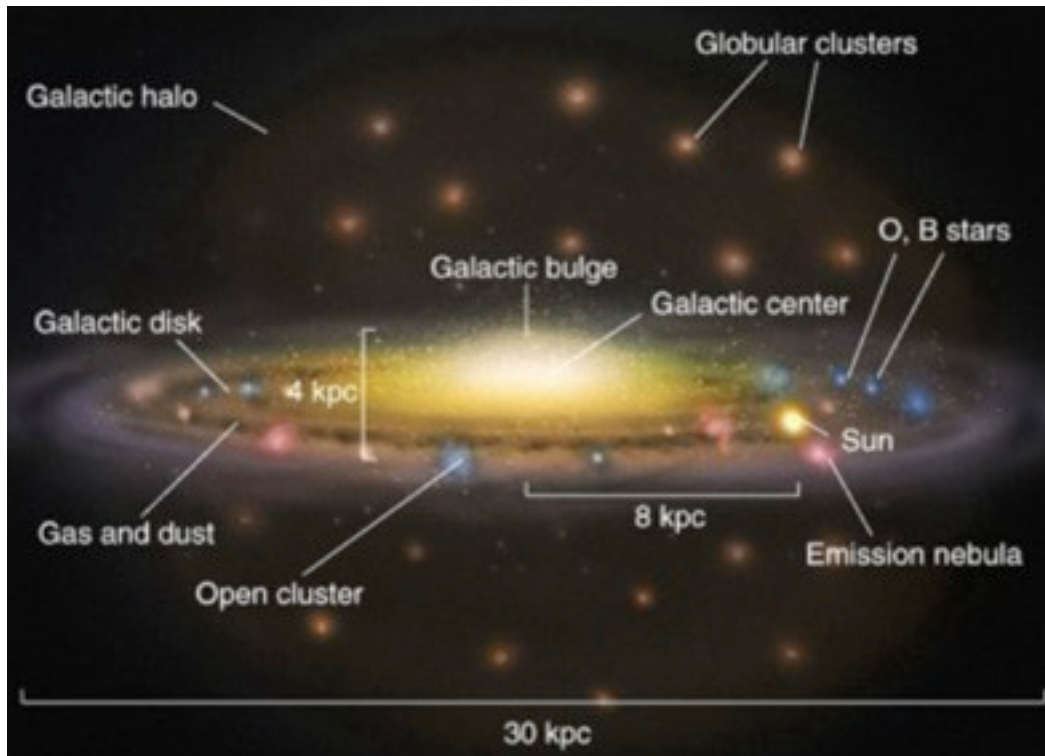


Milky Way 2012

Frank Dodd (Tony) Smith, Jr. - 2011



(image from www.astro.ufl.edu/~vicki/ast3019.html web site)

Milky Way and Andromeda ... page 2

Milky Way, Sagittarius Dwarf Galaxy, and Our Solar System ... page 4

Capture of Solar System by Milky Way ... page 9

Ecliptic Plane ... page 11

Magnetic Field ... page 12

Earth and Milky Way in 2012 ... page 14

Moon and planets NOT significantly aligned ... page 17

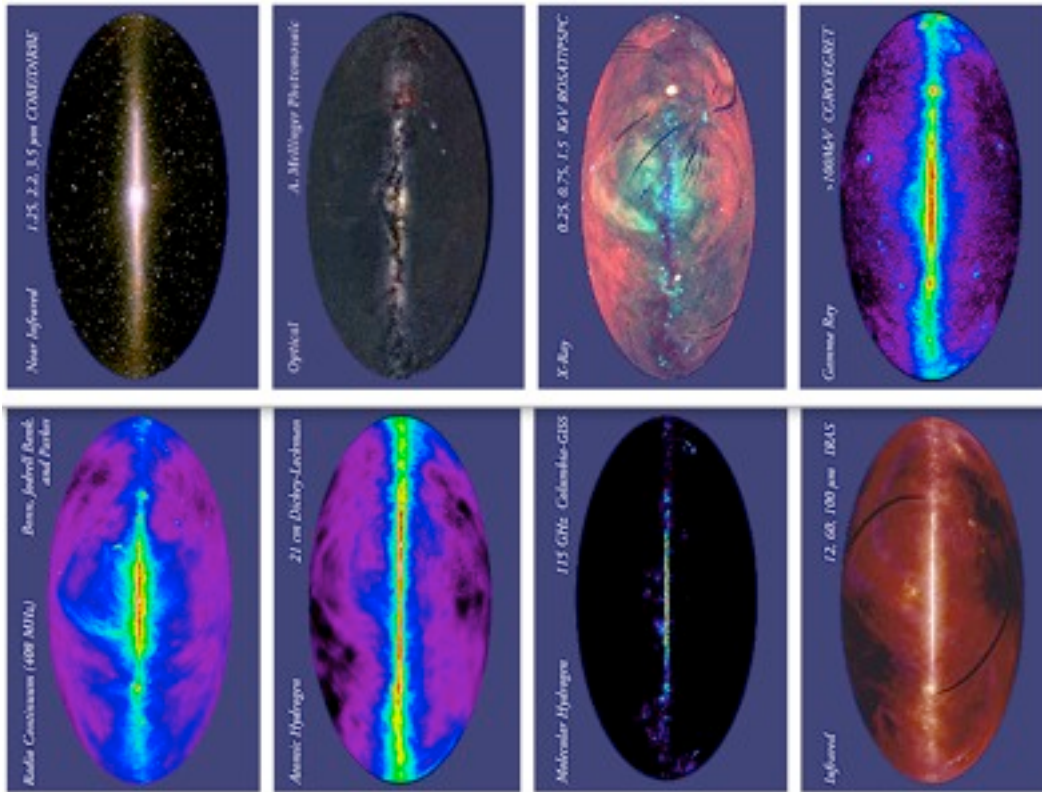
Sun NOT directly aligned with Galactic Center ... page 18

Gamma Ray Bubbles and Milky Way Nuclear Starburst ... page 20

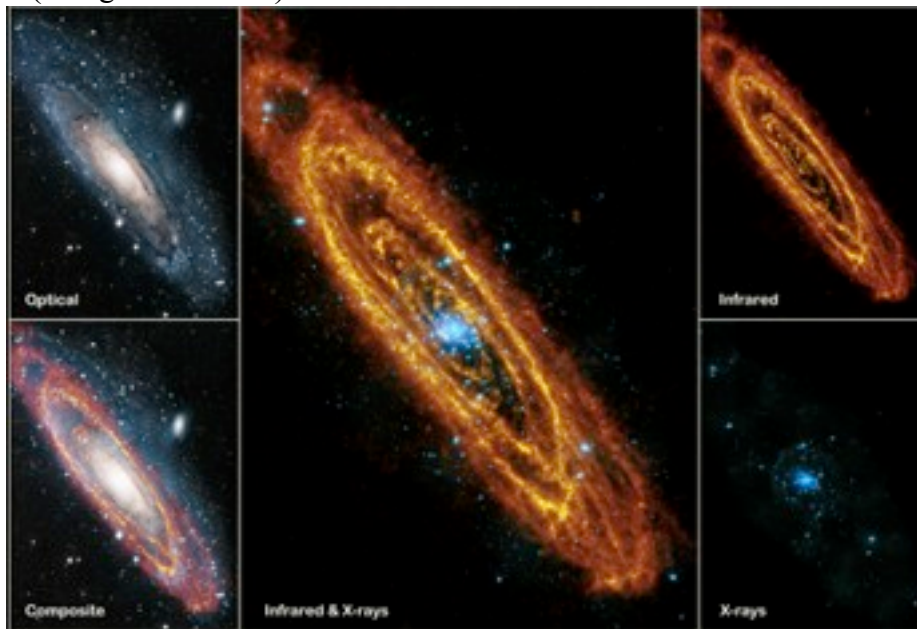
Bubble Breakout ... page 22

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Milky Way (image from NASA Goddard):



Andromeda (image from ESA):

