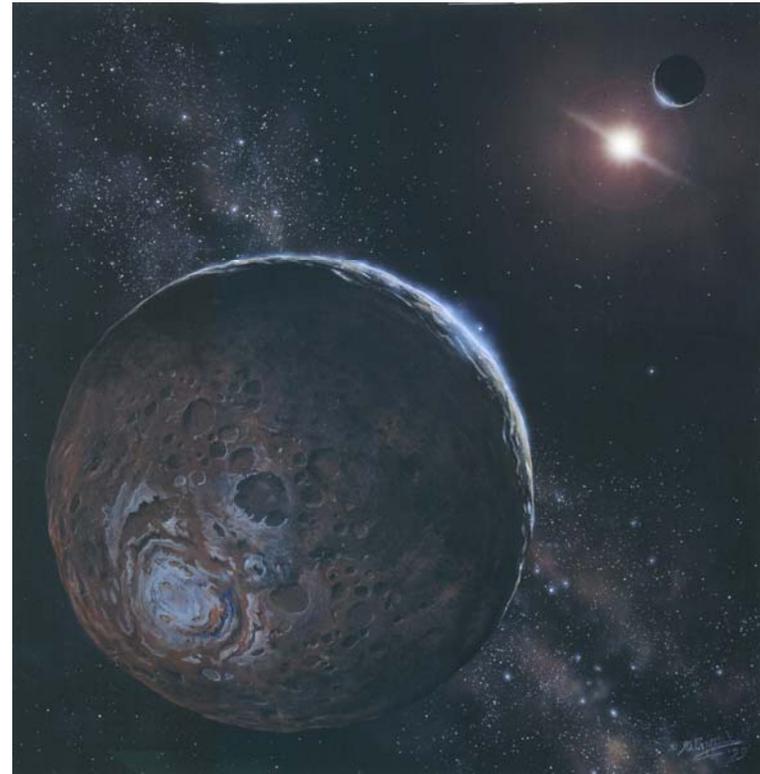


3<sup>rd</sup> Quarter 2006

The Official Newsletter of the



International Association of  
**Astronomical  
Artists**



*"Kuiper Belt Object" by Mike Carroll*

Editor: Jon Ramer

IAAA Website: <http://www.iaaa.org>

## From the Editor:

Hi Gang!

The workshop in Nicaragua is in full prep swing, so if you haven't yet, sign up right away! Got some other tidbits from around the web and the world, plus a great article about the Kuiper Belt from Mike Carroll - and heaping helping of member art. Enjoy....

Jon!

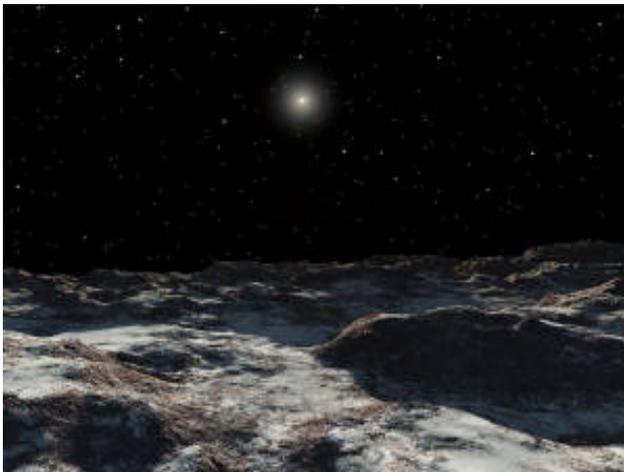
### IN THIS ISSUE:

- MYSTERIES OF THE KUIPER BELT
- WORKSHOP NICARAGUA
- WHERE IN THE WORLD?
- CRITIQUE PAGE SUBMISSIONS
- PROFILE: PATTY INGRAM
- ASTRO FEATURE: NACREOUS CLOUDS

### *“10<sup>th</sup> Planet”*

By Ron Miller

Could there be another planet somewhere out in the Kuiper Belt?



