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Heliosphere Frontiers: Voyager 1 confirms the Forecast of the Theory – of Wave Astrodynamics

Dubna
2005

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ISBN 5– 9279 – 0072 – 0
Phoenix+, 141980, Dubna, Moscow Region, Russia,
11 June 2005;

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Heliosphere Frontiers:
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ISBN 5– 9279 – 0072 – 0 © Phoenix+, 11 June 2005

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COSPAR Associate: Member of International organization - Committee on Space Research (COSPAR) - Member of B, D, E Scientific Commissions.

(COSPAR - most competent international organization, connected with fundamental interdisciplinar investigations of Space).

Author of the (Mega) Wave Universe Concept.

Abstract

Observations of the Voyager 1 confirm the forecast of Wave Astrodynamics [Chechelnitsky 1980-2005], widely represented in 1992 and persistently repeated during past time: **Transsphere** (Plasma Barrier - Standing Shock Wave - zone of transonic current of space plasma; by **conventional** astrophysics are used less certain **phenomenological** terms - Termination shock, **Heliopause**) will be found at heliocentric distance of 90.5 astronomical units (AU)

At Edge of Solar system.

The man-made miracle of scientific and technical thought - a space vehicle Voyager 1 more and more removes from the central region of Solar system.

It has been launched in 1977. About three tens years of an active life in open space - it is in itself worthy admiration.

But it still does not cease to surprise researchers with its unique information.

Observations: As always - Unexpectedness...

The information of last time obtained from a board of Voyager 1 forced astrophysicists- observers not only simply to think, but has caused intense, fierce dispute.

The beginning to it was put by the simultaneous publication of two articles in *Nature* [Krimigis et al. 2003; McDonald et al.2003].

Dispute is not resolved till now –as subsequent articles in various journals testify.

To the publication [Lallement R. et al. 2005] in *Science* it was given, obviously, great importance; - not each work in this journal is accompanied by two separate comments (one of them is the article - comment of known expert Jokipii J. R.).

As also this article could not resolve dispute, such attention testifies, more likely, about understanding by journal of extreme importance of the theme and of the problem, than about the achieved successes in its decision.

Questions and Problem.

If to try to be extremely brief, the essence of dispute consists in a question:

What actually "sees" recently the Voyager 1?

Is it a some distinguished Barrier of Solar system?

***Is it**, more specially, -a Termination shock, shock wave, **Heliopause**?*

***Is it** a physical boundary of Solar system?*

As (by known publications in the literature) observers use very simple models and saving numerical modeling, they cannot answer even a "simple" question:

Where, actually, is (especially, there should be) an observanting obviously unusual Phenomenon, on what distance from the Sun?

Whether it is localized, whether is not distributed widely in space?

Science without Theory - is blind.

All this arisen situation is the next illustration to the thesis which is known and obvious for a long time: *There Is nothing of more practical, than the effective Theory.*

Any **tense** efforts in style " What I see – the same I and sing ", even plentifully flavoured with a mathematical formalism or numerical modeling, with sudden creation of ad hoc models, can not fill an absence of efficient ideas, truly to approach to comprehension of not trivial phenomena of the Nature.

But the Theory speaks...

On the problem which is nowadays in the center of attention in connection with the unique information receiving from a board of the Voyager, the **alternative** theory - Wave Universe Concept, its section - Wave Astrodynamics had spoken already for a long time.

For simplicity we shall result the fragments only some from numerous publications [**Chechelnitsky** 1992-2004], investigated the megawave structure of Solar system.

The Forecast: Prediction.

[Chechelnitsky 1992]:

"*Heliosphere Boundaries. Heliopause*…There are reasons to expect that the… (Heliopause) (Transsphere) may be discovered at the heliocentric distance $a= a^{[4]}_{*} =…=$ **90.447** AU"

[Chechelnitsky **1999, p.80]:**

"… The Standing shock wave inside which there is a Heliosphere, will be found out at heliocentric distance $a^{[4]}_{*}$ = 90.447 AU... "

[Chechelnitsky 2000, Abstract, COSPAR Colloquium, Potsdam]:

"There are theoretical reasons to expect, that Heliopause may be found at the distance a=90.5 AU.

