

12.B.6.4 Pulsars

The BSM analysis of the accumulated observation material about the pulsar leads to the conclusion that the pulsar is an extended object formed of kaons. It has been formed in a particular moment of the star evolution due to a crush of the protons and neutrons from the gravitational forces. This object formed of aligned straight FOHSs is much denser than the atomic matter and its adopted name IN BSM is a “kaon nucleus”. In the process of dying star the atomic matter covering the kaon nucleus is thrown and the free kaon nucleus obtains new unique properties, which will be discussed in the following sections. The new born pulsar from a dying star may still carry some atomic material around its external surface.

12.B.6.4.A. Kaon nucleus

The kaon nucleus is a large bunch of aligned FOHSs. During a normal star existence the both ends of kaons bundle are covered by atomic matter.

Fig. 12.28 illustrates a magnified portion of a sectional view of the kaon nucleus. i

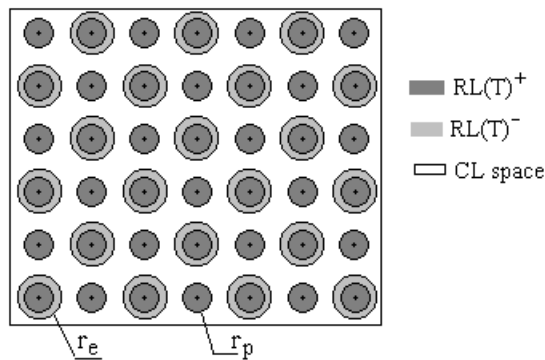


Fig.12.28. A magnified portion of a sectional view of kaon nucleus

Figure 12.28 shows the order of positive and negative FOHS’s in the kaon nucleus. Every positive FOHS contains internal positive RL(T) with central negative core. Every negative FOHS contains internal negative RL(T) and positive FOHS with internal positive structure and negative core. (see the detailed description of the kaons in Chapter 2). The both type of FOHS’s are separated by regions filled with CL space. The twisted proximity fields of RL(T) keeps the structures mechan-

ically isolated. In the same time the penetrated between them CL space is heavily modulated by the aligned RL(T). This provides conditions for a strong phase connection between the SPM vectors of the CL nodes along the gap axes. The common mode synchronization provides energy flows in closed path in a form of magnetic field (for more details see the magnetic field explanation in Chapter 2). It is evident that such arrangement of positive and negative FOHS’s is able to provide **superstrong magnetic field**, while this is not possible for the ordinary atomic matter comprised of atoms. The CL space inside the nucleus is strongly affected by the proximity IG field. Then the resonance frequency of internal CL space might be a higher harmonics of the free CL space (vacuum), so this feature may facilitate the synchronization of MQs. Then the necessary time constant for such synchronization will be reduced. When taking into account that the kaon nucleus is always in a relative motion to the galactic CL space, the reduced time constant for SPM synchronization could mean an additional strength of the magnetic field.

The shown in Fig. 12.28 magnified portion of the nucleus section is without any structural defect. In this case the superstrong magnetic field inside of the structure should be completely homogeneous. For such structure it is obvious that:

(A). The total energy of the magnetic field of the kaon nucleus is proportional to the quantity of FOHS’s.

Note: If the kaon nucleus is not burning and not involved in any interactions with matter, it still possesses a total magnetic field energy in form of reactive energy of CL space. The same is valid for any single permanent magnet.

In Chapter 6 it has been shown, that the proton (neutron) contains three FOHSs: one internal kaon (with negative external RL(R) and positive internal RL(R)) and two pions - one positive and one negative. The process of kaon nucleus formation within the star is related with partial destruction of the helical structures of the protons and neutrons. In this process the external positive shell of the protons (neutrons) is completely destroyed (into RL nodes) including its internal RL(T). The internal kaon and pions, however, may not be com-

pletely destroyed but only cut in one or two places and converted to straight FOHSs. Every survived structure get fully twisted internal RL(T) structures so it obtains a stable unit charge. In order to form a kaon bundle with alternative arranged RL(T)+ and RL(T)- kaons (as shown in Fig. 12.28) the number of the positive FOHSs must be equal to the number of negative FOHSs. The proton (neutron) internal structure (see Chapter 6 and the atomic nuclear atlas) however contain different quantity of positive and negative prisms (mostly in the internal RL structures). The FOHSs of the external positive shell and those of pions and the kaon are also not equal. Consequently, not equal number of opposite FOHSs has to be destroyed in order to obtain a stable charge balanced kaon nucleus. The external positive shell of the proton (neutron), made of wind up FOHS with length about 30 times larger than the kaon length is easier destroyable. Its destruction may provide enormous flow of positive RL nodes (corresponding to a “charged” electroweak current according to the electroweak theory terminology). The released nodes should be influenced from the strong magnetic field of the star. Mixed RL nodes (positive and negative) will provide a flow, that according to the electroweak theory corresponds to a “neutral current”. The both types of neutral current may drag and excite the atomic matter around the kaon nucleus envelope. The latter could be ionized, providing a broad band emission spectrum of lines. These are the observed jets from the dying star, in which the process the kaon nucleus gets a final grow with simultaneous final eruption of the atomic matter.

12.B.6.4.B. Environment conditions in the process of kaon nucleus destruction

Let consider the destruction of a charged balance kaon nucleus. The intrinsic mass quantity of the positive straight FOHS is included mainly in its internal RL(T) structure. The negative FOHS, however, contains both type internal lattices RL(T)- and RL(T)+. Their energy ratio is equal to the energy ratio of the same structures in the electron external shell and the positron (see §6.9.1 and 6.9.3.3 in Chapter 6):

$$(1.44 \text{ GeV})/(1.7778 \text{ GeV}) = 0.0234 (E_{D^+}/E_{D^-})$$

The destruction of any negative FOHS will provide a neutralized flow plus 2.34% charged

component, according to the above relation. (The neutralised component is equivalent to the “electroweak neutral current” according to the terminology of electroweak theory, known also as V-A theory, while the charged component is equivalent to a “charged electroweak current”). The destruction of any positive FOHS will provide only a positive component (the matter quantity in the negative central core is negligible). **Consequently the total flow from the kaon nucleus destruction will be dominated by a large positive component.**

The flow of the positive component (“electroweak charge current”) will be affected by the strong magnetic field and will be located in the jet region.

The flow of the balanced component (“electroweak neutral current”) will be not affected strongly from the axial magnetic field and could be released in a much larger spherical region. The kaon nucleus of a young pulsar may contain some atomic envelope of matter. Then it could be ionized and excited mostly by the neutral component flow.

12.B.6.4.1 Birth of pulsar

During a normal star existence the both ends of kaons bundle are covered by atomic matter. After the final explosion, however, at least one of the both ends become uncovered. Then a process of continuous destruction of RL(T) structure begins forming a jet from the free end. This process has some similarity with the process of single kaon decay in atomic coliders where the released energies, according to BSM correspond to the energy equivalence of the masses of the “bosons” (see §6.9.3.1 Destruction energy in Chapter 6). The RL(T) structures possesses much larger antipressure and consequently a built energy in comparison to CL space energy. They interacts with the CL space in a same way as the energy of bosons in the particle coliders. So the pulsar possesses a continuous operating propulsion mechanism. It is active until all kaon nucleus is exhausted. We may call the process a **kaon nucleus burning**. It has the following distinct characteristics in comparison to the characteristics of the dying star:

(a) most of the atomic matter is erupted, but small portion may still exist in the earlier age of the pulsar

(b) some inclusions of atomic matter could be trapped in the kaon nucleus

(c) the amount of the released energy from the kaon nucleus burning, in comparison to the energy of atomic matter is significantly larger.

The feature (c) could be easily estimated by the example of normal electron (see the internal electron structures of electron system = normal electron in Chapter 3). The electron system containing external negative shell with $RL(T)^-$, internal positive shell with $RL(T)^+$ and a negative central core. The maximum optical radiation from this system is $2 \times 511 \text{ KeV}$, while the total energy from destruction of both $RL(T)$ s is $1.444 + 1.7778 = 3.22 \text{ GeV}$. So the energy ratio is about 3150 times in favour of $RL(T)$ energy. Consequently the energetic signature from the FOHS's destructions will predominate significantly over any oscillation energy of the electron.

In the active stars like the Sun the magnetic polar axis coincides with the spin axis due to the inertial interaction with the Milky way CL space (see Chapter 10). In the dying star, however, the spin axis may get a change due to the reactive momentum from the erupted material. Then the spin axis of the born pulsar could not coincide any more with the magnetic field axis and the kaon bundle (and the magnetic axis) will get wobbling. In such way the reactive forces will provide two momentums - rotational and axial. The pulsar motion in this case will be similar as a coning motion of a rocket (without stabilizers). This kind of rotational motion creates radiowaves, which are detected in packets with a period (in a state of spin stabilization) equal to the rotational period of the kaon nucleus. The mechanism of the spin stabilization and the pulse radiation is described in the next few paragraphs.

12.B6.4.2. Idealized model

The kaon nucleus in the idealized model of pulsar has a shape of cylinder formed of aligned individual kaons.

In the idealized model, the axis of kaon nucleus, with a shape of cylinder, coincides exactly

with the axis of the magnetic field. In the real model (discussed later) this feature is not guaranteed, so the magnetic field is determined by the equivalent kaon axis.

The idealised pulsar model, according to BSM is illustrated in Fig. 12.29.