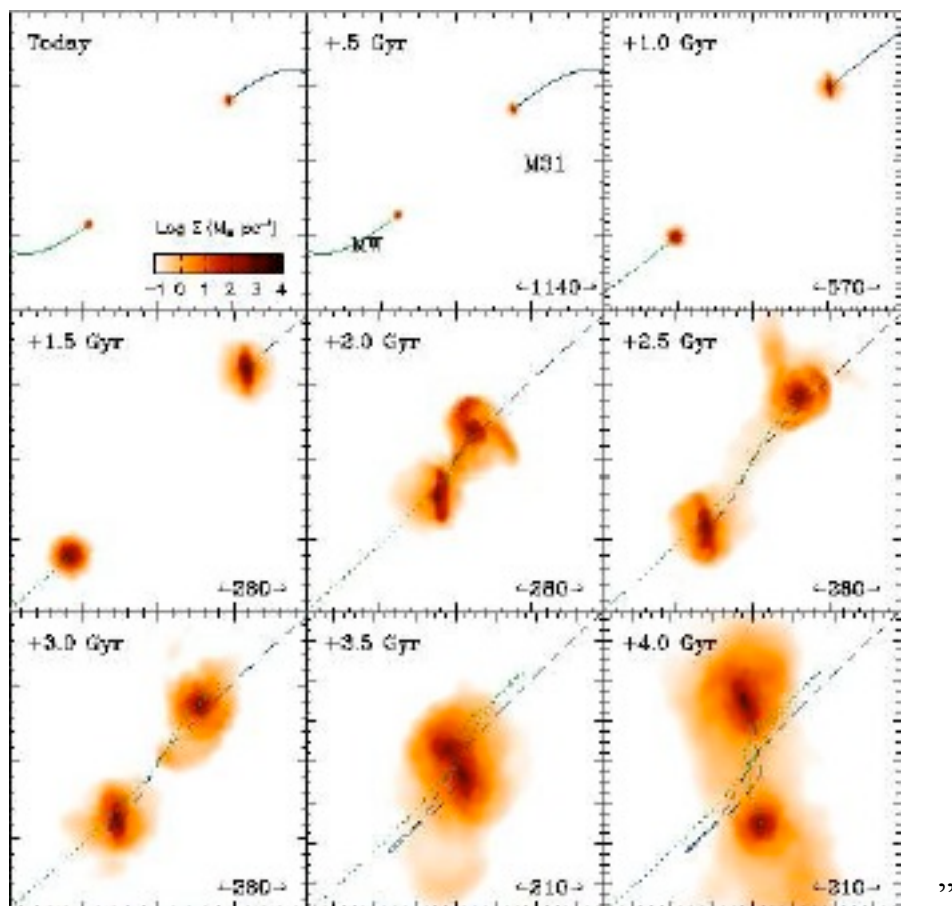


Cox and Loeb in 0705.1170 [astro-ph] said:

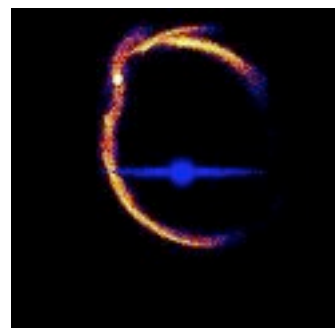
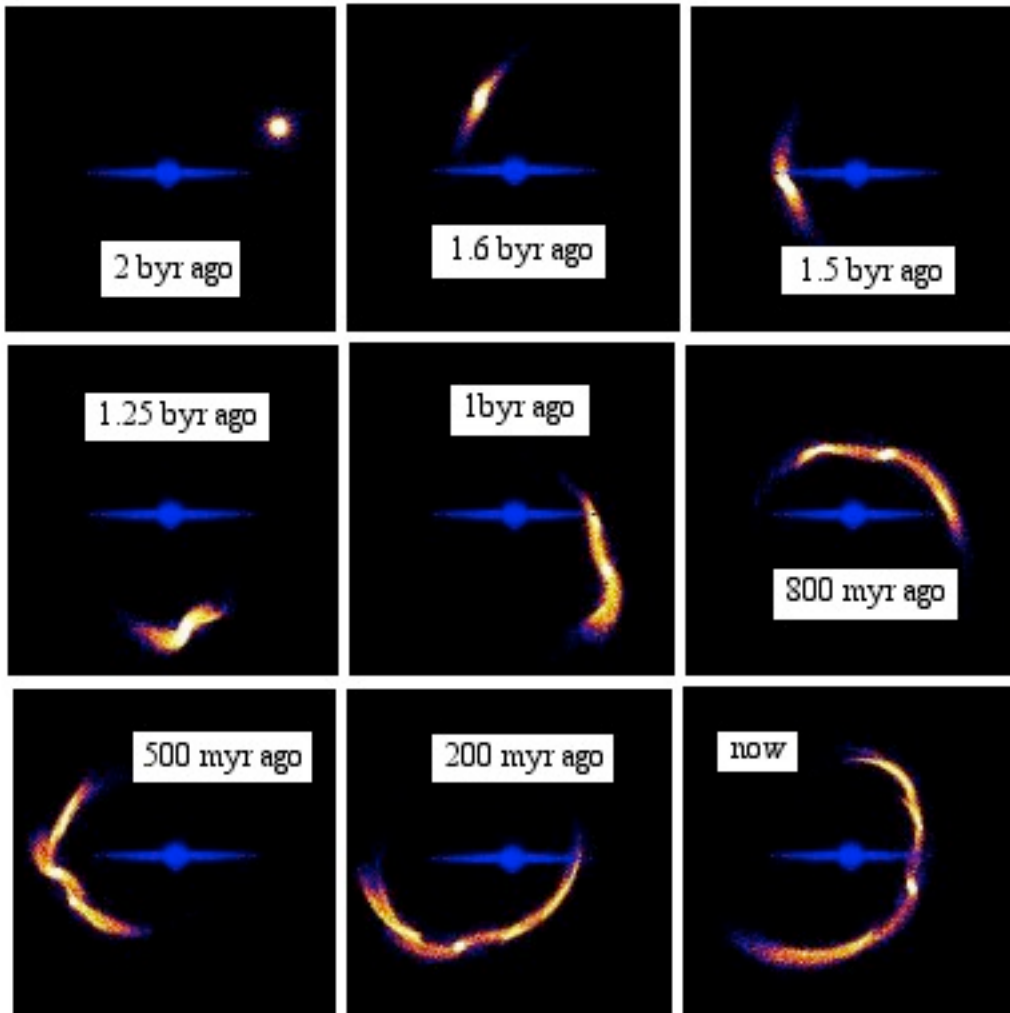
“... the Milky Way ... and Andromeda ... [(images from NASA Fermi GRST and WISE)



]... are moving toward each other at about 120 km/sec ... Allowing for a comparable amount of diffuse mass to fill the volume of the Local Group, we find that the two galaxies are likely to collide in a few billion years - within the Sun's lifetime ... there is a chance that the Sun will be pulled away from its present orbital radius and reside in an extended tidal tail ... there is a remote possibility that our Sun will be more tightly bound to Andromeda ...



A 24 September 2003 astsun.astro.virginia.edu/~mfs4n/sgr/ web page said: “... this animation ... by ... Kathryn Johnston ... begins when a Sagittarius-like dwarf galaxy was a compact, undisturbed system, and follows the Milky Way’s disruptive influence over time ... If this were the Sagittarius system, this simulation would span approximately 2 billion years in the past ...



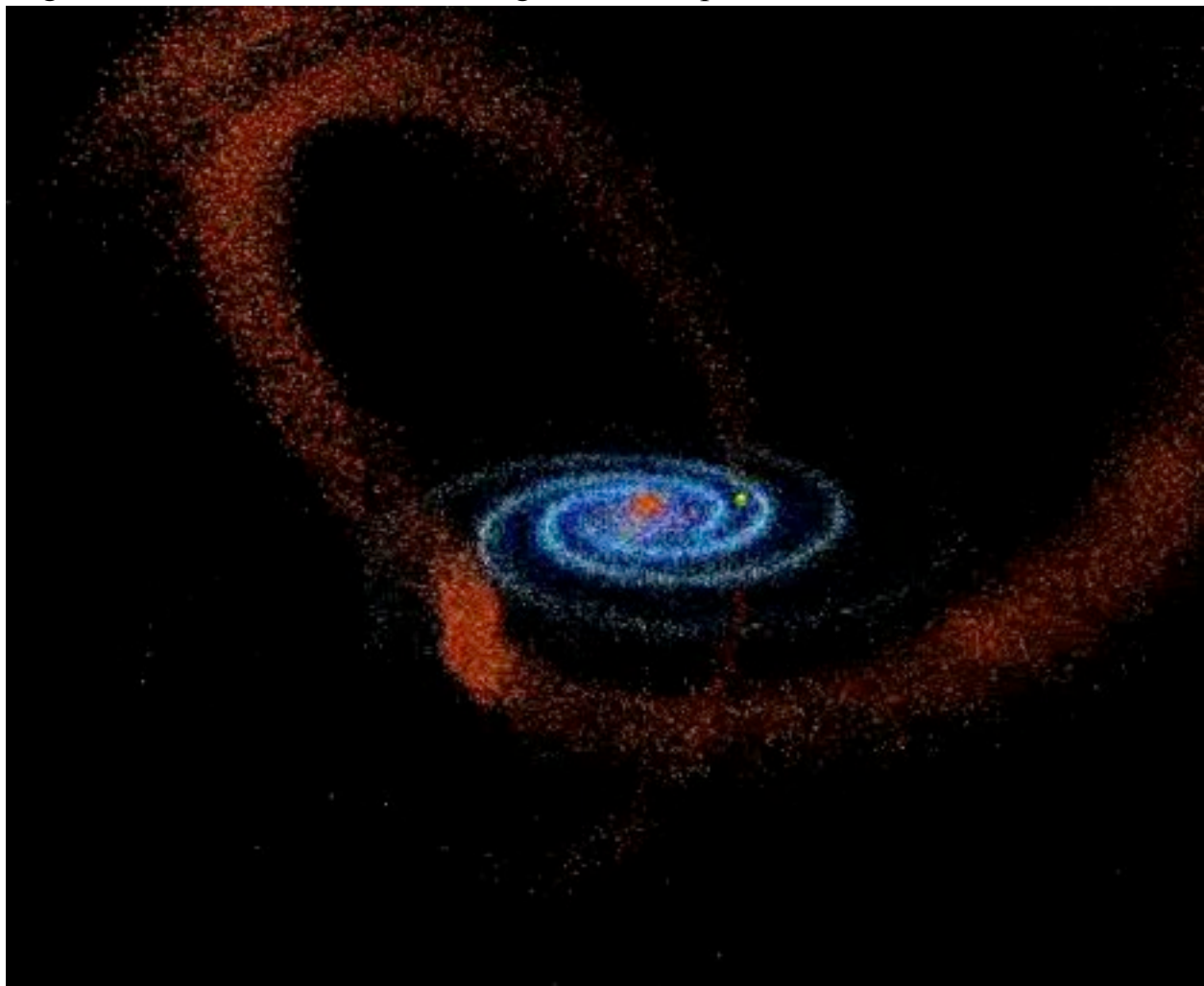
... through 500 million years into the future ...”.

