MACARTHUR ASTRONOMICAL SOCIETY Inc.

Journal

PRIME FOCUS

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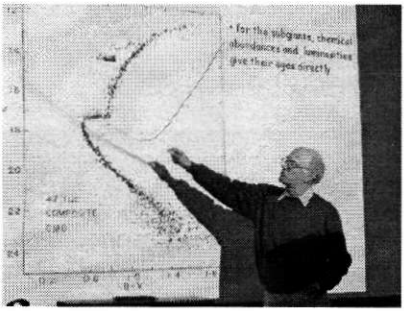
President's Report

Greetings to all members and guests here tonight. Last month we were very fortunate to have as our guest speaker Professor Ken Freeman from the Research School of Astronomy and Astrophysics Australian National University in Canberra.



He spoke about the formation of our Galaxy. It was a wonderfully technical presentation, which gave us insights into the research of this fascinating area. I found myself trying hard to keep up with all the information given on the night.

Yes, I struggled a bit, but lately I can't tell the difference between Venus and Sirius. I know that many members got a lot out of the night when considering such great subjects like cold dark matter, dark and stellar halos, transparent dust, and chemical tagging were up for grabs.

In talking to Ken afterwards I was amazed about how many people we both knew in the astronomical community, a small world to be sure. Also Ken had some very positive comments about the high level of questions that were fielded to him by our members during his talk. All in all a really good night!

Tonight we have one of our own members Doug McEachern giving us a talk on imaging the night sky using various techniques. On behalf of the Society I thank Doug for sharing his expertise with us tonight.

I hope everyone had a chance to read last month's Prime Focus journal. It was great to read an article by our founding President Phillip Ainsworth about his observations from Orange and I really enjoyed the articles by Lloyd Wright, John Rombi and Davy Jones. Frank Kish also came up with an article about measurement areas used to determine the age of the galaxy and universe. Thanks everyone for taking the time to write up these articles and please keep them coming. Indeed if anyone wishes to contribute you are most welcome. The stories can be short or long and if they have a reference to observations or an astronomical subject of your choice than they would be included.

Bear in mind articles do not have to be grammatically perfect. Rather it's the activity or information or even your own feelings that are important. None of us went to journalist school! Well maybe except for Bob Bee that is!

Cancellation!

Oh dear, we had to cancel the special students night down at The Forest which was to be held a few weeks ago on Saturday 5th of August. The weather on that weekend was atrocious with wind and rain.

Very soggy dirt road conditions was a concern for the bus company transporting the students and all parties agreed to postpone until another time. My thanks to all those who would have made the journey down, and a special thanks for Bob Bee who prepared a talk for the night. I may ask Bob to keep it in his back pocket as a return date may come up soon.

Many members eagerly anticipated the Magellan Observatory visit, but cursing the weather was the order of the day. Once again Mother Nature presented the night sky in a drab and definite shade of gray.

Whilst not making trip myself I heard on good authority that a good time was had by all, good company, good food and wine. Better luck next time!

The Dates - 2006

26/08 The Forest
29/08 Mary Immaculate Primary School, Eaglevale
02/09 Macastro Star night, Dudley Chesham Sports Ground
16/09 Stargard Field
18/09 Monthly Meeting
23/09 The Forest
14/10 Macastro Star night, Dudley Chesham Sports Ground
16/10 Monthly Meeting
21/10 The Forest
18/11 The Forest
20/11 Monthly Meeting
25/11 Stargard Field
08/12 Campbelltown Rotary Observatory

You may have noticed that we have relocated the Macastro public nights to the sports ground instead of Stargard. We have previously held our nights at the front field and this has worked well for us. We are still sorting out some OHS issues, i.e. bridge crossing and toilets etc concerning Stargard only in relation to large scale public events. Normal member nights at Stargard are not effected.

Space Cadets

The Cadets held a meeting last Thursday, being 17th August. At time of writing all I can report is that we have had the night advertised in the community diaries in all local papers and have made details available on our website. It's a disappointment that recent attendances have been minimal, but maybe the cold and wet nights played a factor. Whilst the meetings are primarily aimed at young adults and children newer members of the society may gain some value in attending, so please come along. Meetings are held at the Campbelltown library every 3rd Thursday of the month at 5.30pm to 6.30pm.