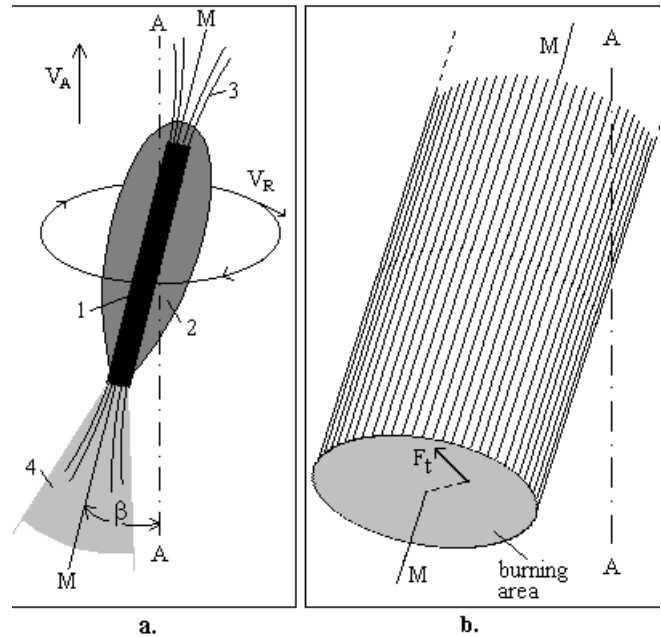


Fig. 12.29

a. Pulsar model; b. Magnified version of kaon nucleus (an idealized version)

In section a. of the figure the idealised pulsar model is shown, where:

- 1 - is the kaon nucleus (idealised shape)
- 2 - is atomic matter
- 3 - is a magnetic line
- 4 - is a jet from destructed $RL(T)$ structures
- A-A - is the spin axis
- M-M is the magnetic axis determined from kaon nucleus

V_A and V_R is respectively the axial and the rotational velocity

β is the angle between the magnetic and rotational axes

In section b. of the figure the burning end surface is shown.

12.B.6.4.3 Pulsar features

The pulsar has the following features:

Typical features:

- (a) superstrong magnetic field

- (b) proper motion
- (c) very stable secular period (estimated by integrated pulse profile)
- (d) very slow period increase with the time
- (f) high degree of polarization of emitted frequencies
- (g) glitches in the pulse sequence
 - subpulse phase drift in respect to the integrated pulse profile
 - sudden small period increase with a slow restoration of the general trend of increasing period.

Specific features:

- (h) double pulse profile
- (i) short time pulse fluctuation and discontinuities

Processes involving RL(T) structures

The pulsar is active object releasing enormous amount of energy stored in the RL(T) structures of the kaon nucleus. The flow debit of RL(T) nodes, however, is limited by the CL space parameters. The nuclear burning in fact includes two processes:

- (a) Destruction of FOHS's with their RL(T)s
- (b) refurbishing of the released RL nodes (consisting of 6 prisms) into CL nodes (consisting of 4 prisms).

The processes (a) has been clearly identified by BSM in the particle colliding experiments, and the process (b) has been inferred (see Chapter 6).

It is evident that the process (b) requires some finite time and the rate of refurbishing for unit time and space volume is a constant parameter in CL space. One good example for this is the constant time for RL(T) destruction (could say also burning) in free CL space known as a muon lifetime (2.2 usec).

It is evident that the refurbished CL nodes has to be folded. Other wise they had to increase the static CL pressure. This parameter, however, is directly involved in the Newton's mass and appears absolutely stable. Let examine the other option.

According to a definition (see Chapter 10) the partial pressure of CL space is given by

$$P_p = P_{s_c} \frac{v}{c} \alpha = \frac{h v_c v}{V_e c} \alpha \left[\frac{N}{m^2} \right] \quad [(10.10)]$$

The obtained CL folded nodes may carry their momentum in a long way through the galaxies CL space until reaching some local CL space. Then their momentum will be transferred to the matter of this local CL space. Consequently this option of the RL refurbishment into folded CL nodes is reasonable. In the same time the Zero Point Energy of the free space is kept constant from the zero point waves. Then we arrive to the following important conclusion:

(A). The refurbishing rate of RL nodes (Λ) into folded CL nodes in unit CL space volume (V) is a constant value.

$$\Lambda / V = \text{const} \quad (12.36)$$

where: $\Lambda = N_{rf} / t$ - number of refurbished nodes per unit time

The released RL(T) from the high velocity jet does undergo immediately a refurbishment. It still has highly ordered twisted shape, but without boundary core. Such structure exhibit strong charge and consequently interacts with the strong magnetic field. This interaction leads to CL space pumping and generation of quantum wave. In this process it releases a portion of its energy (due to its twisting) and then undergoes the process of node refurbishment. Similar processes, according to BSM, exists in the particle coliders (see destruction energies of RL structures in Chapter 6). Consequently the released by the jet RL(T) structure may posses a limited life. This life will depend of the strength of the magnetic field, because it has axial alignment to the FOHS's axes in the burning area. So the released RL(T) structures are well guided by the magnetic field. Then stronger magnetic field will extend the finite life of the released RL(T) structure. In the same time the density of all RL(T) component will decrease with the time, because of the large velocity and the divergence of the jet (due to the magnetic field). Then for stronger magnetic field the beginning of the refurbishing process will start at a larger volume (V). In such case according to conclusion (A) expressed by Eq. (12.36) the rate of the node refurbishment Λ will be

larger. But in the described process it is evident, that the debit flow of the jet is controlled by the refurbishing rate.

Consequently we arrive to the conclusion:

(B). The flow debit (D_F) from the jet is proportional to the total energy of the magnetic field (E_M).

$$D_F = \frac{\Phi_{RL}}{A} = \frac{N_{RL}}{At} \sim E_M \quad (12.37)$$

where: Φ_{RL} - is a flow rate, A - is the burning area, N_{RL} - number of released RL nodes, t - is unit time.

The total energy of the magnetic field is proportional to the quantity of the FOHS's in the nucleus, according to the conclusion (A) in §12.B.6.4.A. The amount of the released matter from the kaon burning for one rotational period is intrinsically small in comparison to its total matter. Consequently:

(C). For a time interval much smaller than the pulsar life the magnetic field could be considered as a constant. According to Eq. (12.37) the flow debit in this case is a constant.

Inertial interactions

The aligned FOHSs' with their RL(T) in the kaon nucleus modulate strongly the aligned gaps of the CL space between them. For this reason the kaon nucleus exhibits highly anisotropical inertial factor. This means that the motion in a direction aligned to its axis exhibits much less inertial interaction, in comparison to a motion in any other direction. For the idealised nucleus the kaon axis coincides exactly with its magnetic axes. So the anisotropy of the inertial factor could be conveniently referenced to the magnetic axis.

$I_F = f(\beta)$ - kaon nucleus inertial factor

The above dependence is a three dimensional function of β in form of prolate spheroid. The inertial interactions with CL space could be easier analysed if regarding the motion of the nucleus as two separate motions: an axial (proper) motion and a rotational motion around the axis A-A. The the inertial interactions with the CL space increases with the angle β . This engage some energy of CL space, that is not directly observable, so it is some type of reactive energy. It is analogous to

the reactive energy at the imaginary CL space separation surface, for astronomical body with a local gravitational field (see Chapter 10). Using the same analogy, the reactive energy is equal to the kinetic rotational energy and could be detected if the latter is changed.

(D). The rotational motion of the kaon nucleus involves a reactive energy of the CL space, equal to the kinetic energy of the rotation.

12.B.6.4.4 Energy radiation process and period stabilization

The mechanism of EM pulse generation by the pulsar is more specific and unique. Optical counterparts are observed only for a new born pulsars indicating that initially it may contain some atomic matter covering the kaon nucleus. After some operational time of the pulsar, this matter perhaps is ablated and if some thin layer is left it should be highly ionised. The CL space in the proximity to the kaon nucleus is heavily biased and the ionised atoms could not emit. So emission in the optical range is missing. This concept is in agreement with the observations.

12.B.6.4.4.1 Concept of energy radiation

The observations of pulsars show short and long term variations of the integrated pulse profile and period. In order to unveil the process of the energy radiation we have to provide analysis in a proper selected time interval. Let accept a time interval much larger than the rotational period but quite smaller than the pulsar life. In such case **the total magnetic field can be considered as a constant.**

The emission of radiopulses is due to a mechanism quite different than the existing mechanisms of the atomic matter. It is a result of the relative velocity obtained between the rotating magnetic field and the expanding charged component of released RL nodes. If neglecting the rotating magnetic field the jet of RL nodes should have a similarity with the process in the particle collider experiments related with Z and Higs bosons.

The spin axis of the pulsar is tilted in respect to the magnetic axes. The released RL nodes stream is expanded in a cone. Such stream exhibits

a strong electrical charge (as in the case of bosons experiments). The refurbishment of RL to folded CL nodes (6 prism to 4 prisms) requires a finite time, so the flowing charge needs a finite time for its dispersion. Then the released RL stream should form a conical spiral, the shape of which is illustrated in Fig. 12.30.