McConnachie et al in 0909.0398 [astro-ph] said:

“... The discovery that the Sagittarius dwarf galaxy was being cannibalized by the Milky Way brought into sharp focus the role of satellite accretion in the build-up of a galaxy’s mass ...”.

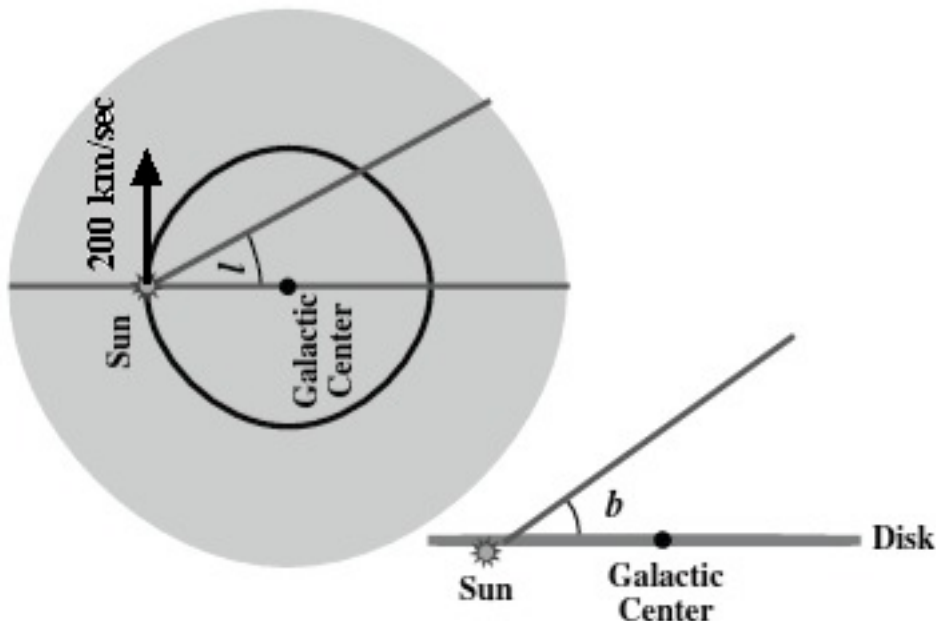
Robert Roy Britt in a 24 September 2003 space.com web article said:

“... Detailed new observations of our Milky Way Galaxy reveals thousands of stars being stripped from a neighbor ... Sagittarius dwarf galaxy ... 10,000 times less massive than the Milky Way ... now a vestige of its former self. ... A model shows the Milky Way’s spiral (blue) with the Sun’s position noted by a yellow dot. Sagittarius debris ... descends through the Sun’s position ...



... stars and star clusters now in the outer parts of the Milky Way have been 'stolen' from Sagittarius ... For only a few percent of its 240 million-year orbit around the Milky Way Galaxy does our solar system pass through the path of Sagittarius debris ...”.

Vicki Sarajedini has a www.astro.ufl.edu web site with a lot of information about the Milky Way, including the following image showing the orbital direction of motion of the Sun and a system of coordinates:



Majewski, Skrutskie, Weinberg, and Ostheimer in astro-ph/0304198 said:
 “... A prominent leading debris arm extends from the Sgr center northward of the Galactic plane to an apoGalacticon about 45 kpc [146,700 lyr] from the Sun, then turns towards the North Galactic Cap (NGC) from where it descends back towards the Galactic plane, becomes foreshortened and at brighter magnitudes covers the NGC. The leading and trailing Sgr tails lie along a well-defined orbital plane about the Galactic Center.

...

the Sgr debris plane is similar to that of the ecliptic ...
 which has a pole $[l, b] = [276, -30]$

...

The Sun lies within a kiloparsec [3,260 lyr] of that plane and near the path of leading Sgr debris; thus, it is possible that former Sgr stars are near or in the solar neighborhood.

...

To study the Sgr system ... we ... define a coordinate system ... we adopt the method of Great Circle Cell Counts (“GC3” ...) ... the peak in GC3 counts yielded poles within a degree of $(l, b) = (273, -13)$ degrees ... [Others]... have ...

identified a peak at $(l, b) = (90, 13)$ degrees ... with Sgr ... Any great circle distribution on the sky produces two antipodal peaks in the cell counts. Contrasting with ...[others]... we elect to identify Sgr with the peak in the South Galactic Hemisphere because this corresponds to the angular momentum pole of the satellite itself

...

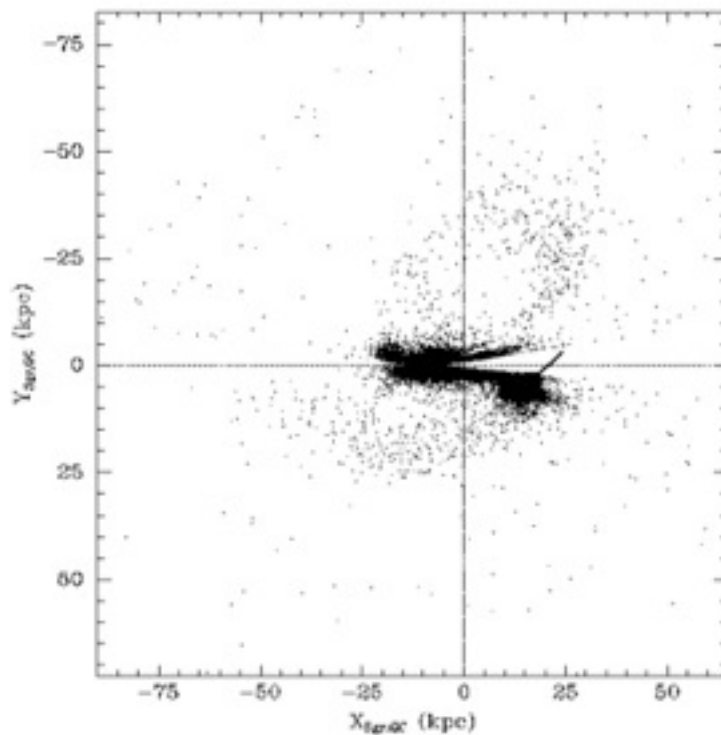
more natural ... coordinate system[s] for the interpretation of Sgr tidal debris ... one heliocentric and one Galactocentric ... are useful ...

In the first, Sgr latitudes, B_0 , are defined by the Sgr debris projected on the sky as viewed from the sun ... Sgr longitudes, Λ_0 , are defined to increase in the direction of trailing Sgr debris, with the prime meridian, $\Lambda_0 = 0$ degrees, defined by the longitude of ... the center of Sgr ...

The second ... We define a Galactocentric (Λ_{gc}, B_{gc}) system with $\Lambda_{gc} = 0$ taken as centered on Sgr

...

The Northern Arm can be seen ... to represent the leading tidal debris tail of Sgr. ...



... Figure 11 makes clear the relationship between the diffuse Northern Galactic Cap (NGC) “fluff” and the Northern Arm ...

the Sun lies within a kiloparsec [3,260 lyr] of the Sgr orbital plane ... thus the actual proximity of Sgr debris to us depends on the length of the leading arm and where it crosses the Galactic plane on this side of the Galactic Center ...

[Figure 11 shows]... the presence of 15 - 30 kpc [48,900 - 97,800 lyr] distant M giants stretching from $\Lambda_0 = 225$ degrees to 280 degrees or more. An even wider angular distribution at closer distances suggests the passage of leading arm material both exterior and interior to the Solar Circle at these distances (the NGP is near $\Lambda_0 = 256$ degrees).

...

our ... best fitting models to the present data set obtain a passage of the center of the leading Sgr within two kiloparsecs [6,520 lyr] of the Sun ... [Other]... models ... predict current passage of leading arm debris through the Galactic plane at a mean distance of about 4 kpc [10,040 lyr] outside the Solar Circle ...”.

Has our Solar System been captured from the Sagittarius Dwarf

or

Has our Sun been in its present orbit in the Milky Way for billions of years

?