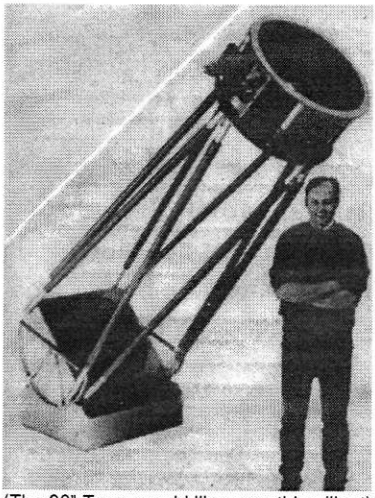
Further details can be found on the MAS website, www.macastro.org.au
Just follow the link to "Space Cadets" which is on the home page. We have some basic info on that link, however just ask when you attend the meetings and you will be issued a special password that will allow you to explore further.

Stargard Field.

The field night held last month 29th July was very successful, clear skies and lots of stars. It was good to see all those scopes set up on the field. It was a little breezy which made photography a bit difficult, however it wasn't overly cold that night and no dew to report.

The Ring Nebula was a fine sight in the scopes and many members busied themselves with locating various objects on offer. The seeing conditions varied throughout the night, but having said that Jupiter showed abundant details when the air was steady.

Recently some opportunities have come our way regarding our plans for Stargard. An offer has been made to the Society to purchase a large truss tube telescope, perhaps 25 or even a 30-inch. I have received a lot of detail about the 30 inch in particular. In my opinion it would be an awesome piece of equipment. Certainly a telescope of this size would give us the opportunity to see structure in galaxies, the possibility of some colour in bright nebulae and spectacular planetary details. From what I am led to believe objects that we can barely see will simply jump right out of the eyepiece.



(The 30" Truss would like something like this, maybe bigger. Ed.)

The resolving power of the telescope would far exceed anything that our own telescopes are capable of. Size does matter in this case.

The scope would come with a lot of extras like digital setting circles and go to automatic object location and tracking system, a light

shroud, guiding refractor, heating systems and mirror cooling fan.

The size of the telescope obviously does not lend itself to be portable. It's really, really big. An idea would be to house it in a special purpose fully insulated container on site. The container would be constructed of double lined 3mm thick steel and would come with a security locking device. I have seen such a container on display and it appears to be very secure indeed and would stop most vandal attacks, grass fires, storms and rain. These events, unfortunately, need to be considered.

A storage container is definitely not glamorous, however it is very practical and gives us the opportunity to expand upon the idea in the future, or indeed relocate to another area of the field as the container is not a fixed structure. Other models of containers that I have seen even have kitchens, lounge areas and office space. I will see how things progress but I think maybe at this stage we may need to keep things simple, i.e. large telescope that will roll out of a container, should be enough space left to have a small lounge or two, some chairs and a table, very cozy!

At the moment I am trying to arrange meetings with the Council, Sports Ground management and the sitting Liberal member for Macarthur Pat Farmer. You may recall that John and I visited Pat Farmer last year with a view of trying to arrange some funding in the future.

At that time Pat asked us to locate an area of land where we could further progress our ideas, he even wrote an article in the local paper in support of our plans. It's taken a while to get all the wheels in motion but it looks like Stargard will suit us just fine.

We will try our best to seek approvals and funding of the proposal which I have estimated at just a tad under $25k in total, telescope $19,900 and container $4,060 all delivered on site and operational. We will also need a big ladder! As this is a substantial initiative on behalf of the Society both the committee and myself agreed that we should put into print as much information as possible, hence this report.

This is firm proposal that we would like to take forward, but there are no promises of any financial assistance whether fully or partially. However, we may find ourselves in the position of having to make decisions and commitments very quickly. John Rombi has come on board to give me a hand with all this and as the Society's representatives we would like to seek your support and encouragement.

Please contact me or John immediately with any questions or concerns about what we are proposing as we don't have much time, especially by the time you are reading this. I would imagine that if we were successful then a deposit would have to be made at the first opportunity. Even if we can just source the telescope funding we may be able to fundraise and expend some capital on the container taking into account our financial obligations, mainly public liability insurance.

The opportunity seems to be upon us now and time frame for this is very short, so contact me on astrosharpe@bigpond.com.au with any comments. I would be happy to go into more detail, or just give us a call on 0410 445 041.