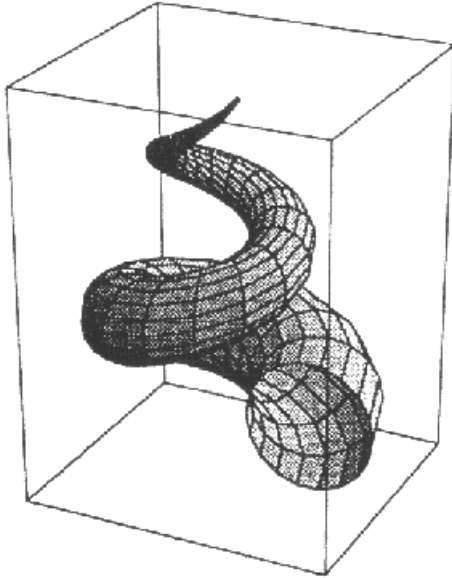


Fig. 12.30

Shape of released RL node stream from a pulsar jet.
The jet is oriented downward

The stream of RL nodes from the burning kaon nucleus of the pulsar is different than from the dying star. The kaon nucleus contains equal number of positive and negative FOHS's but the positive FOHS has only a positive internal RL(T) while the negative FOHS contains both: a negative and a positive RL(T) (inside the negative one, see Fig. 12.28). Then the released flow will be comprised of dominated positive RL nodes. Using again the destruction energies values from RL(T)'s of normal electron we get:

$$\frac{1.7778 + 1.7778}{1.44} = 2.469 \quad \text{- destruction energy (12.38)}$$

ratio between positive and negative RL nodes.

Consequently the energy flow from the released positive nodes dominates. Therefore, the released stream of RL nodes will contain components of "neutral electroweak current" and "charged electroweak current" (according to electroweak terminology).

The observations show, that the pulsars away from the galaxy disk are able to emit radiopulses. So we may analyse the process in free CL space away of any atomic matter. In a free CL space there is not any disturbing factor for the pulsar magnetic field and it will rotate synchronously with the kaon nucleus (assuming the peripheral velocity of its extent is much lower than the light velocity). The same rule is not applicable for the stream of RL nodes. Even ignoring the magnetic field, which is induced by the charged component, the stream additionally exhibits inertial interactions with the CL nodes of the galactic CL space. Consequently the spiral cone shown in Fig. 12.30 will rotate but with some constant phase delay. Then the rotating magnetic field will provide a continuous push on the rotating spiral cone. The relative motion between the rotating magnetic field and the phase delayed spiral cone will have a component moving towards the spiral origin. This process will cause two effects:

- (a) pumping of the CL space in the large volume region of the spiral cone followed by a pulse type of radiation in the radio spectral range
- (b) feedback from the emitted radiation to the rotational speed of the pulsar

In comparison to the CL space pumping from electrons in quantum orbits, the pumping mechanism of the pulsar is active in a very large CL space volume. Then despite the smaller photon energy (corresponding to radio spectrum) the total energy of radiation is enormous. This energy appears as a feedback in the process of kaon nucleus burning and spin frequency (period) stabilization. It may affect the angle between the rotational and magnetic axes. From the analysis of all described features we arrive to the conclusion that:

The stable rotational period of the pulsar is a result of active stabilization mechanism.

The process of spin frequency stabilization could not be explained if ignoring the interaction with the CL space. It relies on the conclusion of the constant debit, given by Eq. (12.37).

12.B.6.4.4.2 Coherence

The coherence is important feature allowing observations using interferometric methods.

By definition, the specific intensity (I_v) from a coherent emission source containing N par-

ticles must satisfy the condition $I_v > NI_{v,i}$, where $I_{v,i}$ is the intensity from a single particle. The coherence mechanism requires a presence of particle bunches of dimensions less than a wavelength, separated by distances greater than a wavelength.

The RL nodes have intrinsically small inertial factors in comparison to the electron and positron. So they are able to obtain relativistic velocities. Having in mind, the high degree of their spatial ordering at the burning surface, their grouping tendency (because of twisting) and their high velocities it is evident, that the coherence conditions could be always obtained in some distance from the kaon nucleus and especially in a free CL space environments.

12.B.6.4.5 Factors involved in the pulsar period stabilization

From the previous paragraphs it is evident, that the pulsar motion in a free CL space involves the following interactions:

- reactive force from the pulsar's jet
- inertial interaction of kaon nucleus characterized with anisotropical inertial factor
- interaction between the positive charge dominating component of (RL⁺) nodes and the pulsar magnetic field

The reactive force from the jet, called also a thrust force has two components in respect to A-A axis:

- Axial component contributing to a pulsar proper motion
- Radial component tending to increase the angle β It is opposed by the inertial reaction from the CL space.

The interaction between the RL⁺ component and the magnetic field provides a rotational momentum in respect to the axis M-M. This momentum interacts with part of the radial component leading to a rotational momentum around the axis A-A.

The rotational momentum in respect to the axis M-M is a result of the initial twisting of RL(T) that predefines the motion of the released RL nodes. Their spatial arrangement is kept in the same order for a finite time.

This condition is valid for any single FOHS and its RL(T) from the burning area of the nucleus.

The predominating positive over negative RL(T)s means a predominating left handed over right handed twisting (if the handedness is correctly assigned). The released twisted RL(T)s interacts with the strong magnetic field in an intercepted conic volume, adjacent to the burning area with some finite conic height. Let accept that the interaction energies are proportional to the destruction energies. Then according to Eq. (12.38) the ratio 2.469 is valid for RL(T)⁺ to RL(T)⁻ components. If the dominated positive component corresponds to a left hand twisting, then it will generate a counter-clockwise rotating force. All such forces from individual FOHSs averaged for one rotational period could be represented by one tangential force, F_t , normal to the magnetic field and lying in the burning surface at arm a from the central axis (see Fig. 12.29.b). This force combined with a small fraction of the radial force from the trust provides the rotational force F_{rot} , that is responsible for the kaon rotation about the axis A-A and generation of quantum waves.

From the kaon nuclear section, shown in Fig. 12.28 is evident, that the charged component of RL nodes is well mixed with the neutralised component. Consequently the magnetic field will influence the shape of the whole stream. In other words it will influence directly the jet cone angle. The energy of the total magnetic field is proportional to the quantity of the kaon nuclear matter. Then for the idealised cone shape the strength of the magnetic field appears proportional to its length. This parameter is changed during the pulsar age, the initially defined time interval is intrinsically small in comparison to the pulsar life.

Stabilized spin frequency with short term variations

The proper motion of the pulsar along axis A-A is provided by the axial component $F_{ax} = F_{tr} \cos(\beta)$, where F_{tr} is the total trust component of the jet along the magnetic axis M-M.

The radial component is $F_{tr} \sin(\beta)$, but most of it is compensated by the anisotropical type of inertial interaction. Then the residual radial component is $(1 - k_1) F_{tr} \sin(\beta)$.

Let considering that the described process provides stabilization around a mean frequency $\bar{\omega}$

with some variations $\Delta\omega$, so the current frequency is $\omega = \bar{\omega} \pm \Delta\omega$. Let assume also that the variational time constant is larger than the rotational period. Without going into details about the constants, the residual radial component will provide an angular momentum

$$(1 - k_1)F_{rr}\sin(\beta) \rightarrow L_1 = m\omega r^2$$

where: m - is the equivalent mass at radius r

Dividing L_1 on some time base we get the torque, that has dimensions of energy potential. Let take a stable time base by using the secular period of integrated pulses, estimated for observational period much larger than the time constant of the variations. Then we have a torque (energy potential):

$$\tau_1 = \frac{m(\omega \pm \Delta\omega)r^2}{T} \quad (12.39)$$

The torque could be regarded as a rotational kinetic energy of the nuclear motion in which the anisotropy inertial factor (I_F) of the nucleus is implicitly involved.

$$E_K = \tau_1 = f(I_F) \quad (12.40)$$

The torque from the interaction between the released twisted RL(T) and the magnetic field could be expressed by

$$\tau_2 = k_B a F_l B \quad (12.41)$$

where: B - is the magnetic field and k_B is a coefficient of proportionality with dimensions of $[1/T]$. The latter may have similar behaviour as the kaon inertial factor I_F .

The difference between the two torques provides the energy of radiated pulses. Its observational estimate is the integrated pulse profile (E_p).

$$E_p = \frac{m(\omega \pm \Delta\omega)r^2}{T} - k_B a F_l B \quad (12.42)$$

The obtained expression is an **apparent energy balance equation of the pulsar** (or energy balance only). In this form it provides the total energy of emitted individual pulses. The term apparent is intentionally used because there is another hidden balance. This is the balance between the kinetic energy (E_K) and the reactive energy (E^R) of the CL space:

$$E_K = E^R \quad (12.43)$$

The expression (12.43) is the **hidden energy balance**. It is similar as the hidden energy balance between the kinetic energy of an astronomical body and the reactive CL space energy around its imaginary separation surface. By the same analogy the change of the reactive energy (first derivative) appears as active energy whose signature can be identify.

Equations (12.42) and (12.43) are pretty general expressions, but they allows to understand the most basic features of the pulsars.

In a general case the condition $\Delta\omega > 0$ is valid but within some limit and the integrated profile fluctuates around its mean value. In this case subpulse drifting is observed. The phenomenon of subpulses is explained in §12.B.6.4.6. If the drift is systematic a condition $\Delta\omega = 0$ occurs periodically. The emitted energy in this case is

$$E_p = 2\pi m r^2 - k_B a F_l B \quad (12.44)$$

The average time interval at which this condition occurs gives the time constant of the stabilization mechanism. The observations show, that the difference between the two terms of Eqs (12.42) and (12.44) is always positive. The first term involves inertial interactions related to the motion of the nucleus as a whole. So it always has some **reserve of accumulated kinetic energy**. The second term does not have a such.

What could happen if B is decreased suddenly with a large value? Then the energy reserve of the first term might be exhausted and the pulse emission will be stopped for a finite time. The stabilization mechanism, however, still work. It is supported by the inertial type of interaction between the nucleus and the CL space. In this case Eq. 12.43 is still valid. **The reaction energy ER, however, could not be changed suddenly**. It requires some finite time. The signature of this effect can be detected from the trend of the consecutive pulses during the time of this phenomenon.