Even if the Sun is not now in the intersection region of the Sagittarius Dwarf debris with the Milky Way, and even if the intersection region is outside the Solar Circle, then it is still possible that:

the Sun and our Solar System lived in the Sagittarius Dwarf until it was captured by the Milky Way in the intersection region
and

the Sun and our Solar System, due to complex interaction with the gravitational field of the Milky Way and with the interstellar dust and gas and Dark Matter of both the Sagittarius Dwarf and the Milky Way, an interaction time that, if the Sun first entered the Milky way within 4 kpc from its present position and moved to its present position at an average speed of 200 km/sec, could have been as long as about 10 million years,
changed its orbital direction from perpendicular descent into the Milky Way galactic plane to its current 200 km/sec motion in a Milky Way galactic plane orbit.

The Capture Conjecture would be supported by data showing that:

the Solar System inherited its Ecliptic Plane from the Sagittarius Dwarf

and

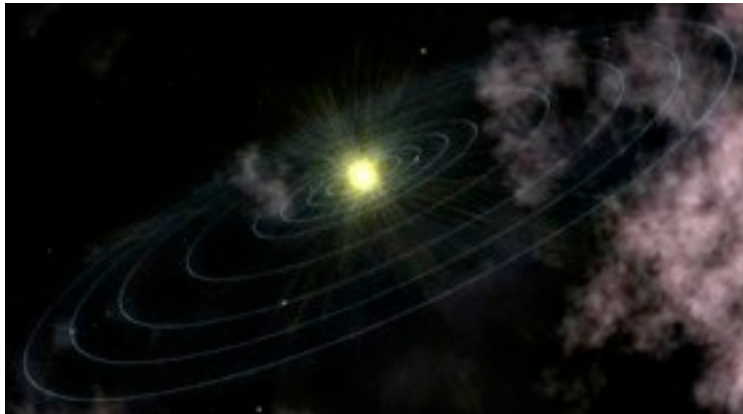
the Solar System is still embedded in dust and gas from the Sagittarius Dwarf.

**The Sun and our Solar System over the past 10 million years
changed its orbital direction
from perpendicular descent from the Sagittarius Dwarf
into the Milky Way galactic plane
to its current 200 km/sec motion in a Milky Way galactic plane orbit.**

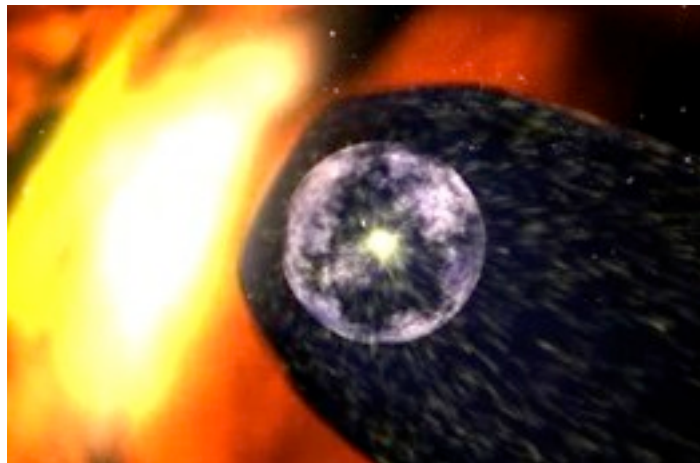
The change in direction would be due to complex interaction with the gravitational field of the Milky Way and with the interstellar dust and gas and Dark Matter of both the Sagittarius Dwarf and the Milky Way.

The 10 million year upper bound on the interaction time is because, if the Sun first entered the Milky way within 4 kpc from its present position and moved to its present position at an average speed of 200 km/sec, it would have taken as long as about 10 million years to complete the transition to its present state.

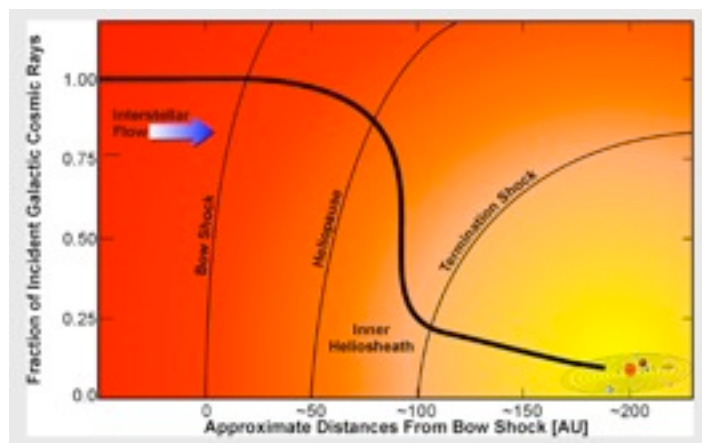
The Solar System (three images from NASA IBEX web site)



may have been enclosed in an interstellar bubble



that reduces our exposure to high energy (greater than 100 MeV) cosmic rays



and

so have maintained the same Ecliptic Plane and ambient interstellar dust and gas throughout the transition whereby the bubble became disconnected from the influence of the Sagittarius Dwarf and became a captive part of the Milky Way.

Are there any events in the past 10,000,000 years of Earth History that might be related to a Milky Way Capture Process?

Prior to Capture, 23,639,040 years ago (the Three Sequences Calendar period calculated in 26 BC China as the Santong Li) Dolphins appeared as the most advanced life forms on Earth. The following dates are very approximate:

3,000,000 years ago the present Ice Age began.

2,000,000 years ago the Yellowstone volcanic caldera erupted, venting 2500 cubic kilometers of ash.

788,000 years ago the latest reversal of Earth's magnetic field occurred.

340,000 years ago the Geminga supernova irradiated Earth, and Neanderthals displaced Homo Erectus.

160,000 years ago Modern Humans displaced Neanderthals.

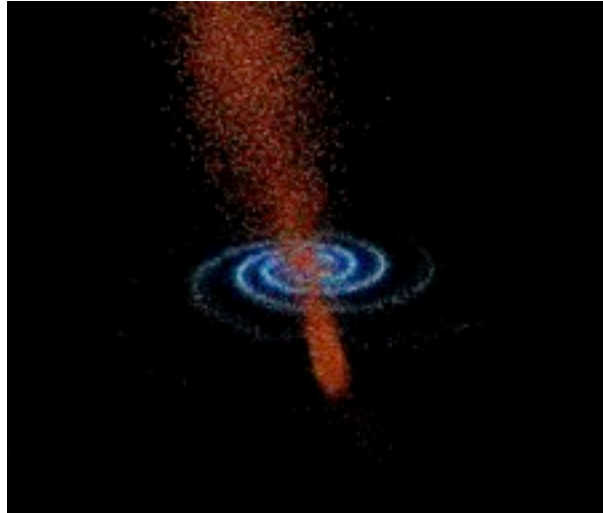
11,600 years ago the Younger Dryas cold snap was followed by the Vela X supernova and fragmentation of the Taurid/Encke Comet, and then by a very sudden(50 years or so) warming event that ended the Ice Age.

The Solar System may have inherited its Ecliptic Plane from the Sagittarius Dwarf:

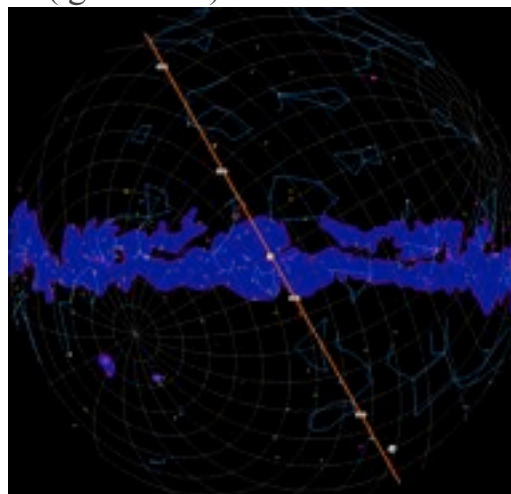
Majewski, Skrutskie, Weinberg, and Ostheimer in astro-ph/0304198 said:

“... the Sagittarius Dwarf debris plane is similar to that of the [Solar System] ecliptic ...”.

The 24 September 2003 space.com article contains an image



showing that the galactic plane of the Sagittarius dwarf is tilted about 70 degrees from the galactic plane of the Milky Way, which is indeed “similar” to the ecliptic plane of our Solar System (gold line) that is tilted about 60 degrees



from the galactic plane of the Milky Way. This led Matthew Perkins Erwin and Dan Eden to be the first people (afaik) to support the Capture Conjecture (see a viewzone2.com web article at /milkywayx.html and milkyway22x.html).