## MYSTERIES OF THE KUIPER BELT

By Michael Carroll *(First appeared in Astronomy Now magazine)*

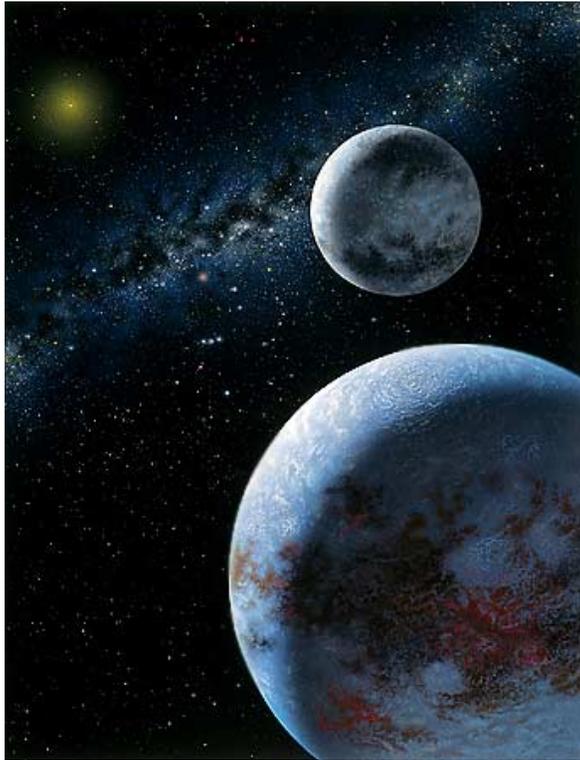
If you want a record of the early solar system, complete with information about how planets grew, how many there were, where and how they moved, Hal Levison knows just the place to look. “The Kuiper Belt is the place to be. It has a complex structure and a lot of varied objects.” To Levison, the Kuiper Belt is the fossil of our planetary formation process. It is likely that objects in the belt are a sampling of material preserved from the formative years of our solar system, reaching back to its accretional epoch. Additionally, the Kuiper Belt serves as a sort of cold storage parking lot for short period comets, adding to the wealth of potential information it may offer. “Remnants of all these questions about the early solar system are encrypted in the Kuiper Belt.”

Levison has been studying the Kuiper Belt, a torus of icy bodies extending beyond the orbit of Neptune, since the discovery of its first member over a decade ago. Levison's computer models have uncovered the dynamics of orbiting bodies in the outer solar system, lending insights into the Kuiper Belt's origins and behavior.

Evidence of a vast ring of ice bodies began to surface in the early 1990s. In 1992, observers led by discovered a distant object circling the sun beyond the orbit of Neptune. It was later designated 1992 QB1. Other discoveries followed that of 1992 QB1 in rapid succession, nearly two dozen in the next two years. Astronomers came to realize that these objects represented a vast torus or belt of icy objects, some the size of substantial moons. Today, there are over 1000 known Kuiper Belt objects (KBOs). It is projected that there are approximately 40,000 objects larger than 100 km across, stretching from the orbit of Neptune, at 30 AU, to about 48 AU.

KBOs orbit fairly near the ecliptic, forming a band much like the asteroid belt. The Kuiper Belt may contain 100 times the mass of the asteroid belt. But therein lies the problem, Levison explains. “One of the great mysteries today is, where did all the mass go? The objects we see [in the Kuiper Belt] are relatively

big. In order to grow to the sizes we see, you need lots of mass, probably ten Earth masses to begin with.” Instead, researchers calculate that the entire Kuiper Belt holds a mass of 0.1 Earth masses. To make matters worse, computer models indicate that the orbits of Kuiper Belt objects should be fairly near the ecliptic with low eccentricities and low inclinations. In this way, objects encounter each other at relatively low velocities, enabling them to accrete into the larger ones seen today. The image described by the models is one of a cold, quiet body of objects floating in leisurely orbits at the outskirts of the planetary system. But again, the models do not fit the observations, says Levison. “We see large inclinations and eccentricities. How did it get from a cold population to this train wreck that we see?”



***“Pluto and Charon”***  
by Lynette Cook

Comet expert Dave Jewitt of Hawaii’s Institute for Astronomy, who was co-discoverer of the first KBO, is intrigued by not only the discrepancy in mass, but by the extent of the belt. The key to understanding our solar system’s past may lie in the structure and extent of the belt itself. “The semi-major axes of KBOs go out to about 48 astronomical units (AUs). There is not a defined edge to the Kuiper Belt, but there is a limit. Why that is provides yet another mystery.”

The outer limit of the belt is not simply an observational bias; it is a real physical feature. Lynn Allen of the University of British Columbia explains that there is not a clear edge to the belt, but rather a drop-off. The Kuiper Belt dwindles out rapidly, beginning at about 55 AU. In Allen’s study, “We actually did not detect *any* KBOs beyond 52 AU, so this is consistent with a drop-off or ‘edge’ at 48 AU, and this is the point most people remember.”

The more distant objects beyond the Kuiper Belt are of a different dynamical class than the primordial type KBOs Allen is studying, as they are believed to have had gravitational interaction with Neptune or other objects, which scattered them into present orbits from a much different origin. Says Allen, “KBOs are on much more circular orbits and are thought to have been formed at their current distance from the Sun,” unlike the more distant objects.