The described phenomenon may have a signature of **absent single pulses**. There is another phenomenon in which absent pulses are observed for a time interval of number of pulses. The possible explanation of this phenomenon is the following: The angle β may not be constant but fluctuating, due to the nuclear inhomogeneity, de-

scribed later (see §12.B.6.4.7). If it becomes zero for some finite time the described emission mechanism will be not valid any more. In such case missing pulses will occur. During this time the equality between E_K and E_R might be disturbed by oscillation about the exact value (due to reactive energy properties). So after a finite time the steady state conditions of Eq. (12.43) could be restored, and the process of pulse emission will continue. The observable phenomenon with such signature is known as a **pulse nulling**.

Detailed analysis of the pulse nulling problem is reported by Ritchings, R.T. (1976). He investigated this phenomenon in 32 pulsars and found that the radiation from many of the observed pulsars is generated in bursts of typically 50 pulses and pulse nulls corresponds to the time intervals between these bursts. The burst occurs less frequently as a pulsar grows older. According to BSM concept, this behaviour is a result of nuclear inhomogeneity and the nuclear composition as a bunch of subnuclei (see §12.B.6.4.7 Real kaon nucleus). Ritching used autocorrelation method and built separate histograms for the missing and detected pulses (after correction of scintillation effect - a pulse distortion from the propagation through the galaxy). The shape and offsets of the histograms are very informative about the real mechanism of pulse generation, according to BSM. The histograms of pulsars with single and multiple (in most cases two) pulse profile are also clearly distinguishable. The latter case corresponds to a double jet pulsar described in §12.B.6.4.9. The results of Ritchings analysis may serve as one good confirmation of the BSM concept.

Factors influencing the secular period change with the pulsar age

The total magnetic field is proportional to the nuclear matter quantity. So it decreases continuously with the pulsar age. The flow debit according to Eq. (12.37) is also decreasing. It is evident, that the change of the secular period will change continuously with the pulsar age. The exact dependence is not derived here, but some of the factors influencing the stabilization process are following:

- decrease of the magnetic field strength and increasing of the line divergence outside the kaon nucleus
- change of contribution of the twisting force to the pulsar rotational momentum
- change of the rotational kinetic and reactive energy
- possible change of angle β
- change of trust force components due to the increased magnetic line divergence

12.B6.4.6 Integrated pulse profile and drifting subpulses

It is apparent that the emitted energy in form of radio pulses is directly involved in the stabilization process. Having in mind that it covers some spectral range the most accurate estimation of the energy pulse is to measure simultaneously all emitted frequencies. This parameter in the field of pulsars observation is called **integrated pulse profile**. Despite the practical difficulties for observing a large spectral range, integrated profiles are obtained for many observed pulsars. Many of them shows one typical feature: **subpulses drifted systematically** across the profile.

Figure 12.31.a illustrates the integrated pulse profile and its components for the pulsar PSR0809+74, while Fig. 12.31.b shows the subpulses drift (Kuzmin, 1992 (an English translation)).

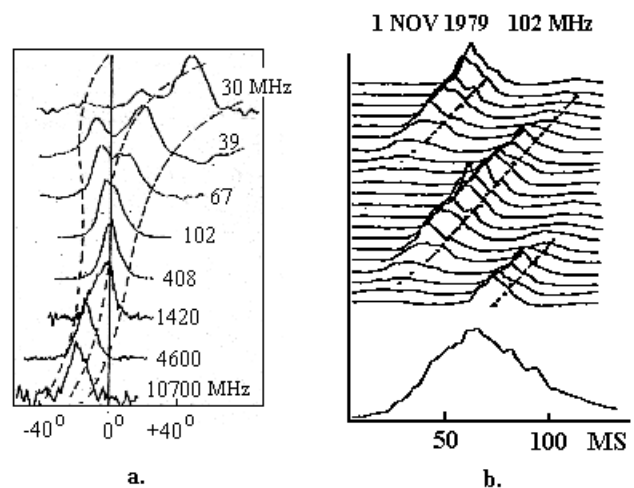


Fig. 12.31

Change in the spatial position and shape of the integrated profiles with frequency for pulsar PSR 0809+74

The explanation of the integrated profile shape and the subpulses is the following: The energy pumping of the CL space and the followed emission (that we detect) is a result of the relative motion between the rotating magnetic field and phase delayed rotating spiral cone, illustrated in Fig. 12.30. The phase delay (should be not confused with the stabilization time constant) is a result of the inertial interaction of the expanding RL nodes in the jet with the CL space. If examining the mutual cross section between them in a plane normal to the proper motion the phase delay will move in the direction towards the smaller conical section. This causes CL space pumping from the moving charge component of RL nodes in respect to the magnetic field. If separating this region in sectors as shown in Fig. 12.30, we will understand that the relative motion has different mean tangential velocity for each sector. From the other side the sectors includes large spatial volumes with different rate of CL space pumping. Consequently, every sector will emit separate radiopulse with spectral width centred around the optimum mean value for this sector. The uniformly distributed energy of the RL nodes in the sectors and the simultaneous emission from a large volume could provide increased coherence of the radio signal. In the same time the close interactions between the neighbouring sectors and the rotational motion of the pulsar might be the cause for the strong polarization of the subpulses.

Figure 12.31.a shows bare signature of such pulses with different mean wavelength but the number of observational frequency is not equal to the number of the sectors. For this reason some pulses appear shorter while other doubled.

The rotation of the cone spiral and the partly coherent radiation from the volumes of the sectors cause a not isotropic type of radiation. In such way, the swapping beam and the source of the emitted signal (the CL space domain) appear rotating with the nucleus around the axis A-A. There is not triggering mechanism, however, for the moment of the quantum wave generations from the column sectors. But this components are exactly involved in the stabilization mechanism discussed in §12.B.6.4.5 They provide the drifting pulses. Consequently:

The drifting pulses are direct signature of the spin rate stabilization mechanism of the pulsar.

The drifted pulses could be considered also as harmonics of the main pulse carrying the necessary small portions of the energy that provides the energy balance according to Eq. 12.30 and keeps the frequency deviation $\Delta\omega$ within some limit. If the kaon nucleus is smooth as in the idealised model, a systematic drift is observed. This clearly indicates its correspondence to $\Delta\omega$. The effect of the frequency drift is very similar as the drifting of single frequency dye laser in a free run mode without locking.

Figure 12.33 illustrates a systematic subpulses drift for two pulsars. Subpulses in these pulsars first appear at the trailing edge of the pulse profile and then they drift toward the leading edge, disappearing several periods later. The effect is more apparent for PSR0031-07, where an interruption region (missing pulses) also is apparent between 37 and 39 pulse number. The effect of missing pulses has been mentioned in §12.B.6.4.5, while the probable mechanism is discussed in §12.B.6.4.10.

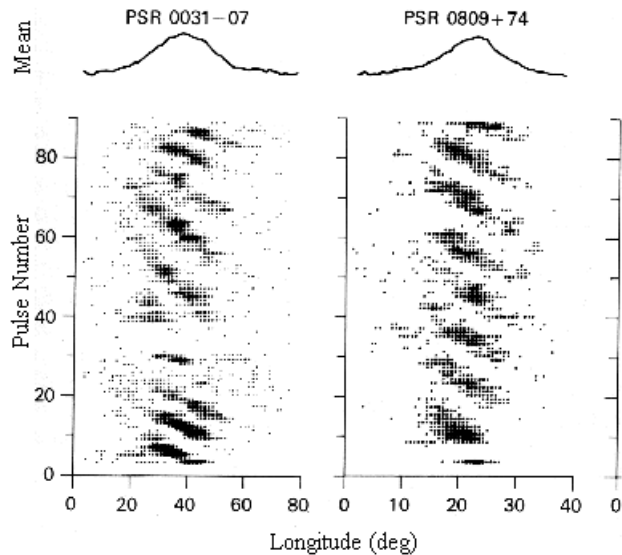


Fig. 12.33

Longitude-time diagram for two pulsars with drifting subpulses. (After Taylor et al., 1975)

12.B.6.4.7 Real kaon nucleus

A. Internal structure

The process of kaon formation and growing is possible only in steps. The analysis of the star evolution using the features of the Hertzsprung-Russell diagram (Fig. 12.26.A) indicates that this process may begin in the phase of instability of the main sequence and ends in the phase of the star dying. Due to the step-like formation, we can not expect the internal structure of kaon nucleus to be so perfect as shown in the Fig. 12.28. Some atomic matter could be trapped inside the kaon nucleus, causing structure defects. In the process of radial nuclear growing the most internal atomic inclusions may crash and defects could be partly repaired. This however is possible if the kaon is not a continuous structure along the rotational axis but bunch of subnuclei. Then the radial section will show less defects in the central region than in the periphery. The possible radial section of a kaon nucleus with defects is illustrated in Fig. 12.34.a, while Fig. 12.34.b shows a magnified part of its axial section.