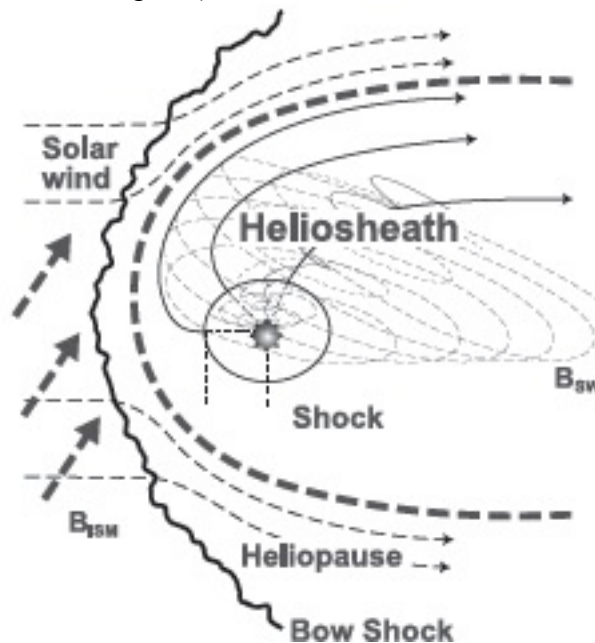
The Solar System is still embedded in dust and gas from the Sagittarius Dwarf.

Opher, Stone, and Gombosi in 0705.1841 [astro-ph] said:

“... **The Orientation of the Local Interstellar Magnetic Field**

...

The orientation of the local interstellar magnetic field introduces asymmetries in the heliosphere that affect the location of heliospheric radio emissions and the streaming direction of ions from the termination shock of the solar wind. ...[(image from 0905.1120 by Lazarian and Opher)



]... We combine observations of radio emissions and energetic particle streaming with extensive 3D MHD computer simulations of magnetic field draping over the heliopause to show that

the plane of the local interstellar field is about 60 to 90 degrees from the galactic plane.

This suggests that the field orientation in the Local Interstellar Cloud differs from that of a larger scale interstellar magnetic field thought to parallel the galactic plane. ...

the galactic plane (GAL) ... is 120 degrees from the ecliptic plane ...

Based on the fact that the galactic magnetic field is oriented nearly parallel to the galactic plane...[it has been]... suggested the local interstellar magnetic field (in the local neighborhood of the sun) was also parallel to the galactic plane. ...

The interstellar magnetic field is frozen into interstellar plasma that is deflected around the heliopause, causing the field to drape over the heliopause.

...

We considered several directions of interstellar magnetic field:

the hydrogen deflection plane... HDP ... ;

the galactic plane ... GAL ... ;

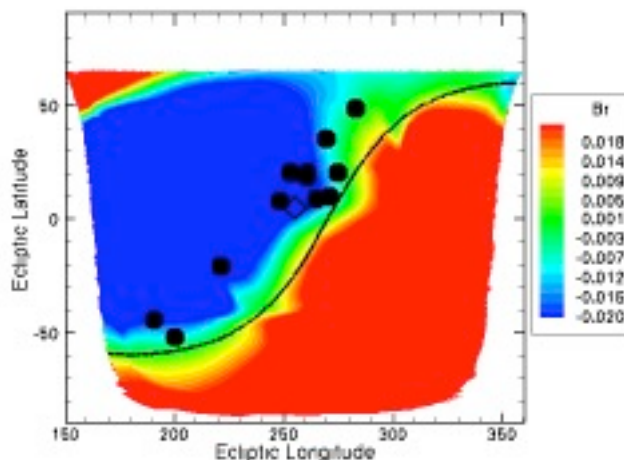
and the plane perpendicular to the galactic plane (PPG)

with different inclination angles α , where α is the angle between the interstellar magnetic field and interstellar wind velocity.

In the model coordinate system, with β being the angle between the interstellar magnetic field and the solar equator,

HDP correspond to $\beta=60^\circ$, GAL to $\beta=120^\circ$, and PPG to $\beta=44^\circ$

...



...[The above figure]... indicates that the heliopause is strongly influenced by the interstellar magnetic field direction ... and has a plane of symmetry approximately parallel to the plane of the local interstellar magnetic field

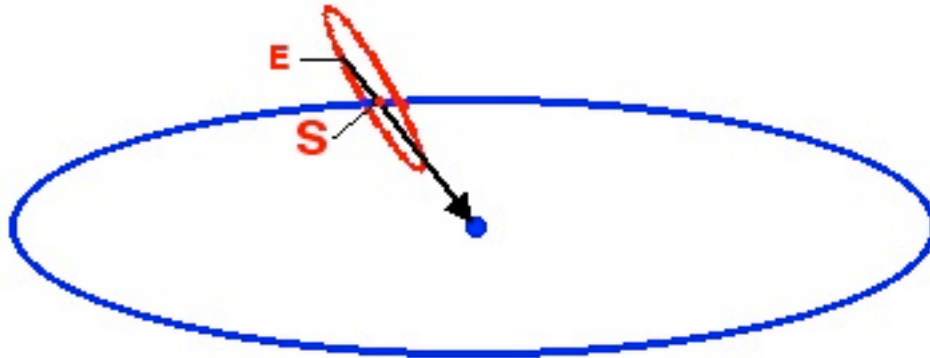
...

The second set of observational data that we used to constrain the orientation of the local interstellar magnetic field was the streaming ions from the termination shock ... we showed that an interstellar magnetic field in the HDP could distort the termination shock in a direction that explains the TSPs outward streaming at [Voyager I] V1. ...

we find from Voyager observations that the plane of the local interstellar magnetic field is not parallel to the galactic plane, but 60° to 90° from that plane (rotated clockwise from a view from the Sun). This suggests that the field orientation in the Local Interstellar Cloud differs from that of a larger scale interstellar magnetic field thought to parallel the galactic plane. ...”.

Earth and Milky Way in 2012

Since the Milky Way Galactic Center (blue dot at center of blue circle)

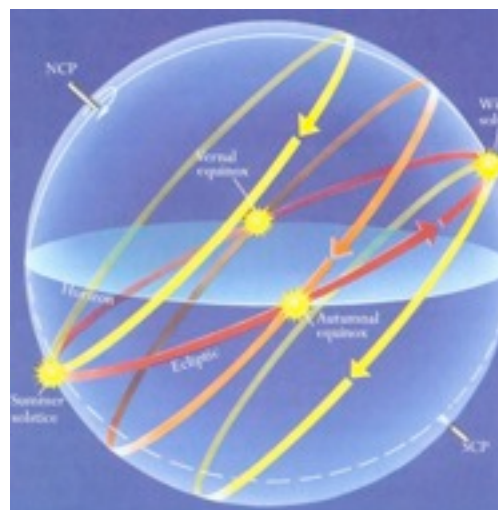
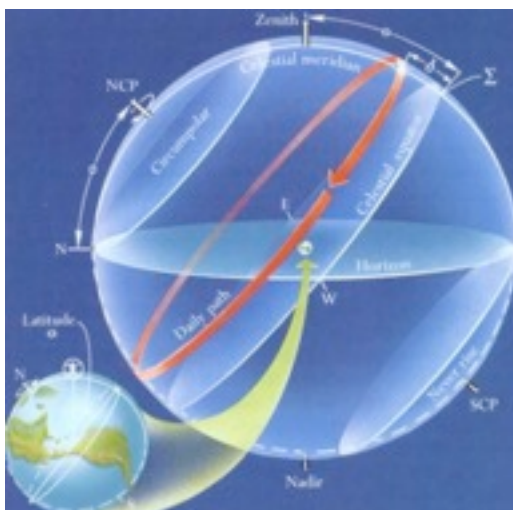


is in both the Milky Way Galactic Plane and the Ecliptic Plane of our Solar System (red circle = Earth (E) orbit, red dot = Sun (S)) it is possible for the Earth to line up with the Sun and the Milky Way Galactic Center so that, from the Earth, the Sun appears to be at the Milky Way Galactic Center.

If the configuration had very simple geometry, then this would happen every year, once in each Earth orbit around the Sun (until the motion of the Solar System in its 240 million year Milky Way orbit moves the Ecliptic Plane away from its present configuration)

but

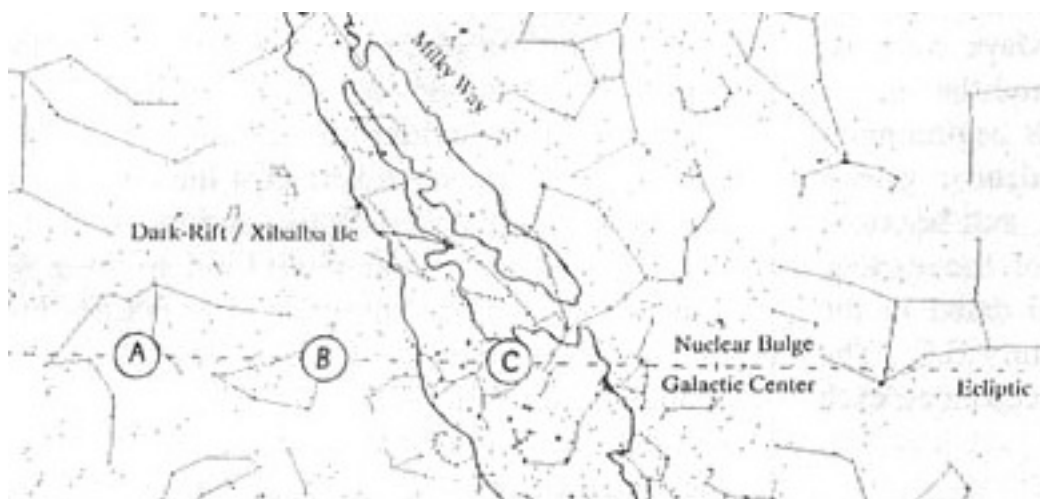
the Earth spins on its axis oriented about 23.4 degrees away from being perpendicular to the Ecliptic Plane, and that axis precesses with a period of about 26,000 years. A web page by Jim Kaler at stars.astro.illinois.edu/celsph.html says: "... The celestial sphere ...