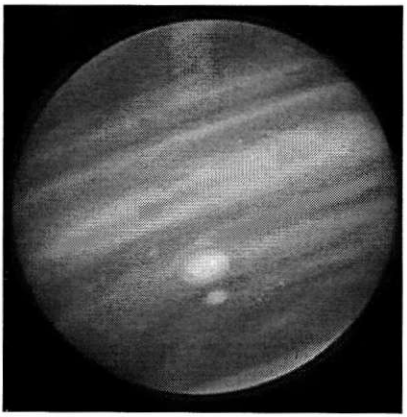
Well I know that's a lot of news to download so without further to add I will say "Good stargazing and stay safe and warm".

Noel Sharpe President ■

Stormy Jupiter

The weather is getting wild on Jupiter.

Astronomers have snapped a picture of two hurricanes, the biggest seen anywhere in the solar system, whipping past each other. Winds in both storms, which appear in the infrared image as large white spots, have been clocked at 560kmh.



The larger hurricane, popularly known as the Great Red Spot, towers 8 km above the surrounding cloud tops and has been raging for at least 350 years. It is so big you could fit three Earths inside it. The smaller one - Red Spot Junior - is at least as big as Earth. It formed between 1998 and 2000 as three smaller storms, blowing for more than 60 years, merged.

While scientists still do not understand what drove such massive hurricanes, there was no doubt they were fierce. Astronomers doubt the two storms will merge. Instead, they will simply pass each other, like two ships in the night.

Other tiny white spots, barely visible in the picture, are powerful thunderstorms ripping through the planet's atmosphere of hydrogen and helium. The Gemini telescope made the infrared image, which causes the red storms to look white. ■

The Mars Hoax

There is currently a hoax doing the rounds on emails about a spectacular opposition of Mars on 17th August this year. "It will be the closest you will see it until the year 2287 and will look as big as the Moon to the naked eye" the email promises. **Rubbish!** To the naked eye, the Moon is over 70 times larger in diameter than Mars will ever look.

The same hoax appeared last year and it was just a false then as now. Of course, it is either accidentally or deliberately confusing itself with the record close opposition in August 2003 and it's true there will not be another like that till 2287 (and also 2206) but certainly not this year. The next favourable (around 55.7 million km) opposition is expected in 2018. This August, however, despite the lurid promises of the hoax email, Mars will be much further away, much smaller and definitely not in opposition. So if a friend forwards that email to you, set him or her straight, then delete it. Science is hard enough to teach without such hoaxes. RB

MacDob for Loan

This is a reminder to members of MAS who may not have a telescope of their own that they can borrow the Society's own telescope, MacDob, for a month or two at a time.

MacDob is a 150mm (6") F8 Dobsonian that is very easy to transport in the average car and even easier to use. It comes with three sizes of eyepiece and a Moon filter.

With a focal length of 1200mm, it gives good ranges of magnification and with 150mm of aperture, is up to locating most deep space objects you'll want to catch. All people who have used MacDob agree that for a 'cheap' telescope, it has excellent optics and provides great views of the deep sky, as well as the moon and planets. With Jupiter in good viewing positions this month, this is an ideal opportunity to see it up close and personal with MacDob.

If you want to borrow MacDob, please see me at a meeting, or call (46474335) in advance so I can arrange return by the current borrower at the next meeting. Let me encourage you to do so as we want this Society asset to get well used.

Bob Bee ■

Happy Snaps from a Public Night

Here are a few snaps taken at the most recent (non-rained out) public night at the Campbelltown Rotary Observatory. See if you recognise yourself or anyone else. (Photos courtesy of Dick Everett.)

Finding the Age of the Universe
By Frank Kish PART II

[This is the continuation from Part I *in the July 2006 issue.]*

c) The Cosmic Expansion

The *Inflationary Period* of the Universe, which was closer to the Big Bang, is from where the cosmic expansion believed to have begun. The initial exponential expansion, i.e. *inflation*, is intended to provide for us the meaning of space-time and everything in it through the mathematical equations of the *Standard Cosmological Model*. The theory of the *cosmic expansion* is therefore primarily part of the Standard Cosmological Model.

Principally, the expansion of the Universe is now explained by some versions of the Big Bang theory of cosmology as being opposed to the rival "steady-state" theory.

Experts tell us, as mentioned before, that the expansion of the Universe occurs not because galaxies move in any direction away from one another, but because space itself is expanding, thus the galaxies have no other choice than to move along with this expansion. They also note that the internal dimensions of galaxies do not change with the expansion of space.

Therefore, in Big Bang theories, cosmic expansion and a finite age of the Universe go hand in hand. "Since the Universe is constantly expanding, its size depends on its age". (J.Barrow).

Hence, the age of the Universe is the interval between the Big Bang to the present, and its age therefore can be established from the rate of its expansion.