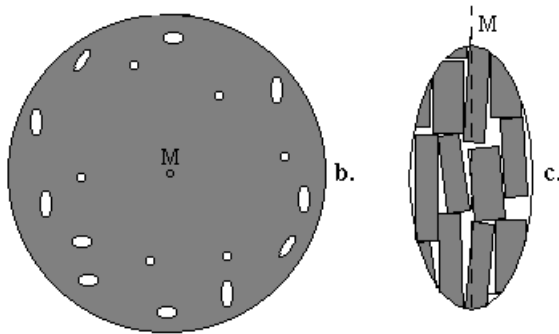


Fig. 12.34. Defects in a real kaon nucleus
 a. Radial section with defects;
 b. Magnified part of axial section illustrating kaon subnuclei

B. Pulse energy variation

The defects in the real kaon nuclear structure appearing as a bunch of subnuclei will cause the position of the magnetic axis of the pulsar to be dependant on the positions of the individual subnucleus. Then in the process of nucleus burning two types of **sudden changes of the magnetic axis are possible:**

- **small angular shift:** - change of the parameter β
- **small radial shift:** - change of the parameter: k_B

Both type of changes will affect F_{rot} according to Eq. (12.37) causing a period change but the mechanism of spin rate stabilizing will correct it by adjusting the energy of the emitted radiopulses. This is one of the reason for the observed **pulse to pulse energy variation.**

C. Sudden small period increase with a slow restoration of the general trend

Some large atomic inclusions near the circumference of the nucleus section may disturb the magnetic field homogeneity in this area. Part of the magnetic lines may exit outside of the nuclear surface (the effect is similar as in the magnetic bar with defects caused by air inclusions). Then this part of the field will be also involved in a quantum wave generation but with much smaller energy. The energy of this radiation is part of the total radiated energy. When the burning process overpasses this region the kaon nucleus become suddenly more homogeneous and the polar oriented magnetic field more concentrated. This will affect the jet parameters by slightly decreasing the apex cone angle. Then according to Eq. 12.38 the period of the spin rotation and pulse emission will be slightly increased. From 1968 to 1969 three sudden small drops of the period are observed for Vela pulsar, PSR0833-45. The observational data showed that the deviation from the general trend of the increasing period decayed slowly away after about a year. This may indicate that the pulsar magnetic filed is influenced stronger by a nuclear defect when it is closer to the burning end.

D. Real nuclear shape

So far all the features of the pulsar has been explained by the idealised model, assuming a cylindrical shape of the kaon nucleus. The massive astronomical object, however, are spherical and obtaining of kaon nucleus with cylindrical shape is less probable. The most probable shape could be a prolate spheroid composed of multiple kaon subnuclei closely aligned to the common magnetic axis. Fig. 12.35 illustrate a possible shape of such nucle-

us with magnetic axis aligned to the major axis of the spheroid..

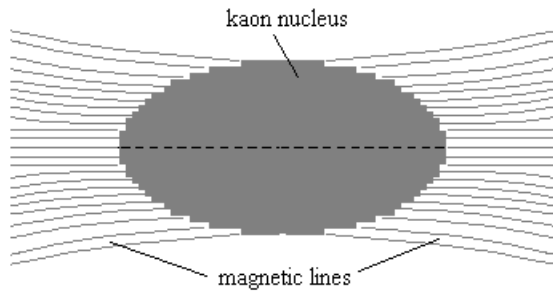


Fig. 12.35

A probable real shape of kaon nucleus with magnetic lines

Having in mind the conclusion (C) of §12.B.6.4.2 (Eq. 12.36), the analysis provided for the idealized case of cylindrical nucleus should be valid for the real shape nucleus as well.

There is one problem that should be correctly solved: Some kaon subnuclei will be involved in the burning process not in the beginning but in proper time later. How the ends of the FOHS's of the peripheral subnuclei will be preserved?

Some possible explanations are the following:

(1) The external subnuclei are covered by thin layer of atomic material. The layers is formed of highly ionised atoms that have lost all their electrons. Such ions could not emit radiation. The repulsion between these ions is significantly reduced by the strongly modulated CL space in the proximity of the superstrong magnetic field and the increased IG forces in that region. During the burning process the positive ions may contribute to the positive component from the RL nodes. Their charge component may become active at some minimal distance from the kaon nucleus.

(2) The external subnuclei are not covered by atomic matter, but RL(T) destruction in the open ends of FOHS's does not start due to a strong biased CL space from the kaon magnetic field. The destruction is possible in the area of common burning where the fine structure of the magnetic field is disturbed by the turbulence from the destruction, i. e. this might be a self sustainable effect.

12.B.6.4.8 Proper motion of the pulsar

The proper motion of the pulsar is caused from jet axial component that is much stronger than the radial one.

Map of pulsars with periods from 0.1 msec to 10 sec is shown in <http://pulsar.princeton.edu/pulsar/map/PulsarMap.html>.

It is evident from the provided concept, that the propulsion system of the pulsars is active for a long time. Then they may travel a significant distance from the place they are born. This allows their motion to be traced, but mainly for a velocity direction. One method for estimation of their velocity, called **pulsar scintillation**, relies on the interstellar scattering and Faraday rotation effect. The method is not quite accurate and may provide some higher velocities, but number of correction procedures exist. Interferometric measurement are also provided. Most of the measured velocities are in the range 100 - 200 km.

Fig. 12.36 illustrates the calculated traces for large number of pulsars in our galaxy whose velocities are measured by the scintillation method (see Cornell news: Tracking pulsars; <http://www.news.cornell.edu/releases/June98/scintillation.deb.html>).

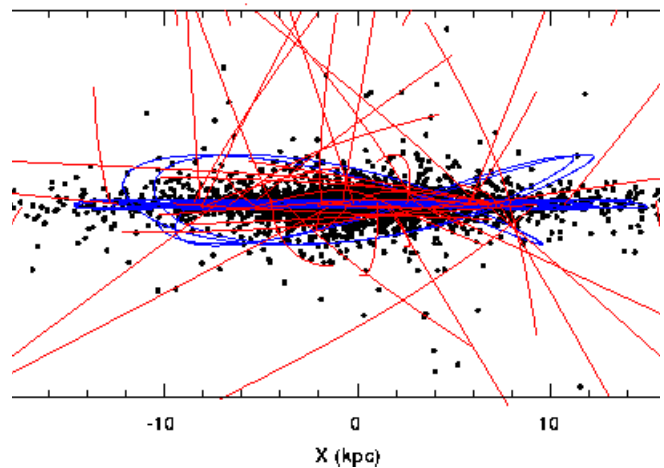


Fig. 12.36

Pulsars in motion: The red lines indicate the orbits of fast-moving pulsars, some of which will escape from the galaxy. The blue lines show the orbits of slower moving pulsars. The black dots are ordinary stars that delineate the Milky way galaxy www.news.cornell.edu/releases/June98/scintillaion.deb.html

One important consequence of the pulsar proper motion is **that they may pass through GSS and continue their motion in a foreign CL space.** In such conditions, however, their dynamics is different. The balance between the nucleus rotational kinetic energy and the reactive CL space energy might be disturbed. In the foreign CL space the released RL nodes after their conversion to CL nodes may form a long pipe of CL space not mixable to host CL space. Then a stable pipe can be formed in which the atomic matter may get a specific type of interactions. Observational evidence of such phenomena is discussed in §12.B.11.

12.B.6.4.9 Pulsars with double jet

While the uncovering of one end of the kaon nucleus is the most probable case, the another option when the two ends are uncovered is not excluded. In this case two jets at 180° become active. Figure 12.37 illustrates the burning nuclear of such type of pulsar.

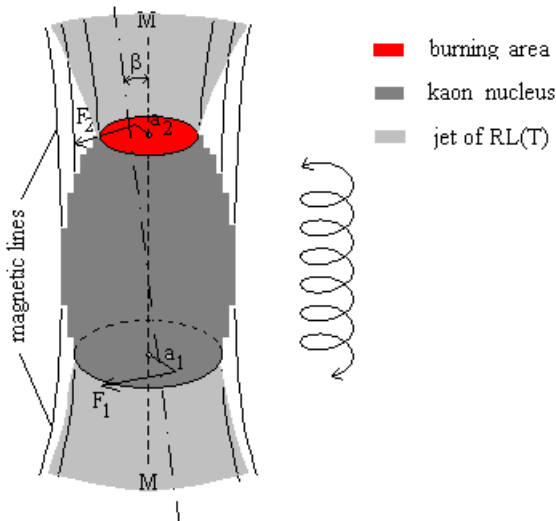


Fig. 12.37
Pulsar with two jets

In the shown case the two burning surfaces have different areas. Only the peripheral magnetic lines of the nucleus and of the burning areas are shown. Such pulsar will have some specific features:

- (a) no proper motion
- (b) a small angle β between the magnetic and spin axes
- (c) separate energy pulses from the two jets

- (d) a comparatively smaller period
- (e) a faster aging

According to the conditions given by Eqs. (12.36) and (12.37), the thrust forces of the opposite jets will be equal. Consequently, the pulsar will not have a proper motion. (It may have some proper motion if the internal nuclear homogeneity in both sides is different). For equal internal homogeneity along the pulsar axis, the magnetic field from both sides is equal, but the burning area of upper jet is within smaller area of the magnetic field. One specific difference between them is the torque from twisting forces (obtained by the interaction between the positively dominated twisted RL(T) and the magnetic field). The angular momentum from both twisting forces are with opposite direction, but the lower one is larger than the upper one. Then the frequency stabilization effect will be of a differential type. The rotational period will be stabilized by the pulse emission generated from both jets. For a long term the degree of the period stabilization will be proportional to the difference between emitted energies from both jets. It is clear that the burning rate of the double jet pulsar is twice higher than for a single jet. So it will age faster. The secular period will show a faster increase.

Another important feature is that for nucleus possessing a good rotational symmetry and low internal defects, the angle β tends to approach zero, because the twisting forces across the burning areas will have a good rotational symmetry. In such case, the pulsar's dynamics could appear differently. If accepting some rotational asymmetry however, the same analytical approach as for the single jet pulsar could be applied. In any case the angle β for the double jet pulsar should be much smaller than the single jet. Then for a same reactive energy E^R , the rotational frequency will be larger. The conditions for $\beta \approx 0$, however will exhibit a longer time constant. It could be identified by investigating the null states and the pulsar behaviour after a sudden frequency jump of detected pulses (due to a burning of some inclusion or disaligned subnuclei). This problem is discussed in the next paragraph.