... As ... the Sun ... moves along the ecliptic against the background stars ... the Sun ... appears also to move north and south of the celestial equator ... the Sun appears to move against a band of 12 ... Zodiac ... constellations ... [such as, during the present precessionary epoch,]... Sagittarius ... December 18 ...[to]... January 20 ...[On December 22, the Sun reaches its most southerly extent, at a declination of 23.4 degrees south, at the Winter Solstice ...”.

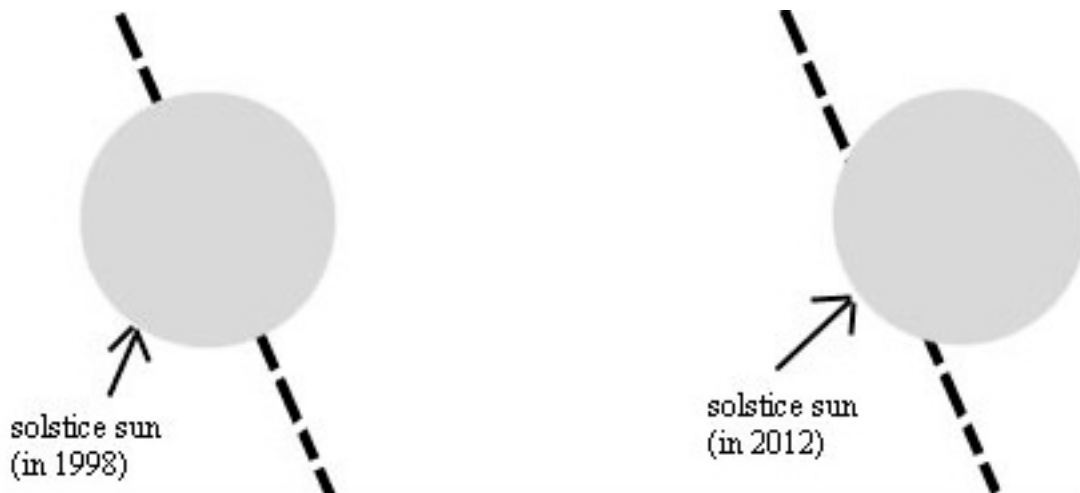
Since the Milky Way Galactic Center is in Sagittarius at a declination of about 29 degrees south, the closest approach of the Sun as it appears from Earth will be at Winter Solstice during the present precessionary epoch when the Winter Solstice Sun is in Sagittarius.

John Major Jenkins on an alignment2012.com/whatisga.htm web page said: “... we can visualize the 2012 Galactic Alignment ...



... Position A is when the December solstice sun was ... some 3,000 years ago. Position B is 1,500 years ago ... Position C is “era-2012”, when the December solstice sun has converged, as a result of the precession of the equinoxes, with ... the Galactic equator ...

The precise alignment of the ... center-point of the body of the sun as viewed from earth ... with the Galactic equator was calculated to occur in 1998 ... The sun is one-half a degree wide. ...



... Therefore, the sun, on the December solstice, will take approximately 36 years to precess through the Galactic equator ... Thus, the Galactic Alignment ...

“era-2012” ... is 1998 +/- 18 years ...

1980-2016. ...

This Galactic Alignment occurs only once every 26,000 years, and was what the ancient Maya were pointing to with the 2012 end-date of their Long Count calendar ...”.

Terence McKenna on Art Bell radio show 5/22/97 said:

“... .. I've got a formal mathematical theory [based in part on the King Wen Sequence I Ching] that ... produce[s] ... a time-scale wave ...

by fitting known historical and paleontological and geological data into these waves at different scales, I was finally able to discern a best fit. ...

... There is only one point in the entire cycle where ... the universe is actually evolving some kind of process of self-metamorphosis, and human beings indicate that we have crossed some boundary into some new era, a new epoch of ever greater acceleration into this process of self-revelation. ... that point occurs on this solstice date in 2012. ...”.

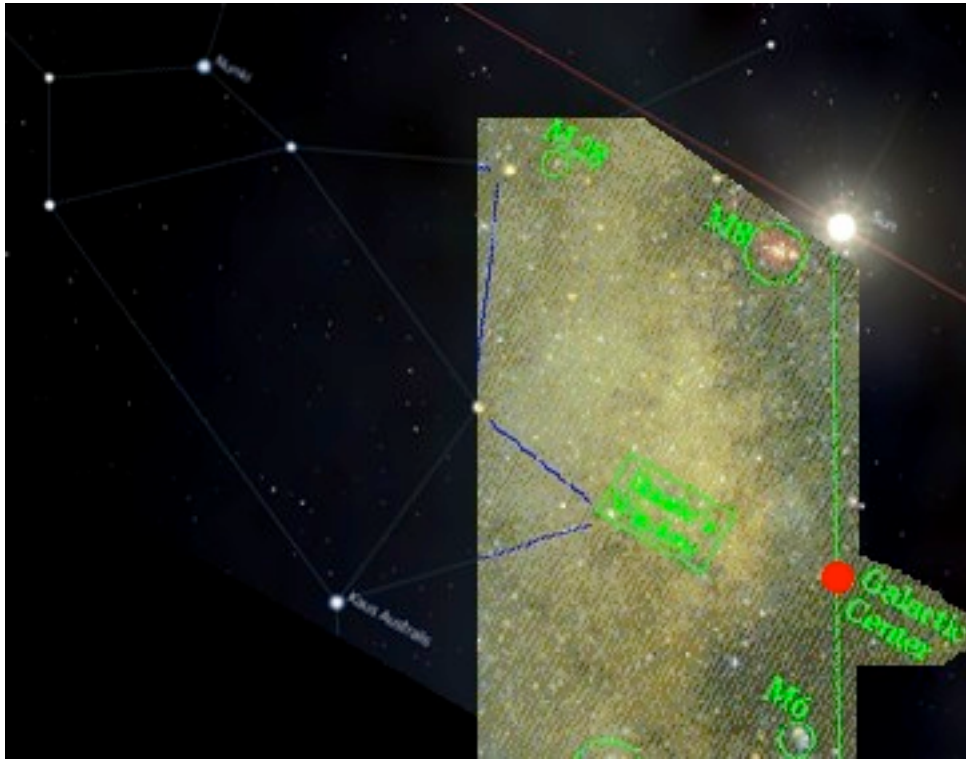
So, the Terence McKenna theory and the Mayan calendar point to December 2012 as significant date in Future History:

What is the astrophysics of the December 2012 Galactic Alignment ?

The Moon and planets are NOT significantly aligned with the Sun:



The Sun is NOT directly aligned with the Galactic Center:



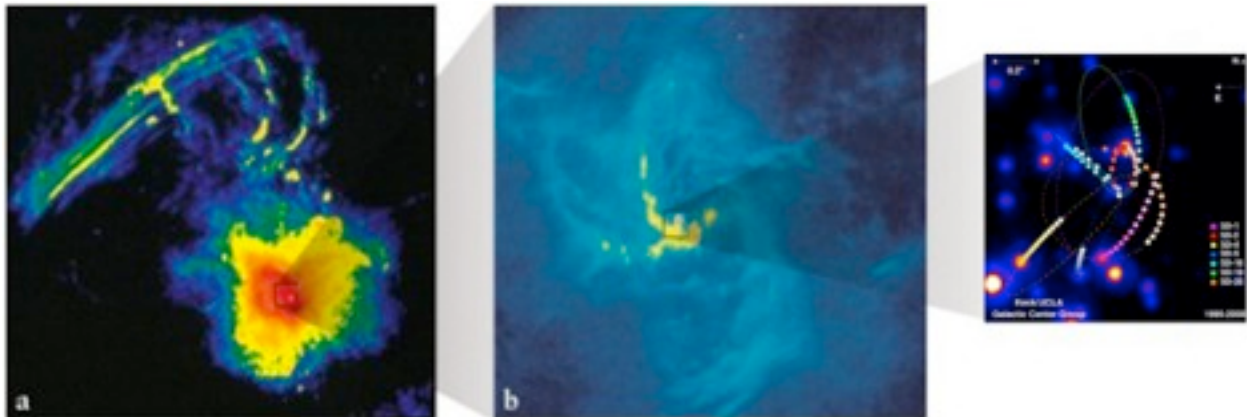
but is in a relatively tranquil region of Sagittarius



during the December 2012 Winter Solstice.

Galactic Center Sagittarius A* is Starved Black Hole:

Vicki Sarajedini on a www.astro.ufl.edu/~vicki/ast3019.html web site said:
“... Radio Image (80 pc across) shows feature SgrA and radio filaments
Radio image (10 pc across) shows feature known as SgrA* - thought to be position
of SMBH ...