At present the natural *time* scale of the Universe is its *expansion time* of about 13.7Gy. and its natural *distance scale* is 13.7 billion light year; it is easy to see from this the difficulties astronomers face when trying to get reliable distance measurements using the theory of the accelerating cosmic expansion.

These are the reasons: At first, there was this problem of a "disappearing" Universe, i.e. due to its accelerating expansion we see less and less of it.

Now, in addition to the "disappearance", since astronomers in the 1990s produced an audit for the "total energy" of the Universe, they realised the dilemma of just how small amount of visible, gravitating material they found. They reasoned that they could accept the "dark matter" hypothesis, but that would make the Universe younger than the stars in Globular Clusters.

Another wild idea entered into the cosmic picture, that the initial hot-dark matter of neutrinos is now accompanied by cold-dark matter, all based on evidence of things "invisible". (Kirshner).

When Einstein appeared surprised to find that the universe was expanding, he applied a "quick-fix" to solve that problem by inventing the idea of **"cosmological constant",** which he later on just as quickly deleted, saying: "Who needs it?" As Kirshner puts it: "But you cannot fight facts even when they are wrong."

Now the astronomers seemed to be in a similar dilemma as Einstein was, i.e.: suspecting that "they might still need it", so they resurrected the "cosmological constant", which we call today **"dark energy",** (highly hypothetical still), to counter-balance the

inward pull (or pressure), of gravitating matter. Otherwise, one may be tempted to question the properties surrounding the Big Bang theory or even the relativity theory itself.

Thus, once again the cosmological constant has an important role in complementing the cosmic expansion, whose measurements with the latest "modifications" now would fit in neatly with the age of the oldest globular clusters and the age of the Universe.

d) The Bases for the theory **of the cosmic expansion**

- The hypothesis of the *inflationary period*, following the Big Bang of the Universe.
- The hypothesis of the *cosmological constant* and/or the *dark energy*.
- The hypothesis of *redshift of galaxies* indicates the apparent *velocities* of the galaxies away from us. It is not yet certain that the redshift is caused by an increase in galactic distances.
- The *Hubble Constant*, which was regarded as a fairly reliable cosmic-distance scale, at least for comparison purposes with other distance scales.
- The apparent *magnitude of galaxies*, (but with some modifications), seems to agree with the cosmic expansion theory.
- The *number counts of galaxies* against their redshift may work in a static universe, as shown by observations, but as some cosmologists say, this theory in an expanding model appears to have some weak points.
- The *microwave background radiation:* (The observed facts are questioned by some regarding its true causes). Moments after the Big Bang, heavy elements synthetised by thermonuclear reactions.

To enable such reaction to proceed fast enough to offset the rapid decrease of density caused by the inflation of the early Universe, the matter in the Universe must have started at very high temperatures, associated with a similarly strong thermal radiation field. As the Universe expanded, both matter and radiation would cool, and eventually the temperature would drop too low for further nuclear reactions.

Matter would continue to cool as each photon is redshifted by the cosmic expansion. Astronomers detected the traces of the above described thermal radiation of the early Universe and identified it as the cosmic microwave background radiation, (CMBR).

Note by F. Shu: "One point should be made clear: The free-expansion model must represent more of an overestimate if the universe is bound than if it is not. Gravity plays little role in slowing down the expansion of an unbound universe; so $1/H_0$ must be a good estimate for the age of such a universe."

One may justifiably conclude from this remark that the Hubble Constant could vary further, due to the present indecision on whether the Universe is bound or unbound.

3) THE NUCLEOCOSMOCHRONOLOGY, USING TYPE II SUPERNOVAE

This method is synonymous with nuclear chronometers, and analogous to radio-active dating. The rate of radioactive decay is written in the chemical elements, the building blocks of the whole Universe. From these objects and events chronological data are collected and the ages of the supernovae, from which the ages of our Galaxy and the Universe is calculated, as it is now generally

accepted that these three events have similar age.

a) The Nucleocosmochronology
It is a radioactive dating of heavy elements in supernovae of our Galaxy, for estimating the life-formation activities in astrophysical objects and events. Heavy elements are formed by capturing of neutrons by the nuclei of iron and its neighbouring elements.