The analysis of R. Ritchings (1976) about the pulse energy around the pulse nulling phases confirms the BSM concept of a double jet pulsar and allows to infer the mechanism of the pulse generation. It supports the concept of the reactive energy

of the surrounding CL space. The signature of the differences between a single and a double jet pulsar is apparent from their pulse energy histograms. Fig. 12.38. **a** and **b**. show respectively the histograms for a single pulse (single jet) and a double pulse (referenced from Ritchings as multipulse due to a separation of one of the pulses in subpulses components). The BSM explanation of subpulses has been provided in 12.B.6.4.6).

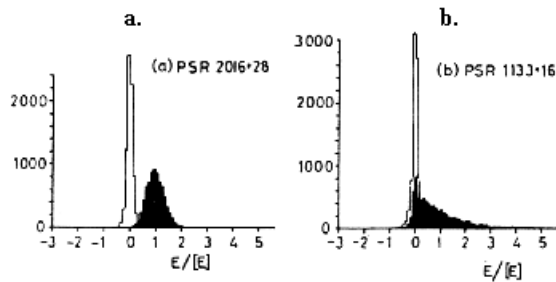


Fig. 12.38. Pulse energy histogram:
 a. from a single pulse pulsar
 b. from a multiple pulse pulsar (double pulse with a constant subpulse, according to BSM)
 The abscissae are in units of mean pulse energy
 [After Ritchings (1976)]

The black area histogram is from the detected pulses while the white area - from the missing pulses.

A typical example of a double jet pulsar is the **Crab pulsar in the Crab nebular**. Its secular period is 33 ms. The Vela pulsar in the Vela nebular exhibits similar characteristics.

The Crab and Vela pulsars exhibit also a number of additional features, which however are caused by some specific features of their host nebula. The Crab pulsar and nebula are discussed in §12.B.10.

12.B.6.4.10. A relaxation time constant due to a change of reactive energy E^R and its signature

The inertial interaction between the moving and rotating kaon nucleus and the galaxy CL space is a mechanism in which the anisotropical inertial factor is involved. It is reasonable to expect, that it may put a signature on the stabilizing process by some time constant larger than the rotational period. In §12.B.6.4.7 B. it has been explained how the position of the magnetic axis could be suddenly changed. This means a change of the angle β that

will lead to a change of the rotational kinetic energy (E_K). In the same time the balance according to Eq. (12.43) should be satisfied, so the reactive energy should be also changed. But the reactive energy (E^R) could not be changed very fast, because it has a finite time constant. Consequently, this constant could be detected and estimated in such type of event.

A signature of the relaxation time constant could be identified from the analysis of the pulse nulling effect and from the period glitches of the observed pulses.

The analyses of R. Ritching (1976) about the pulse nulling effect provides clearly indication about the existence of the relaxation constant and its behaviour with the pulsar aging.

Relaxation time is observed and reported by Lohsen (1975), after speed-up of the Crab pulsar by a frequency jump of $\Delta\nu = 0.097$ periods on February 4, 1975. A sharp increase in the pulse frequency is observed, resulting in an initial phase shift of 0.1 periods. The frequency shift slowly decayed, approximately following an exponential low. Figure 12.39 shows the time residuals trend before and after the glitch, whose time is referenced as a “0” day.

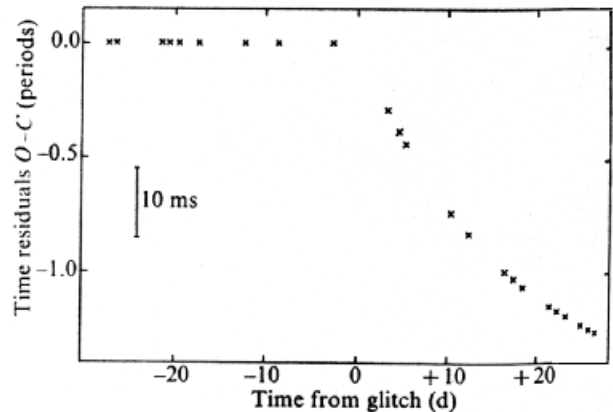


Fig. 12.39

Observed pulse arrival times minus arrival times computed from cubic fit to the data before the glitch (Lohsen (1975))

From the same data Lohsen estimated the natural logarithm of the frequency differences $\Delta\nu(\nu_o - \nu_c)$ and found a relaxation time of 17 days for the frequency jump.

The observed data indicates presence of two relaxation time constants: a longer one, corresponding to the exponential shape of the frequency change (longer than 20 days) and a shorter one corresponding to small oscillations around the frequency decrease trend (~17 days).

According to BSM, the frequency jump of the pulses does not mean that the real rotational frequency is jumped. During the relaxation time the pulse energy and its moment of emission are both regulated by the reactive energy E^R . In such way the event will start with an initial phase shift, followed by a slow phase drift during the relaxation time. The initial phase shift is really observed and reported by Lohsen (1975).

16.B.6.4.11 Summary:

- **The pulsar is not a neutron stars, but kaon nucleus possessing one or two jets cause by the destruction of the FOHSs with their RL(T) structures.**
- **The kaon nucleus creates a superstrong magnetic field**
- **The rocket-like spinning motion of the pulsar through the galactic space is driven by the thrust forces from its jet**
- **The pulsar jet contains both: a neutralised and a positive charged components corresponding respectively to “a neutral and a charged electroweak current” (according to the Electroweak Theory, known also as a V-A theory).**
- **The generation of quantum waves (detected radiopulses) is a result of the angular speed difference between the rotating magnetic field and the charge component mixed in the jet volume with a shape of a conical spiral.**
- **The spin frequency is stabilized by a self adjusting mechanism whose stable reference parameter is defined by the constant rate of the RL(T) refurbishment per unite CL space volume.**

12.B.6.5 Termination options of the star evolution: a black hole, a binary pulsar, or a supernovae

From the concept of the pulsar as a burning kaon nucleus we see that three options of the dying star are possible:

- (a) a kaon nucleus with uncovered one or both ends
- (b) a kaon nucleus with covered both ends
- (c) a kaon nucleus of both types ((a) and (b)) in a binary system
- (d) an explosion due to a radial crash of the FOHSs of the kaon nucleus

The option (a) corresponds to the active pulsar described so far.

The option (b) corresponds to a different astronomical object with observational features of accretion disk (considered so far as a “black hole”).

Two types of option (c):

- I-st type corresponding to a binary pulsar
- II-nd type (not described so far)

The option (d) corresponds to a phenomenon known as a supernovae.

12.B.6.5.1 A passive kaon nucleus in a role of “Black hole” object

If the mass of the star is below some critical limit it could not be able to form a large kaon nucleus. From the other hand, the quantity of the erupted material in the process of kaon growing is proportional to the kaon increase. Consequently, the star with a mass closer but below some critical limit may die more quietly. If the star mass is just above this limit, but closer, it is possible the kaon nucleus to be freed in the final eruption phase while still covered by thin atomic layer. Such object will behave quite differently than the pulsar. We may call it a **passive kaon nucleus** (not possessing a jet).

The passive kaon nucleus will have the same strong magnetic field as the pulsar. Its initial spin momentum will be exhausted from the interaction between the rotating magnetic field and the surrounding matter. The atoms of the thin atomic layer could not operate normally, because of the large biasing of the surrounding CL space from the strong magnetic field. Such object will not have the radiation characteristics of the pulsars.

The passive kaon nucleus will exhibit one specific feature, which is not so apparent in the pulsars. For any radial section of the kaon nucleus the total electrical charge is balanced. Outside the kaon nucleus, however, in a direction of the magnetic lines the positive charge will dominate. This is a result of the hidden positive FOHS inside the negative FOHS (see Fig. 12.28). The strong axial alignment of the positive component may pass through the thin atomic matter, creating a huge dipole of positive charge in the external CL space. Consequently, the passive kaon nucleus will have very strong positive electrical field aligned with the strong magnetic axis. The latter will allow the electrical dipole to be stretched out at significant distance from the nucleus. But for enough large distance it will behave again as a point positive charge in a similar way as the proton behaviour. This is a unique kind of object.

The described object could be discovered only by the following feature: If some atomic matter passes nearby the object the atoms could be heavily polarised and ionised. The free electrons then could be attracted by the strong positive charge. Approaching the kaon nucleus the trapped electrons will be guided by both axially aligned fields - magnetic and electric. So the electrons will form a narrow beam with a conical helical trace. Simultaneously they will be continuously accelerated and the beam will become narrower. In such conditions the positron-electron system of the normal electron could be activated (see Chapter 3) and an emission of X-rays may occur. Such phenomenon is observed and it is known as an **accretion disk**.