It must be expected, that the existence of the Heliopause at the distance a=90.5 AU will be opened at the beginning of XXI Century".

[Chechelnitsky 2002, Abstract]:

"There are theoretical reasons to expect, that Heliopause may be found at the distance a=**90.5** AU. "

Etc…

Let's note only, that in Abstracts (from tactical reasons) we must use habitual term Heliopause, **magnetopause** (as well as - Termination shock, Heliosheath, etc.) instead of more precise and exact term ***Transsphere*** determined by the alternative theory (Standing Shock Wave (SSW) - the Barrier of transonic current of space plasma) (see also Fig.1, taken from Chechelnitsky 2000, Hot Points...).

That speak Observations.

In themselves (not interpreted within the framework of any theories or representations) observations can speak not so much as it would be desirable.

But for them commentators speak:

Krimigis et al. 2003 assert, that they "see" the Phenomenon (Termination shock)

at distance 85 AU.

McDonald et al. 2003 deny the most courageous observers and consider, that the true meeting with Termination shock still ahead (" Voyager 1 still has not reached the termination shock ").

In May, 2005 Edward Stone, Voyager project scientist at the California Institute of Technology [NASA Press Release May 24, 2005; Reuters, May 25, 2005 11:53 AM ET] asserts, that on distance " at 8.7 billion miles from the Sun ", that is 14 billion km = 93.6 AU, the Phenomenon (Termination shock) *already is crossed* and Voyager I has entered Heliosheath

Short review of opinions, doubts, expectations, connected with Voyager I information, represents by R.A.Kerr [Kerr 2005] ("…The debate has since continued without a resolution.")

The dry residue of this drama confrontation is obvious:

Anybody from observers yet is not capable to explain deeply, what actually he "sees", especially, to name the exact heliocentric distance of this causing Phenomenon. (Use of habitual

phenomenological terminology, probably, gives some confidence, but does not clear up deeply essence of an event)

But it is clear, that the Phenomenon lays in an interval 85 - 93.6 AU

And this result (as artillery " a falling nearly - far "), actually, *is the greatest achievement of experimental and observational astrophysics and space technologies.*

The alternative theory with the forecast as 90.5 AU gets in the middle of an interval allowable by observations.

We believe, that by some tense of will and efforts, the localization of the Phenomenon in area 90.5 AU can be even more precisely proved.

The substantial review of expectations of observational astrophysics of last time is given, for example, in article [Stone and Cummings 2001]. If to carry out a middle line on the first summary Figure presented in it than middle **value** of the forecast on the basis of observations also gets in area 90.5 AU. It quite corresponds also to the conclusion of authors contained in Abstract: "***Five different methods*** of inferring the distance to the shock lead to estimates that cluster ***in the range 90 ±10 AU."***

Destiny of the Forecast.

Most widely the Forecast of Transsphere position $a^{[4]}_{*}$ = 90.447 AU with the detailed comment has been represented in 1992 in the report " Wave structure of Solar system " [Chechelnitsky 1992], on World Space Congress, Washington DC, 1992. A series of preprints with the same name has been transferred for distribution to institute AIAA (Washington), including -for Library of Congress.

Since then this Forecast repeated invariably and persistently at various international conferences, in hope, that new efficient ideas will cause if only the minimal interest among habitual representations.

Persevering display of the Forecast is interesting to trace, for example, on Abstracts consistently following COSPAR Scientific Assemblies - Washington 1992, Hamburg 1994, Birmingham 1996, Texas 2002.

Anyhow (more likely under pressure of the observational data, than because of attention to efficient ideas), forecasts of standard astrophysics on the basis of observations (instead of theories)

also were gradually compressed from a wide interval 50-200 AU up to size 80-100 AU.

But, apparently, and now efficient representations not only are not adapted by mainstream.

With them simply "are not familiar" (or pretend, what it so?).