The capture can occur in two places, namely:-

i) In the envelop of Red Giant stars, which is called the **"slow process" (s),** and

ii) In the Supernova remnant, just outside the neutron star or the black hole. This is called the **"rapid process" (r)**; and all elements heavier than Bismuth are believed to be formed this way. Also the elements that are most suitable nucleo-chronometers are formed by the "**r**" process.
Through determining the age of these elements, it gives the age of the oldest supernovae, the Galaxy and the age of the Universe.

b) The Measuring Method
It is a dating process, which involves analysing from samples of meteorites; a suitable pair of longest-lived nuclei that were in abundance in the earliest times of the Galaxy. Such chronometer elements used were: ^{232}Thorium / ^{230}Uranium, and also ^{235}Uranium / ^{244}Plutonium. In their production ratio, one element decay enriches the other element in a pair.

This production ratio is mathematically calculated, because several atomic masses contribute to the abundance of each of these nucleochronometers, the effect of variations from the average abundance is reduced.

Behind this dating process lies the assumption that all the elements were in one event, which although may give an idealised model, the assumption is still incorrect. However, from using these chronometers, **the present age** of the Galaxy and the Universe is calculated to be **12.5 +/. 3 Gy**. approx. (Star CS31082-001-Cayrel, 2001).

c) Type II Supernovae
When a massive star leaves the main sequence (HR-Diagram), to become a supergiant of >8 M_{Solar}, it is surrounded by fusion reaction within its gaseous outer shells, until its innermost silicon shell being fused to a massive iron core, (>1.4 M_{Solar}), which collapses in less than one second. This compressed core of the supergiant reaches a density of 400 million tons per cm^3, now begins to rebound, creating thermal shock waves throughout its shells, until a colossal explosive force, at cca. 5% the speed of light and accompanied with brightness of an entire galaxy, blows off all its outer shells.

This phenomenon is called the **Type II Supernova**. The emission lines of the supernovae remnants, in addition to lines from H, H_e, C, O and F_e, also show lines from elements heavier than Iron (i.e. containing more than 26 protons in their nuclei).

The high-energy shock waves in these supernova explosions are the only place in the Universe where heavy-metal elements, among them gold, silver, iron, nickel, chromium, titanium, vanadium copper, uranium and lead are made in bulk, and spread by its remnants in the interstellar medium throughout the galaxies. These are the elements that make up stars, planets and all forms of carbon-based biological life in the Universe.

d) The End-stage of Type II Supernovae
Type II Supernovae end up with a compressed stellar core, called **neutron stars**, which may be regarded as being one gigantic atomic nucleus; having greater gravitational-potential energy than a white dwarf. They may also become rapidly spinning neutron stars, called **pulsars,** (which by the way, "rotate and do not pulsate"; F.Shu.). Pulsars are also known as **variable radio stars**, having a very brief period of pulsations, producing narrow beams of electromagnetic radiation, sweeping around itself similarly to a search-light as it spins.

This end-stage means that the greatest ultimate energy source common in all stars is gravity.
Type II Supernovae are considered the most reliable as nuclear chronometers or cosmic yardsticks for establishing the age of the Universe.

[The concluding Part III of this article will be in the September issue of Prime Focus.]

Numbering the Planets

The hot story this week is the committee of experts' unanimous recommendation to the International Astronomical Union about the definition of what is a planet. More particularly it is about whether Pluto should retain the status of planet or the other 'Pluto-like' bodies that have recently be discovered should be dubbed as planets. Where will it all lead? Is this the end of science as we know it? Has popularisation taken over from scientific objectivity? Read on and either rejoice or weep – your choice.

Planet name inspiration? ... Xena Warrior Princess. (At least this is one positive outcome to the whole drama. Ed.)

Astronomers and educationalists, hold on to your telescopes and chalk, then read on.

The solar system has 12 planets, not nine. That's the earthshaking conclusion of an influential international committee, which on a future date after going to print will recommend a new definition of what qualifies as a planet.

The change is necessary, experts say, because of discoveries in the past decade that have revealed a glut of Pluto-sized bodies beyond the orbit of Pluto - until now considered the furthest planet from the sun.

Quick quiz: Who discovered the planet Pluto and when?

Those findings sparked an intense debate among planet-watchers. Should the new worlds be welcomed as planets, or was it a mistake to call tiny Pluto a planet in the first place?