Several theories have been put forward to understand this outer limit. Some researchers propose that most of the outer Kuiper Belt has been pulverized. The “missing mass” could be eroded within 50 AU due to gravitational disturbances and resonances from the giant planets. These perturbations would not only kick objects out of the Solar System, but would also increase their collisional speeds so that they grind themselves to dust. The problem with this scenario is that observational data is lacking. A second theory posits that Neptune set up early resonances with the outer fringes of the belt, tossing distant objects out of the solar system and constraining the orbits of inner ones.

Still another intriguing possibility is that the Sun encountered a passing star, whose gravity ripped off the outer edge of our protoplanetary disk. Ida and Makino first proposed this idea in a 1992 paper. Says Jewitt, “At first, it went over like a lead balloon. At the time, people didn’t believe there was an edge to the Kuiper Belt. Now we know.”

If the Sun had been a member of a dense star cluster early in life, the proposed near encounter could have taken place, with an interloper star passing within 150 AU of the Sun. Two lines of evidence support the idea of the Sun developing within a crowded starry neighborhood. The first is the edge of the

Kuiper belt. The second has to do with the element Aluminum 26, an isotope that decays within a few million years. It can only be created by supernova or other energetic star. What gives Jewitt and other researchers pause is that Aluminum 26 has been found in meteorites. "It's possible that a nearby supernova blew the stuff into the solar system," Jewitt says.

Hal Levison adds, "The Kuiper Belt could have started with lots of mass and then had it stripped away. That would explain some of what we see." But not all. Jewitt asks, "Even if the Kuiper Belt was disturbed by a close encounter with a star, how would you remove ninety-nine percent of its mass and still leave these large objects?"

Still, Levison and others think they may have it figured out. Levison headed a team that published results in the May 26 2006 journal *Nature*. According to the team's computer studies, the outer giant planets did not form in their current locations. Jupiter and Saturn consist mainly of the gases from the early solar nebula (hydrogen and helium), while Uranus and Neptune contain materials similar to comets, with comparatively small amounts of nebular gases mixed in. Jupiter, Saturn, Uranus and Neptune began as ice cores, all about the size of Neptune today. The team's models suggest that Uranus and Neptune formed between Jupiter and Saturn during the first 10 million years of the sun's life, their orbits constrained in a tight band. Jupiter gained more material from the solar nebula, swelling to 30 times its initial core size and triggering a planetary migration. As Jupiter's orbit fell closer to the sun, Saturn, Uranus and Neptune spiraled outward. Jupiter reached a threshold, and its increased mass destabilized and scattered the other giants.

700 million years after the solar system's formation, Jupiter and Saturn became locked in orbital step, with Saturn orbiting the sun in exactly twice the time that Jupiter does. The gravitational resonance of the two planets combined to alter the orbits of their smaller siblings, Uranus and Neptune. Orbits of the two smaller giants became elongated, at times even crossing each other's path. The two planets ventured so far out that they plowed through a vast band of ice and dust, orbiting just outside of the planetary quartet. Uranus and Neptune sailed through the icy band, casting debris into the inner solar

system. This series of events may explain what is known as the late heavy bombardment. 3.8 billion years ago, a rain of asteroids, meteoroids and comets battered the inner planets. Most of the impact basins we see today were laid down in this cataclysmic epoch, ushered in by the wayward orbits of the ice giants, say the authors. If Levison's team is correct, this violent planetary dance also resulted in the Kuiper Belt's modern structure.



### ***“Quahor”***

**By Ron Miller**

Distant object discovered by astronomers in the 1990s.

How much "rearranging" can planetesimals cause in the Solar System? These are some questions that I'd like to see answered. Boy, I could go on for a while here!"

"What's important to remember," says Hal Levison, "is that if we can understand the processes in the Kuiper Belt, we can better understand the process of planetary formation, and that's what it's all about."

The complexities of the outer solar system hold the key to many facets of our planetary history. The edge of the sun's family consists of many overlapping populations, from the Oort Cloud to the Kuiper Belt with its extended disk of icy bodies. Each of these populations has a different dynamical origin.

When asked what mysteries are most intriguing to her, Lynne Allen enthuses, "I think the missing mass is a great question. Where did Kuiper belt objects form? How do planetesimals form, and what influence do they have on larger planet formation?"

# CENTRAL AMERICAN VOLCANO TOURS INCORPORATED...

Dear Friends & Members,

The 2007 IAAA Granada Workshop is right on track with 11 confirmed member reservations so far.