Ad Hominem.

Such phenomenon of biased selection is rather distributed in a modern science.

During an epoch of the perfect information technologies, high-speed data transmission and the Internet, the problem (as well as during former times) consists not so much in finding out new, earlier unknown laws, but in overcoming barriers and to be heard, in particular, by observers, owners (holders) of the unique primary information.

It is real ability not only to perceive and with advantage to adapt alternative representations, but also simply to hold variety of ideas in a field of the sight. Instead it dominates a conventional "uniform thinking" (with small variations in the allowed limits).

We are not inclined to discuss here why it occurs. Everyone who knows "a life of a science" not only hear a lot, can imagine and details.

But the general diagnosis is obvious:

Monopoly. Absence of wide and free Discussion

In some degree it concerns the central scientific journals.

There are Questions - and it is many of them...

Let's present one interesting, compelled and fair recognition [Reuters, May 25, 2005]:

"By monitoring the craft's speed and the increase in the force of the solar wind, Voyager scientists now believe the **craft has made it through the shock and into the heliosheath.**

Predicting the location of the termination shock was hard because the precise conditions in interstellar space are unknown and the termination shock can expand, contract and ripple, depending on changes in the speed and pressure of the solar wind.

"Voyager's observations over the past few years show the termination shock **is far more complicated than anyone thought,**" said Eric Christian, a scientist with NASA's Sun-Solar System Connection program…"

According to developed representations, the Boundary of the Heliosphere represent as physically and spatially narrow region where the Solar wind replaces a mode of the current. It is *a transonic zone* (by the way, and term ***Transsphere*** is connected to this phenomenon).

But there is a "unpretentious" question:

And what this speed? What exact value of sound speed that determines all dynamic structure of far region at Edge of Solar system?

In the answer it is possible to hear set of words about significant difficulties of space researches.

Values with which commentators operate, are connected to habitual speeds of the Solar wind [NASA Press Release]: "The termination shock is where the solar wind, a thin stream of electrically charged gas blowing continuously outward from the Sun, is slowed by pressure from gas between the stars. At the termination shock, the solar wind slows abruptly from its average speed of **300 to 700 km per second** (700,000 - 1,500,000 miles per hour) and becomes denser and hotter."

Wave Astrodynamics answers this question definitely and precisely, and the answer considerably differs from habitual. But it is a subject of other, special discussion.

"Rubicon is crossed. "

We believe, it is possible with sufficient reason to apply these well-known words to the information promulgated **by** Stone & Team on May 24, 2005 about overcoming of a significant Boundary at Edge of Solar system. *It is the fine, impressing result, a finale chord of long work of many astrophysicists-**observers**.*

And is it the End...?

Once again we will address to developed representations.

The standard astrophysics habitually using known planetary analogies, represents a discussed Phenomenon of Solar system (which it names - Termination shock), as the Limit, after which

begins already essentially another boundless space - interstellar space.

But it not so.

According to representations of Wave Astrodynamics, beyond the $G^{[2]}$ Shell of Solar system (in which there are planets-giants - Jupiter, Saturn, etc.), the quite real Trans -Pluto $G^{[3]}$ Shell follows, in beginning there is **detected** nowadays by Voyager I a Phenomenon - **Transsphere** -Termination shock) . This $G^{[3]}$ Shell reaches up to heliocentric distances a little exceeding 550 AU

About its existence speak, in particular, aphelions of extreme, long- periodic comets. Physical manifestations (in particular, radio signals) may be expected from dominant orbits at distances 129.5 AU and 181 AU.

Thus, influence of the Sun and in these regions does not come to an end (but that is not heliopause) [see Chechelnitsky 1992, etc.].

And on distances beyond Transsphere 90.5 AU the sovereignty and domination of the Sun proceeds

That means, it is not yet the End of Solar system.

The deep understanding (as well as researches of far edges) of Solar system just begins.