The core of the problem is this: The International Astronomical Union (IAU), charged with categorizing objects in space, can define everything from an asteroid to a star but has no definition for a planet. Officials never needed one until new discoveries in recent years highlighted the inadequacy and a stark debate began

Many astronomers do agree Pluto should never have been called a planet. It is only 2,300 kilometers wide, smaller than Earth's Moon. It travels an elongated orbit that also dips above and below the plane of Earth's orbit by 17.1 degrees. By the late 1999, as observations were revealing Kuiper Belt Objects (KBOs) that approached the size of Pluto, controversy grew. The flap reached a peak when diminutive Pluto received a unilateral demotion when the esteemed Hayden Planetarium in New York City chose not to include it in a new display of planets.

Some astronomy researchers would prefer simply to toss Pluto clear out of the planet picture and go back to eight. It's just a big rock, they say, the largest of the KBOs. In fact, Pluto's orbit, like those of other KBOs, is controlled by Neptune's gravitational presence. Pluto is yanked around the sun twice for every three trips made by Neptune. Astronomers call this an orbital resonance of 3:2.

The middle road in the argument goes like this: Pluto is a planet, and the public would be confused and even upset to change that. Leave it as the ninth and final planet, but scientifically keep in mind that it's a KBO and don't otherwise increase the count of planets in our solar system.

Now there's an answer that just might satisfy Pluto-boosters and Pluto-phobes (i.e., haters) alike. A seven member panel of astronomers, historians and one science writer gathered in Paris last month under the auspices of the International Astronomical Union to settle the question. After a sleepless night (probably feulled by copious quantities of Port), they agreed on a simple yet revolutionary approach to the problem.

A planet, they decreed, is any star-orbiting object so large that its own gravity pulls in its rough edges, producing a near-perfect sphere.

Note there are two key elements to this definition:

i) star orbiting. (This excluded the larger moons around other planets)
ii) gravity produced spherical shape. (This exlcuded the larger non-spherical asteroids and KBOs)

That definition excludes 200,000 small, odd-shaped rocks, comets and asteroids that wander around the sun.

It also means Pluto remains a planet. But the new definition also **includes** three other big space rocks, including one now

considered an asteroid and another long described as a moon of Pluto.

Also to be included is an icy body beyond Pluto, which would belong to a class of planets to be known as "plutons".
"In a day and a half of hammering it out, we came up with this unanimous recommendation," said Owen Gingerich, chairman of the IAU's "planet definition committee" and an emeritus historian of astronomy at Harvard University.

Because planet-seekers are finding new worlds beyond Pluto at a steady clip, the list of newly defined planets (or plutons) could grow well beyond 12 - perhaps dozens more worlds await. For example, we already know about Kuiper Belt objects (spherical and orbiting the Sun) such as Ixion (estimated 1200km diameter), Varuna (est. 900km) and Quaoar (est. 1300km). These would bring the list up to 15. Anyone have a mnemonic for these? And there are bound to be more of these discovered as our space-bound telescopes (George Bush permitting) get bigger and bigger.

Astronomers from around the world are scheduled to vote on the new definition on August 24 at the IAU's meeting in Prague. It would constitute the first official recognition of new planets since Pluto's discovery in 1930.

Gingerich said he had already received backing from 10 of the group's division chairmen. Although there's nothing binding about the coming vote, the IAU is considered the world's authoritative source on the naming of heavenly bodies.

Pluto is unlikely to be officially delisted as a planet, most experts agree. A suggestion along those lines generated a public outcry back in 1999, prompting the IAU to issue a press release stating its regret that "incomplete or misleading" press reports on the status of Pluto "appear to have caused widespread public concern." The statement went on to assure that "no proposal to change the status of Pluto as the ninth planet" had been made within the IAU.

When NASA's New Horizons probe visits Pluto and the Kuiper Belt in 2015, it will almost surely become crystal clear -- if it hasn't already before then -- that Pluto *the planet* is also just a common rock, very unplanet-like in most astronomers' eyes, roaming in a sea of planetary wannabes.

* * *

It is fascinating to consider all these issues. It goes back to basic astronomy - the planets. It gives everyone in the astronomical community – professional and amateur – something to talk about with the public. It doesn't really matter what your view is – it is bound to differ from someone else's and provide fuel for lively (and hopefully constructive and non-violent discussion).

Apart from the delightful fact that it ought to send any honest astrologer into a catatonic state of planetary influence overload, consider that it will throw all the current learning tools and Trivia Pursuit Q&As out the window. e.g What's the name of the 5th planet? "Jupiter?" Wrong, it's Ceres. The 9th planet? "Pluto?" Wrong, it's Neptune. How many planets in the solar system? 9, no...12, wait...15, what's that, 17? I give up, where's the sports section?
Ah, astronomy, don't you just love it?

RB