The following members will be part of the workshop/exhibition:

- Betsy Smith (USA), Confirmed 1
- Kara Szathmary (Canada), Confirmed 1
- David A. Hardy (UK), Confirmed 1
- Jon Ramer (USA), Confirmed 1 (plus 1 to be confirmed)
- Bettina Forget (Canada), Confirmed 1
- Mitchell Bentley and wife Cathie (USA), Confirmed 2
- Lionel Bret (France), Confirmed 1
- Bill Hartmann & Gayle (USA), Confirmed 2
- Erik Viktor (Belgium / Canada / Costa Rica...) Confirmed 1

There is still time for other members to register and join in...



## HOTEL RESERVATIONS

Most participants have been invited to contact the hotel Patio del Malinche or vice-versa and it would seem that most have already booked their rooms over the internet.

If you have NOT reserved your room yet or heard from the hotel please contact Erik Victor at "info@swampbuster.org" ASAP so he can take care of it.

The Hotel is also freeing more rooms for us (from another tour-operator) so it looks as if we will all be in one hotel -- an advantage for everyone.

## ACTIVE PARTICIPANT INFO

Most of the participants have sent their registration forms, but some lack the vital participant info Erik needs in order to



organize the agenda of the event for each exhibitor/speaker. Please check, and update this info ASAP.

Erik needs info on what you are bringing (paintings description, number. . . etc) 3D animation, etc. Give as many details on the content as possible but also on the time schedule, space and hardware you may require.

Remember, this is a highly interactive event in a leading art gallery so please give your best!

## DIGITAL ART PRINTING, PAINT & CANVAS

We are working with our Host in Granada - the Casa de los 3 Mundos - to get some of our digital art printed over there. It is possible but we are waiting for more details on pricing from them. Digital files may also be sent for projection at the exhibition; please contact Erik for details of file-size etc. The Institute is also trying to find a sponsor so we have free acrylic paint and canvas. As both are produced in Granada they should be a lot cheaper than the same things at home, so it would seem that with or without sponsor it could be the most economical way to have the hardware in Granada instead of buying & bringing it over by plane. More info will be available about these topics in the coming weeks.

## PROGRAMMING

An informal proforma agenda will be available on the workshop website: <http://workshop.swampbuster.org>

## EVENT DURATION

The event duration is from the 15<sup>th</sup> of February until the 22<sup>nd</sup>. Flight should be booked to arrive in Managua on the 14<sup>th</sup> and leave on the 23<sup>rd</sup>. Longer stays are possible.

## ADDITIONS ARE STILL WELCOME

Although most bookings seem to be in, newcomers are still invited to join the party as long as there are hotel rooms available.

Welcome to the 2007 Nicaragua/Granada IAAA Workshop !



## WHERE IN THE WORLD?...

So where in the world was this picture taken?....

In Pamukkale, Turkey!

Pamukkale is a UNESCO natural heritage site located in south-western Turkey in the Denizli Province in near the ancient city of Hierapolis. In Turkish “pamuk” means “cotton” and “kale” means “castle” giving this fascinating site a very literal name of “the cotton castle.” The site itself is a vast series of travertine terraces more than 100 meters higher than the level of the valley below and several hundred meters across.

The site is estimated to be over 12,000 years old. Tectonic movements in the local Menderes river basin gave rise to a number of very hot springs, and it is the water from one of these



springs, with its large mineral content, chalk in particular, that created Pamukkale. Apart of some minor radioactive material, the water contains large amounts of hydrogen carbonate and calcium, which leads to the precipitation of

calcium carbonate. The mineral springs have left fantastic concretions - series of terraced levels designing bizarre solidified cascades, dazzling in their radiance and changing their color according to how the sunlight strikes them,



stupendous mineral conglomerations in the form of fantastic stalactites.

Only few remaining places in the world are somewhat similar, like the Mammoth Hot Springs in the USA, Huang Long



in the Si Chuan Province of China, and Yellowstone National Park in the USA. A significant difference at Pamukkale is that visitors can actually walk *into* the formations and swim in the pools! Which makes for some great photographic opportunities....



## CRITIQUE PAGE CONTRIBUTIONS

Many members post their works to the IAAA Critique web page so other members can examine the work and offer advice on possible improvements. For those of you who don't know how to contribute to the Critique page, here are the general guidelines.

Send it as an e-mail attachment to [joe@joebergeron.com](mailto:joe@joebergeron.com). JPEG is the preferred file format. Keep your file sizes smaller than 200K, both to conserve server space and to speed downloads. Please also send a smaller thumbnail JPEG, maximum 200 pixels high or wide. Finally, please submit no more than two images at a time. You can view and make comments on submissions at the following url:

["http://homepage.mac.com/joebergeron/IAAA"](http://homepage.mac.com/joebergeron/IAAA).

