Age of the Universe from the Degree of Curvature of the Major Arms of Spiral Galaxies

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Abstract: The degree of curvature of the major arms of the massive spiral galaxies leads to the correct age of the Universe equal to about 21.6 Gyr.

1. Introduction

Ludwig *et al.* (2009) derived solar ages from 1.7 to 22.3 **Gyr** [1] – we can read it in some recapitulation concerning the ages of stars [2]. The upper limit is very close to the age of the Universe obtained within the Scale-Symmetric Theory (SST), about 21.614(96) **Gyr** – we claim that we cannot see the initial period 7.75 **Gyr** of evolution of galaxies [3]. On the other hand, within the Cosmological Standard Model (CSM) we obtain ~13.8 **Gyr**. Such a big discrepancy follows from the wrong interpretation of the Michelson-Morley experiment. In reality, due to the quantum entanglement, the speed of light c is the speed of photons in relation to a source of them or in relation to an object with which the photons interacted for the last time. Detectors are always the last-interaction objects so they measure always the speed of photons equal to the c.

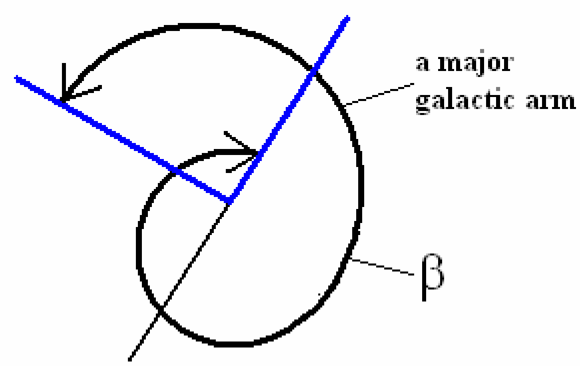

Fig.1
The degree of curvature $\beta = 450^{o}$.

Here we show that the degree of curvature of the major arms of the massive spiral galaxies leads to the correct age of the Universe equal to about 21.6 **Gyr**.

Here the degree of curvature β **[°]** is the central angle defined by a major arm of a spiral galaxy (Fig.1).

The tidal locking (or a mutual spin-orbit resonance) of the Moon and the Earth caused that the rotation and revolution periods of the Moon are the same. In paper [4], we showed that similar processes caused that the period of rotation of protogalaxies (so of the present-day galaxies as well) was (and still is) equal to the period of spinning of the baryonic part in the very early Universe. The baryonic part was built of the protogalaxies and the cosmological period, $T_{cosmological}$, of such a baryonic loop was [4]

$$T_{cosmological} = 1.201 \textbf{ Gyr} . \qquad (1)$$

Our exact result 1.201 **Gly** is close to the observational result ~1 **Gyr** [5].

2. Evolution of the main arms in the Milky Way and other galaxies

The Milky Way was formed from the four SST protogalaxies (initially it was a quadrupole) [4] so it was a binary system of binary systems. It means that we should observe 2 major arms and 4 minor arms (Fig.2). The initial distance between the 2-protogalaxy systems was bigger than the distance between the protogalaxies in the single binary systems. It caused that initially the temperature along the direction defined by Scutum-Centaurus arm and Perseus arm was lower than for the two other directions – it leads to conclusion that the two major arms should contain old stars while the four minor ones should contain younger stars and gas.

The observational data show that there are the two major arms (the Scutum-Centaurus and Perseus) containing old stars, and three or four minor ones (the Norma, Carina-Sagittarius, Orion-Cygnus, and ?) containing gas and young stars. Probably the Norma arm is composed today of two very close arms which practically overlap (Norma and Norma-bis?).

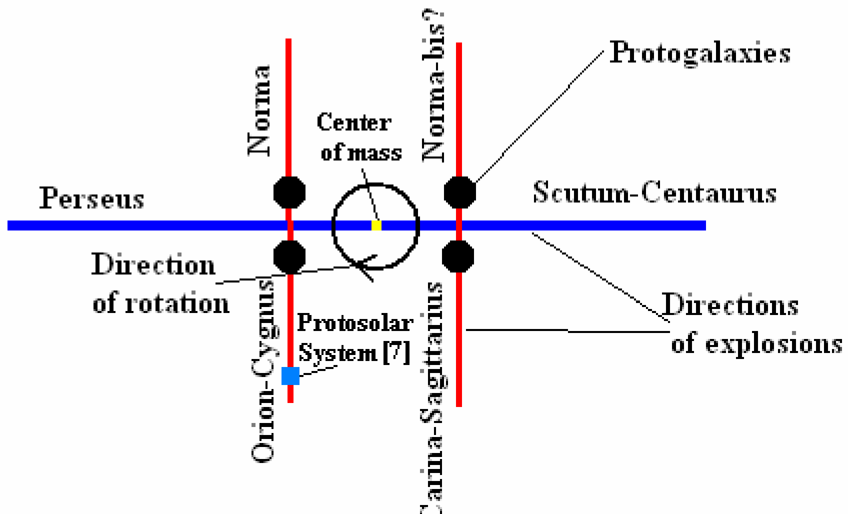

Fig.2
Orientation of arms in the very early Milky Way.