...[third image from paper by Mark Reid 0808.2624 [astro-ph]]... Investigate IR stellar motions in region of about 1 pc across ... to estimate BH mass
... Velocities consistent with Keplerian motion (all mass at center)
 $M = 2.6 \pm 0.2 \times 10^6 M_{\text{sun}}$
... Curvature of the paths near SgrA* constrain the volume of the mass to about Schwarzschild radius (few $\times 10^6$ km), supporting SMBH theory.

...
Chandra S-ray image of SgrA* ...



Rapidity of ... X-ray flares indicates they originate near the Schwarzschild radius of the BH. Even during the flares, X-ray emission from the nucleus is relatively weak. Suggests that SgrA* is a starved black hole, possibly because explosive events in the past have cleared much of the gas from around it. ...”.

Gamma Ray Bubbles and Milky Way Nuclear Starburst:

Su, Slatyer, and Finkbeiner in 1005.5480 [astro-ph] said:

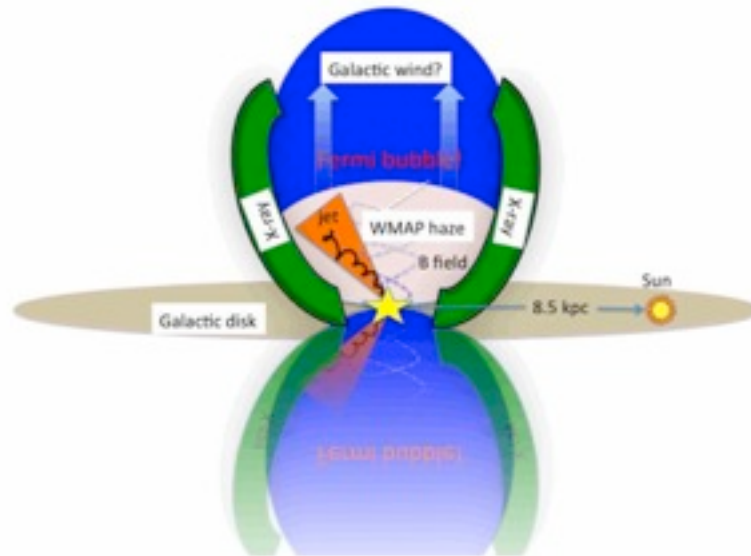
“... Data from the Fermi-LAT reveal two large gamma-ray bubbles ...



... extending 50 degrees above and below the Galactic center, with a width of about 40 degrees in longitude.

...

Two blue bubbles symmetric to the Galactic disk indicate the geometry of the gamma-ray bubbles observed by the Fermi -LAT. ...



... Morphologically, we see corresponding features in ROSAT soft X-ray maps, shown as green arcs embracing the bubbles. The WMAP haze shares the same edges as the Fermi bubbles (the pink egg inside the blue bubbles) with smaller extension in latitude. ...

both bubbles ...[have]... a total power ... in the 1 to 100 GeV band of 2.5×10^{40} GeV/s or 4.0×10^{37} erg/s, which is about 5% of the total Galactic gamma-ray luminosity between 0.1 to 100 GeV ...

we envisage the bubbles as hot low density (n about $10^{(-2)}$ $\text{cm}^{(-3)}$) cavities filled with about 2 keV gas, with (from the Fermi data) height about 10 kpc, expanding at velocity $v \leq 10^3$ km/s: thus we estimate the energy of the Fermi bubbles to be about 10^{54} to 10^{55} erg, with an age of about 10^7 $(v/1000 \text{ km/s})^{(-1)}$ yr

...

the central MBH in our Milky Way ... with an estimated mass of MBH about 4×10^6 M_{sun} ... has extraordinarily low bolometric luminosity of about 10^{36} ergs/s, and so is currently in its quiescent dim state ...

Clearly the MBH has not always been so underluminous: it may have experienced a long active state in the past few million or tens of million years through one or more accretion events, driving jets out of the disk, shocking the ambient material, producing both gamma-rays and CRs, and appearing more similar to normal lowluminosity AGN ...

If the MBH were radiating at the Eddington luminosity, it would take only about 10^3 to 10^4 years to reach the estimated energy of the Fermi bubbles; for a percent level accretion rate (about 10^{42} erg/s), it would take about 10^5 to 10^6 yr, comparable to the estimated cooling time of the electron CRs.

...

... The Fermi bubble structures were likely created by some large episode of energy injection in the GC, such as a past accretion event onto the central MBH, or a nuclear starburst in the last about 10 Myr

...

in ... a nuclear starburst ...[the]... wide opening angle of the bubbles is not a problem ... the bubble shape is similar to that observed in NGC 3079, and the X-ray features observed by ROSAT are similar to those observed in other nearby starburst galaxies. However, no corresponding $H\alpha$ signal of the Fermi bubbles is observed, in contrast to other known starburst galaxies ... Moreover, radioactive ^{26}Al (half-life about 7.2×10^5 yr) is believed to be mainly produced by massive stars, supernovae, and novae in the Galaxy ... One expects strong ^{26}Al gamma-ray emission concentrated towards the GC, with a flux comparable with the total gamma-ray flux from the disk, if the outflow was produced by a starburst ... However, such a strong concentration at the Galactic center is not found ... indicating that the accretion activity of Sgr A* is more plausible as the origin of the mass outflow.

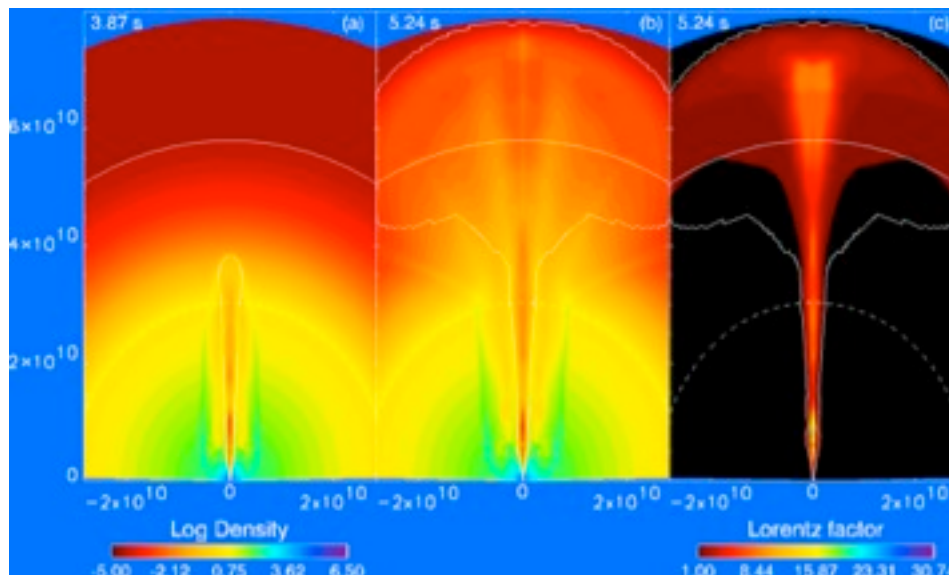
...

What is the future of the Fermi bubbles, are they in a “breakout” stage?

An interesting possibility is that the northern arc and even part of the Loop I feature are parts of the relics of previous bubbles, and the bubble production is a periodic process. The bubbles might be fast expanding shocks which might finally expand freely into the galactic halo ...”.

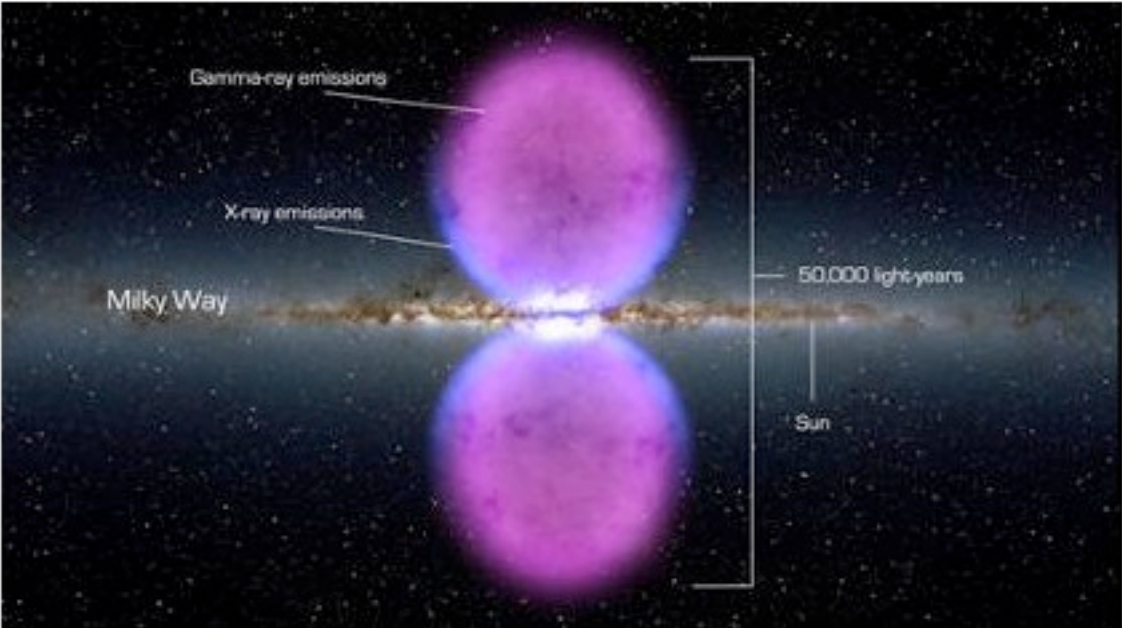
Aloy, Muller, Ibanez, Marti, and MacFadyen in material (including MPA preprint 1226e, November 1999 draft) on a /www.mpa-garching.mpg.de web site said: “... GRBs are located at cosmological distances, and have a gamma-ray energy output that can be as large as 10^{54} erg ...