---

## PROFILE: PATTY "MOON" INGRAM

I grew up in the northwest and always enjoyed a oneness with nature. I have always had an inquisitive drive about life which I hope shows in my art. The land has an energy that mesmerizes me and is comparable to good music.

My paintings are composed in my studio but my mind is visiting far, far away places. I was influenced from any sci-fi stories or shows starting in the early 60's and carries over to the present.

As a child I was forced to entertain myself because my parents worked long hours in the bar and restaurant business. There chosen profession meant moving quite often but always returning to the beauty of Oregon including the mountains, desert and coast, but especially the Columbia River gorge. Swimming and hiking was always my favorite past time. My early life was filled with an assortment of jobs with an actual count of 25 different vocations by the time I was 30, sometimes

three different jobs in a year! I was always artsy in a crafts kind of way but I received an oil paint set from my husband and haven't quit painting since. I paint everyday but it has never felt like a job. I always have 8-10 pieces in progress. I had been painting about two years when I entered my first show. I sold three paintings there and have been making a living with my art ever since. I participated in many workshops but mostly self-taught from trial and error. I continue to educate myself by going to museums, galleries, reading art books and magazines and of course conversing with other artist's.

My paintings consist of regular land and seascapes but is mostly made up of spacescapes. These are a mix of reality, eye-dazzling space, with a touch of humor thrown in. I start with a blank canvas and let my unconscious mind seep into my work and the piece just develops as it wants to develop. Black space with intense color. The mind lets the hand and brush make the decisions but always with a touch from the funny side. I work in isolation but always have my music on the loud side. I have also been teaching the wet on wet technique for 8 years at 5 locations around my state. It seems the left brain side of me is the teacher and the right brain side of me is the ever exploring and experimental student.

---



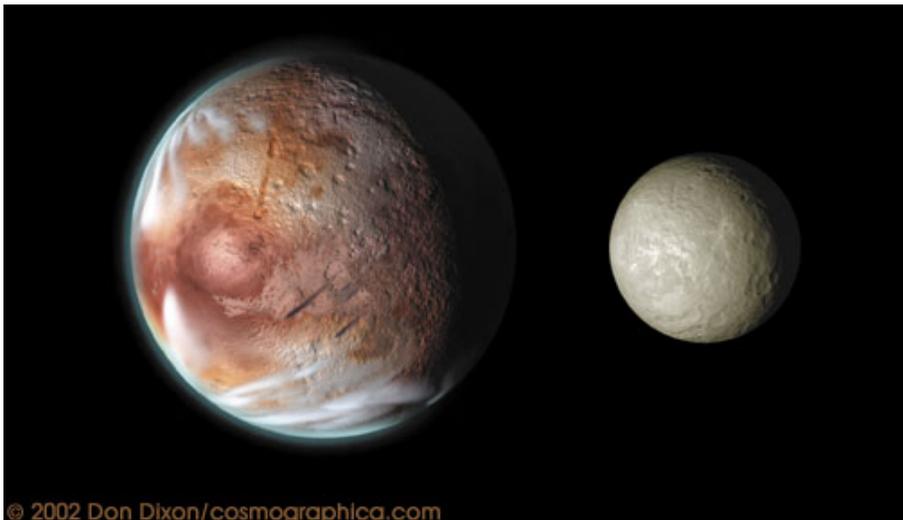
*"Pluto"* By William Hartmann

## SHOWCASE: DON DIXON

Don is a prolific artist and lifetime member of the IAAA. His work may have been seen by more of the public than any other IAAAer as he is frequently commissioned by Scientific American and other periodicals. Both of these images were originally published in SA.



*“The Kuiper Belt”*



*“Pluto and Charon Compared”*

## ASTRONOMICAL FEATURE OF THE QUARTER: NACREOUS CLOUDS



Nacreous clouds are one of the rarest of atmospheric phenomenon. Sometimes called mother-of-pearl clouds, they form 10 to 20 miles up in the stratosphere and mesosphere, compared with cirrus ice clouds at around six miles. Wavy bands that undulate and ripple, nacreous clouds are iridescent and seem to glow brightly in vivid colors up to two hours after ground level sunset or before dawn. There is some speculation that they form more readily after large volcanic eruptions due to volcanic dust particles combining with airborne ice crystals. Atmospheric temperatures have to be below minus 80 degrees Celsius for them to form, so these clouds are seen mainly in the far north and solar polar regions. The best examples occur in Antarctica due to the generally colder air mass there.

*Text from various web sites, image: Cherie Ude.*