It has been shown that the inactive kaon nucleus (not possessing a jet) could provide conditions for the superstrong magnetic field with either N-S or S-N orientation referenced to the kaon nuclei. The stable appearance of one or another orientation of this field is supported by external interactions in which the magnetic field is involved. Let assuming that the magnetic field during the phase of a stable direction of the magnetic field provides conditions for an accretion disk from one side with a shape of right handed conical spiral. Then the shape of the other accretion disk (from the other side) will be a left handed conical spiral (because of the opposite direction of the magnetic field). In such case both accretion disks will pro-

vide rotational momentum of the nucleus in one and same direction. If the pulsar is in a close gravitational interaction with a giant star (they have been a binary stars), the kaon nucleus will ionize the external layer providing continuous source of electrons for the accretion disks. In the same time it will possess spin rotation and common rotational motion. Therefore, it will carry a significant reactive energy E^R as in the case of the active pulsar (possessing a jet). While the energy E^R of the pulsar in free CL space is kept constant, now the proximity of the nucleus to the star will ionize and drag atomic matter from the external layers of the star, so the latter will be spinning in the equatorial region around the nucleus. In the same time the rotational period, depending on the accretion disk, could not be stable as in the case of an active pulsar. Consequently, fluctuation may exist. The described binary system will exhibit strong X-ray radiation from accretion disk and some optical radiation from the spinning ionized atomic matter.

Double objects with features, described above, have been detected but explained differently, so far. The observed Cygnus X-1 pair object of supergiant star HDE226868 and X-ray companion has features matching to the described concept. The invisible partner of the system has been claimed as a "black hole" and given as a classical example in the college physics (see Fig. 12.40)

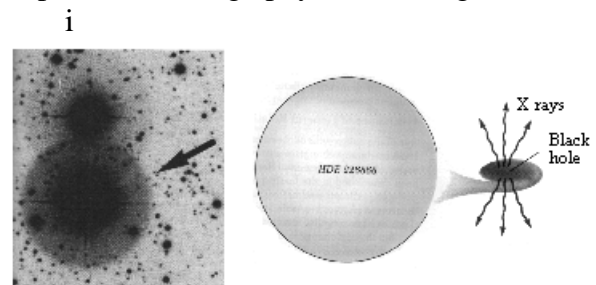


Fig. 12.40

Similarity between the features of the black hole concept and the undeveloped pulsar (BSM concept) with companion of giant star

The observed radiation detected by Rossi X-ray Timing Explorer has a very common signature to the described above effect. In 1997 the observed phenomena is announced as a "frame dragging effect" and is reported in the Sky & Telescope maga-

zine, December, 1997 under the title “Seeing black hole spin”.

From the presented concept it is evident that the passive kaon nucleus may become a pulsar in some particular moment if one of its ends is uncovered. This may happen due to the continuous bombardment from the accelerated electrons. The electrons (possessing RL(T) structures) may crush when hitting the polar region. The released RL(T) structures may oblate the atomic matter that cover the end of the kaon nucleus. The uncovering of the end enables the jet process, so a pulsar will be born. Before the pulsar is born a transition phase may take place in which the object may emit an optical radiation from the gas clouds in the vicinity. Such clouds can't be left from the explosion, but formed later from the leftover atomic matter that cover the kaon nucleus. A possible example of such object is the supernova SN1986J in the galaxy NGC891 30 million light years away. The supernova explosion has occurred in 1983. (for more info, search for “SN1986J supernova”).

Summary:

- **The considered so far Black hole with accretion disk appears to be a passive kaon nucleus**
- **The passive kaon nucleus is a predecessor of a pulsar**

12.B.6.5.2 Binary pulsar

Binary pulsars are not rare in our galaxy. This is the possible evolutionary end of one of the binary stars. For such system the probability for quiet end of one of the stars against a birth of a supernova is larger due to the gravitational pull-up from the second star.

The normal binary pulsar is formed of kaon nucleus with one burning end. According to the presently adopted concept about the pulsars, the binary pulsars have been considered as “neutron stars”, while their motion has been considered as a result of initial velocity obtained in the process of their formations. Such concept could not explain the long track motion of many pulsars in our galaxy, some of which may escape from the our galactic CL space. BSM unveils that the pulsar possesses a continuous propulsion energy due to its jet. For

this reason BSM does not use the mass estimation of the pulsar based on an initial energy momentum.

One characteristic feature of the binary pulsar is the x-ray radiation. The explanation according to BSM is a following:

Binary stars are quite abundant in the Universe. Let considering a binary star system with dissimilar masses, while both have a mass above the critical one (for evolving into a pulsar). The heavier one will evolve earlier, so its jet of released RL(T) nodes will irradiate periodically the other star. This radiation may continuously evaporate and ionize matter from this star. The positive component of RL(T) (equivalent to electroweak charge current) in the far field of the pulsar will attract the electrons from the ionized matter so they may form a shell, which will be kept between the star and the quasar. The pulsar will have two type of rotational motions: one around its axes (with short period in order of ms) and a second one with the star companion around a common axis. Then the electron shell may be periodically irradiated by the pulsar jet. The electrons could be strongly excited by the positive RL(T) component of the jet. This excitation ends with an emission of X-rays from the electrons (electron shell- positron oscillations, see Chapter 3). The radiation is in X-ray range with the proper pulsar period (the period of the two bodies rotation about their barionic centre is usually much longer).

From the presented concept it is evident that the described mechanism does not involve accretion disk that is a feature for continuous X-ray radiation. It is also evident that the X-ray pulses and the possible optical pulses are not generated by the same mechanism as the radio pulses from the pulsar. Therefore, such radiation is not involved in the pulsar stabilization mechanism and if such pulses are eventually detected they will be phase shifted. The observation of X ray, optical, and radio pulses from Vela pulsar PSR0833-45 are in full agreement with this concept.

One additional phenomena may also take place. The refurbished CL nodes may carry part of the momentum of the RL nodes. Then a flow of folded nodes with a large group velocity may pass through the star's gravitational field. This will cause a relativistic effect exhibiting Doppler shift. If some atomic layers are in that zone, they may

show Doppler shifted absorption lines even if they are not moving. Some observations shows large (relativistic) Doppler shifts in a quite similar situation. **The assignment of the observed Doppler shift to object velocity in such case should be re-considered.**

12.B.6.5.3 Supernova

In the normal kaon nucleus all FOHS's are separated by CL space gaps as shown in the radial nuclear section given in Fig. 12.28. There is a critical minimum value for the gap (see Chapter 6). Below this value the radial stripes of RL(T) between neighbouring FOHSs will start to interfere by their IG forces (inverse proportional to the cube of the distance). Such interference will inevitably invoke a triggering of a destruction of the whole FOHS, accompanied with a release of the internal RL(T)s. Now it is apparent that this may happen in the final process of the dying star when the kaon nucleus obtains the last growing portion. Because the kaon nucleus growing is directly related to the gravitational pressure, it is obvious that this option is dependable on the initial mass of the star. But we saw that larger disalignments of the kaon subnuclei may also lead to a radial destruction even for smaller nucleus. Consequently the expected initial critical mass for such option may have some variance around a mean value. How large could be this variance is a question, because the starting of the process does not mean that all helical structures will be destroyed. If the mass is not large enough and the process starts in zones of subnuclear disalignments, the whole nucleus may break into separate nuclei, so they will undergo their evolution as pulsars.

If the mass of the star is well above the critical one, the kaon nucleus may obtain a significant grow before the final eruption. Then in some moment of the star's evolution the minimal critical distance value between FOHS's could be overpassed and the radial destruction may be initiated. If the quantity of the atomic matter is still large, the process of destruction may involve also a large portion of the kaon nucleus. The process will be developed as a huge explosion that will throw all the atomic matter away. Most of the matter will be evaporated due to the enormous flux of RL nodes

released in all directions. **This phenomena is supernova.** In any case some small portions of the kaon nucleus may survive. The both ends of such nucleus more probably will be uncovered. Such type of kaon nucleus will behave as a pulsar with two opposite jets and very small proper (linear) motion. It will show faster period increase, because its nucleus burns twice faster.

In some supernova explosions, before the pulsar is born a transition phase may take place in which the kaon nuclei might be enveloped with some atomic matter, so a jet is not developed. Such object may emit an optical radiation from the gas clouds in the vicinity. Such clouds could not be left from the explosion, but may be formed later from the leftover atomic matter that cover the kaon nucleus. A possible example of such object is the supernova SN1986J in the galaxy NGC891 30 million light years away. The supernova explosion has occurred in 1983. (for more info, search for "SN1986J supernova").



Fig. 12.40.A Supernova NGC891

One example of the described scenario of supernovae with a born pulsar is the **Crab nebular and the Crab pulsar**. The former star (or stars), evidently has been of II-nd population, so it has been a remnant from the former galactic matter. All of the globular clusters stars, for example, are such remnants and their features are discussed in §12.B.7. Most of the features of the Crab pulsar are explainable by the presented general concept. Some specifics, however, are influenced by the features of the II-type star population and their CL spaces. The same is specifically valid for the matter in the Crab nebular and the interactions between the pulsar and the atomic matter from the former star. The specific features of the Crab nebular and pulsar are discussed in §12.B.10.

12.B.6.5.4 Summary about the evolution of stars with masses between 11 and 50 solar masses

(a) The stellar evolution in the main sequence of H-R diagram (known as I-st type galactic population) is valid for the matter of the present galactic life.

(b) The matter of the Globular Clusters (stars, dust, CL space) is a remnant from the previous galaxy life, which have escaped the phases of the galaxy collapse and recycling. The stars from this matter does not follow the main sequence of H-R diagram.

(c) The phase of instability in the H-R diagram is characterised with a formation of kaon nucleus inside the star.

(d) The kaon nucleus assures the strong magnetic field of the star. The latter provides conditions for synthesis of elements with higher Z-numbers

(e) In the phenomena of star dying the kaon nucleus gets additional increase.

(f) In the final eruption of a dying star with a large mass the most amount of the atomic matter is lost and at least one end of the kaon nucleus become uncovered. The observable phenomenon is a supernova that may give a birth of a pulsar.