The spiral galaxies that evolved from binary systems of the SST protogalaxies should have only two main arms. The M31 galaxy (Andromeda) evolved from 8 protogalaxies so the arrangement of the major and minor arms should be more complicated.

3. The angular delay for rotation of the edge of galactic disc in relation to rotation of the surface of the galactic bulk

From formula $\alpha_i = G_i M m / (c \hbar)$ where α_i is a coupling constant and G_i is the associated constant of interactions [6], and from the invariance of spin of loop for a constant mass of the loop: $m v_{Orbital} r$ = **const.**, we obtain that period of spinning/rotation, $T = 2\pi r/v_{Orbital}$, is inversely proportional to squared coupling constant

$$T \sim 1 / \alpha^2 . \quad (2)$$

The period of rotation $T_{cosmological}$ = 1.201 **Gyr** is characteristic for the interior of the Monoceros ring [4]. Inside and near the galactic bulk there dominated the nuclear strong (α_S = 1 [6]) and nuclear weak interactions ($\alpha_{w(proton)} = 0.0187229$ [6]). On the other hand, on the edge of the baryonic disc dominated the nuclear strong interactions so from the proportionality (2) we have

$$f = T_{edge} / T_{cosmological} = [(\alpha_S + 2\,\alpha_{w(proton)}) / \alpha_S]^2 = 1.0763 , \quad (3)$$

i.e. rotation on the edge was a little slower than rotation near the central part. The delay is

$$\Delta\beta = 360^o - 360^o / f = 25.52 \textbf{ degrees} \text{ per } T_{cosmological} . \quad (4)$$

4. Age of the Universe from the degree of curvature of the major arms of galaxies

If the age of the Universe is ~13.8 **Gyr** then due to the Fig.2, we should not observe in the distant Universe the spiral galaxies. But we see them so the Universe is older.

We can see that the Milky Way (MW) has already turned N = 18 times (21.614 **Gyr** / 1.201 **Gyr** = 18) so the degree of curvature for the major Perseus arm should be

$$\beta_{MW} = \Delta\beta\, N = 459^o \textbf{ or so} . \quad (5)$$

And it is (Fig. 3 and [8]).

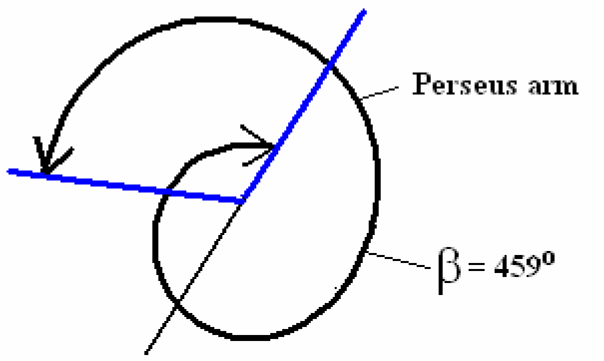

Fig. 3
Perseus arm in the Milky Way.

For the spiral galaxy BX442 at the distance 10.7 **Gyr** we obtain $\beta_{BX442} = 232^o$ **or so** – and it is (Fig.4 and [9]).

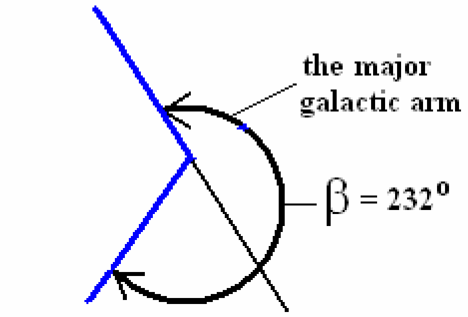

Fig.4
The major arm in galaxy BX442.

For the spiral galaxy ISOHDFS 27 at the distance 6 **Gyr** from the Earth we obtain $\beta_{ISOHDFS27} = 331^o$ **or so** – and it is (Fig.5 and [10]).

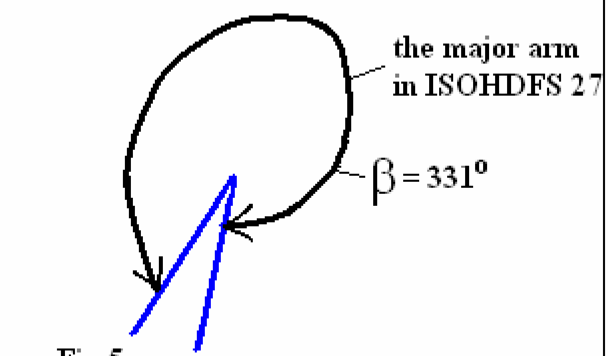

Fig.5
The major arm in ISOHDFS 27.

5. Summary

Here we derived the correct age of the Universe from the degree of curvature of the major arms of the massive spiral galaxies such as the Milky Way, BX442 and ISOHDFS 27 – it is about 21.6 Gyr as it is in the Scale-Symmetric Theory. The time distance between the SST age and the CSM age follows from the wrong interpretation of the Michelson-Morley experiment.

We can use the degree of curvature of the massive spiral galaxies to estimate ages and time distances to them – it acts as a cosmological standard ruler.

References

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