Its collapsing core forms a rotating black hole, which then grows by sucking in the rest of the star within about ten seconds. In a complicated process the liberated gravitational binding energy of the accreted matter leads to an energy deposition preferentially in regions near the rotation axis and close to the horizon of the black hole. This causes a collimated relativistic outflow or jet along the rotation axis which eventually gives rise to a GRB. ...

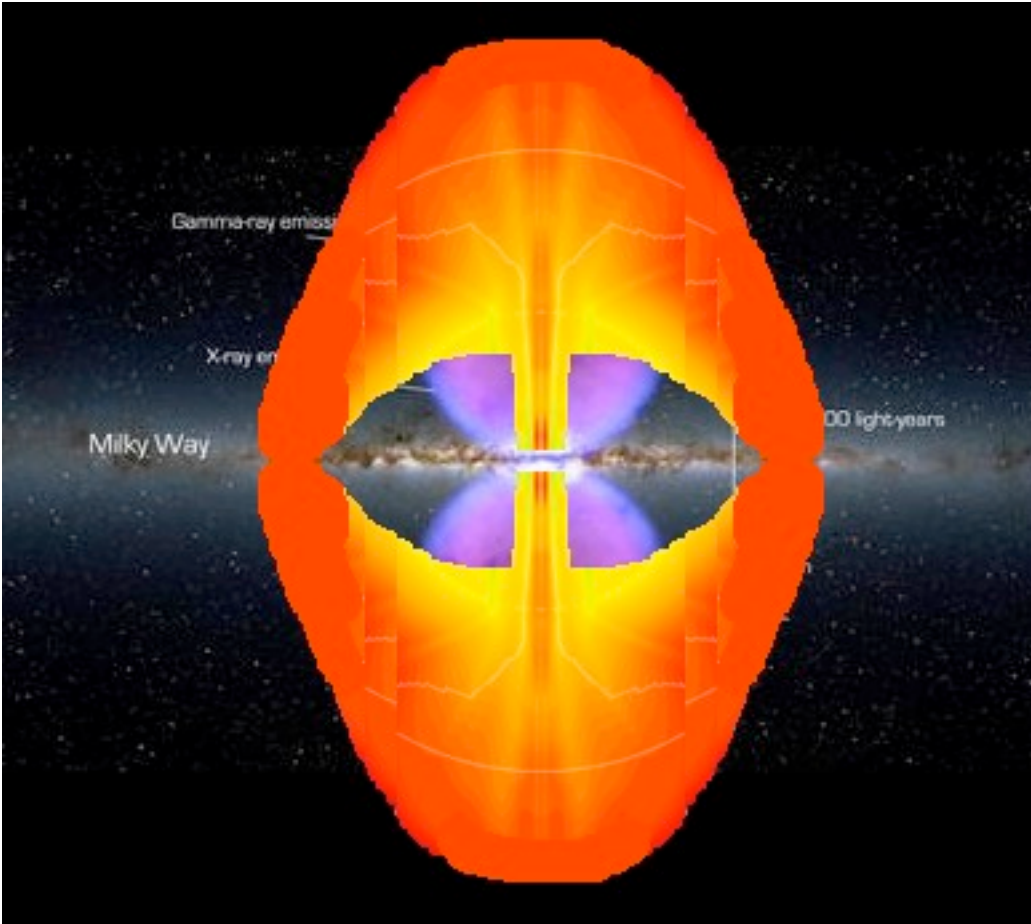


... The collapsar scenario predicts a supernova-like event ...”.

Such a Milky Way Breakout Event might look like a transition from



to



Galactic Surfing

Here is my speculation about how inter-galactic beings like the Black Cloud of Fred Hoyle or the "... molecular quantum computing cloud that would be able to absorb magnetic and light energy from planets and stars, compute information, and move in space by using light pressure ..." as proposed by Arvydas Tamulis (see the book *Life in the Universe* by Schulze-Makuch and Irwin) with lifespans of at least tens of million of years might now be having fun surfing the Milky Way:

At least tens of millions ago the Sagittarius A* black hole in the Milky Way Center was a storm, as Vicki Sarajedini of U. Florida says at <http://www.astro.ufl.edu/~vicki/ast3019.html>

"... Chandra X-ray image of Sgr A* ...

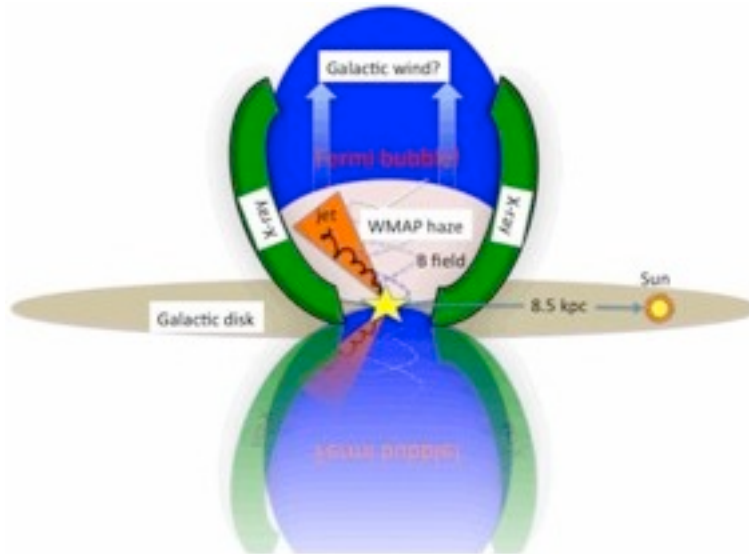


... Even during ... flares, X-ray emission from the nucleus is relatively weak. Suggests that Sgr A* is a starved black hole, possibly because explosive events in the past have cleared much of the gas from around it ...".

The Sgr A* Storm has as of now generated huge swells as Su, Slatyer, and Finkbeiner in 1005.5480 [astro-ph] say "... Data from the Fermi-LAT reveal two large gamma-ray bubbles



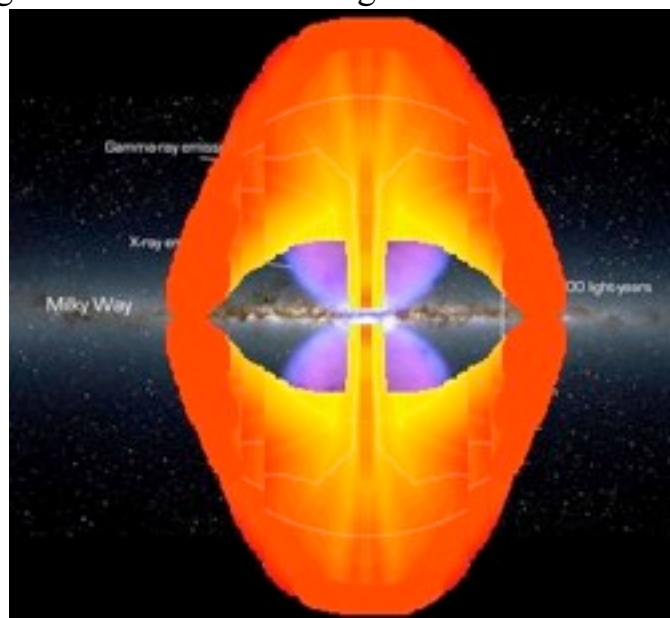
extending 50 degrees above and below the Galactic center ... [that] were likely created by some large episode of energy injection ... such as a past accretion event onto the central MBH [Massive Black Hole - Sgr A*]... in the last about 10 Myr ...



... are .. the Fermi bubbles ... in a "breakout" stage ? ...".

Breakout Stages of GRBs are described by Aloy, Muller, Ibanez, and MacFadyen in material (including MPA preprint 1226e, Nov 1999 draft) on a www.map-garching.de web site which has nice computer simulations.

When you superimpose those GRB simulations on the image of the Fermi bubbles, you get a nice image of a Galactic Breaking Wave



on which the Black-Coud Beings could be surfing in the future (maybe as near as a few tens of millions of years or so) perhaps with a Galactic-Scale WipeOut event landing right here on Earth.