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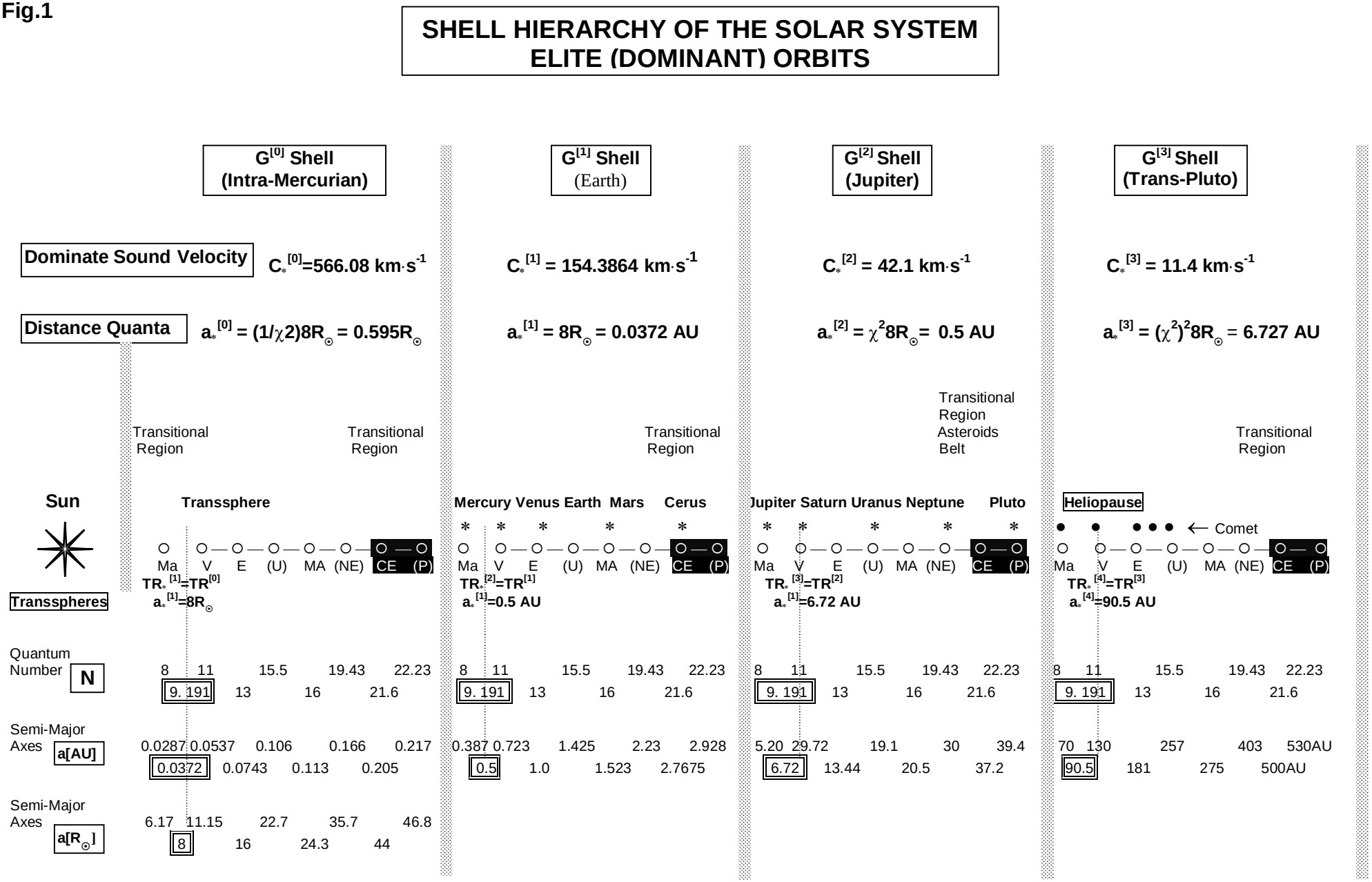
Fig.1



χ = 3.66(6) – Fundamental Parameter of Hierarchy (Chechelnitsky Number) (χ^2 = 13.4444)