(g) The pulsar is characterized with a process of continuous kaon nucleus burning (destruction). It obtains a high rate rotational motion with an actively stabilized period and an axial thrust force. It emits enormous energy by generating quantum waves in a large CL space volume.

(h) The single jet pulsar possesses a linear (proper) motion, while the double jet pulsar - not.

(i) The single jet pulsar may pass a significant distance in the galaxy CL space and may quit the home galactic CL space.

12.B.7. Remnants from previous galactic life

12.B.7.1 Theoretical concept

In §12.B2 it was mentioned that during the phase of the galactic collapse the galactic CL space may get some internal break. In such case some is-

lands containing large number of stars (as the open clusters) may escape from the collapse. Left isolated in a pure void space (in a classical meaning), they will undergo a fast evolutionary process described below.

In any case the space surrounding the isolated star cluster will lose a big amount of its CL structure. Once separated the self restoring feature of the broken CL space will invoke gathering of the leftover CL space. This will move the stars from the isolated cluster much closer. Then a **process of cluster collapse occurs, leading to a formation of a Globular Cluster (GC)**. (We must keep in mind that the Newtonian gravitation occurs only in CL space). The process of GC formation, however, may have some transitional phase. In Chapter 10 it was found that the intrinsic condition for a stable complex of CL space and atomic matter (stars, planets dust and so on) is when the ratio between the Partial CL pressure (related to the inertia in CL space) and the Static CL pressure (defining the Newtonian mass) approaches the relation:

$$P_p/P_S = \alpha^2/\sqrt{1-\alpha^2} \quad (10.18)$$

It is clear that in the process of the galaxy collapse, the folded nodes could escape easier because they are not strongly connected to the CL structure. In the same time the amount of the folded nodes in an unite time define the dynamics of the matter (a larger velocity means a larger amount of the folded nodes). Consequently:

- The CL space of the globular cluster will exhibit a decreased Maxwellian energy due to the reduced P_p/P_S ratio (a reduced amount of the necessary folded nodes).

In the end of the evolution process, the escaped from the collapse open cluster will be converted to a globular cluster (GC) where the stars will be very closely spaced.

The process of the GC formation from an escaped star cluster may be tremendously shorter than the process of the star formation during the active life of the galaxy. The globular clusters may survive all hidden phases of the galactic recycling. In the same time, they play a very important role during the hidden phases of the galaxy: surround

the protogalactic nucleus and keep it inside the own void space.

When the new galaxy is born, some of the globular clusters, which has been closer to the protogalactic nucleus, could be broken and will form filaments (because the old CL space structure is not mixable with the new one). GC which are more distant from the protogalactic nucleus, however, may survive. The CL space of the survived GCs will be interconnected to the new CL space in a similar way as the neighbouring galaxies. The local CL space of GCs, however, is preserved, because the diameter to length ratio of the prisms in the GC will not be exactly the same as for the prisms from the new galaxy formation. **Consequently a separation surface similar as a GSS surface will exist between the CL space of the GC and the CL space of the new host galaxy. This means that the photons emitted from the matter in the GC will appear red shifted when detected outside.** The red shift will come from the two reasons:

- a lower Maxwellian energy of the GC
- a energy fraction loss from the trespassing the photon through the GSS between the GC and the CL space of the new host galaxy.

In the present Cosmology now the GC are often categorised as a similar as the small size lenticular or disc galaxies. However, the GC, according to BSM concept is a result of quite different evolution. **It distinguishes also from any galaxy by the fact that the Globular Cluster does not possesses a galactic nucleus.** These feature is very important for the behaviour of the GC in the new galactic CL space. It means that the lost energy of the GC could not be compensated by the same way as in the normal galaxy, which obtains a constant energy supply by the galactic nucleus.

The reduced total energy means that the CL space parameters including the Planck's constant are affected. The latter is involved in the definition of the Newton's mass of the matter. In the new born galaxy, the GCs are forced to rotate around the galactic centre as the other matter. **Consequently the GC exhibit interaction with the flying folded nodes coming from the host galaxy. In order to keep the compatibility with the host CL space conditions, the GC matter may undergo a particular evolutionary process. The matter density and the energy of the GC could be segregated in**

concentric layers of stars. Such effect is a typical for the GCs and is known as a mass segregation. Some stars from the periphery could be lost, living part of their rotational energy to the total energy of GC. The matter of GC may also undergo reversed evolutionary process in respect to the evolution of the stars from the main sequence. This means, that the metalicity may go partly in direction of decreasing instead of increasing. In other words elements with larger Z numbers may convert to lower Z number (by nuclear reactions) if the reaction leads to energy release. For the same reason the star released by GC and occurred in a foreign CL space may undergo again a phase of instability. **According to BSM, such star behaves as a cepheid of II-nd type.**

Note: According to the feromagnetic hypothesis (formulated in Chapter 8), the Iron is most abundant because of the harmonics correlation of the N_{RQ} of the galactic CL space and the N_{RQ} of the modulated CL space inside the solid substance of Iron. However in the GC, the CL space parameters are strongly modified and the Iron may not be the most feromagnetic (and consequently stable) element for that space.

Massive and tightly packed GCs typically contain from 100,000 to million and more stars. Approximately 150 of these huge clusters populate the halo of the Milky way galaxy. Their age, estimated by the existing methods appear to be in order of 15 billions years. This parameter by itself has been one of the big puzzles of the Big bang theory (because the estimated Universe age appears smaller). The estimated age of some GCs in Andromeda galaxy appear to be in the range between 10 and 20 billion years. For more information about this issue see <http://www2.astronomy.com/astro/News/News/020400Hubble.html>.

In the next section, the provided above considerations are confirmed by analysis of observational data about the GCs and the Cepheids type II.

12.B.7.2 Experimental analysis

12.B.7.2.1 Reduced energy to matter ratio and CL space energy of the GC in comparison to the host galaxy

King's study (1996) have shown that a lowered Maxwellian energy dependence appears to be

a good approximation to the solution of the Fokker-Plank equation describing the phase-space diffusion and evaporation of stellar systems like GCs. This model fits the density profile of GC quite well, but it has not been accepted at that time because a “lack of physical meaning”. Later the model has been modified, considering that the GC system is consisted of two separate subsystems:

- a slowly rotating halo subsystem
- a rapidly rotating disk subsystem

According to BSM, the first subsystem might be in the own GC’s CL space, while the second one - in the foreign CL space (the CL space of the host galaxy).

Figure 12.41 shows the comparison of the surface brightness in NGC 3379 with a theoretical curve, according to the early King’s model (King, 1996).

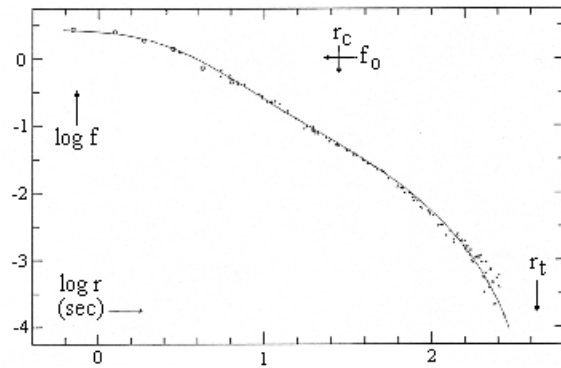


Fig. 12.41

Comparison of the surface brightness in NGC 3379 with a theoretical curve according to King’s model (King, 1996)

Another indication about a lower GC’s total energy comes from the comparison between the period-luminosity relations obtained for classical cepheids and for cepheids of II-nd type. The latter type of cepheids is considered as a typical for cepheids from GCs. Figure 12.42 shows the relations for both type of cepheids.

A similar difference between both types of cepheids is valid for other galaxies as well. Baade W. and Swope, H.H. (1965) have shown this for Andromeda galaxy.

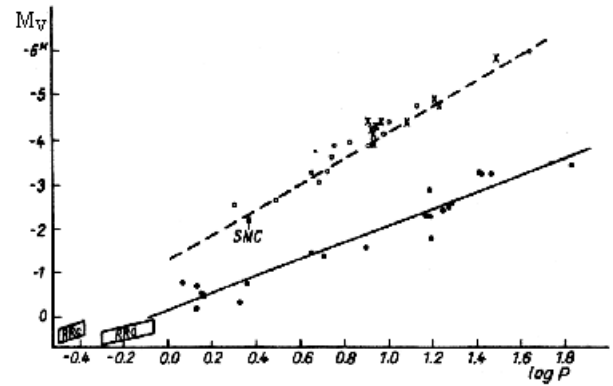


Fig. 12.42

Period-Luminosity relationship for a classical cepheids

(above) and for W Virgins stars (below). o - variables in galactic clusters, x - variables in the Large Magelanic Cloud.

(Courtesy of Dickens and Carey (1967))

Another observed phenomena, characterizing the cepheids of II type (from GC) is the **spectral line doubling**. It usually occurs during the phase of eruption. The two lines are often referenced as a blue and red component, respectively. The line doubling is usually combined with **another effect**: the radial velocity curves estimated by different spectral lines show a phase displacement. The existing so far theories for explanation of this phenomena accept a concept of a shock wave moving upward and intercepting the falling inward external layer. This concept, however, is not quite convincing in the explanation of the following effects:

- if the shift is of Doppler type only, why the lines are not smeared?
- the blue component is always stronger: this means, that one layer is always above the other.

The line splitting and the phase displacement for a II-nd type cepheid is firstly reported by R. Sanford (1952). Fig. 12.43 shows the calculated radial velocity assuming a Doppler shift for a W Virgins cepheids (type II) from GC M15 (NGc7078), (by R. Sanford, 1952).

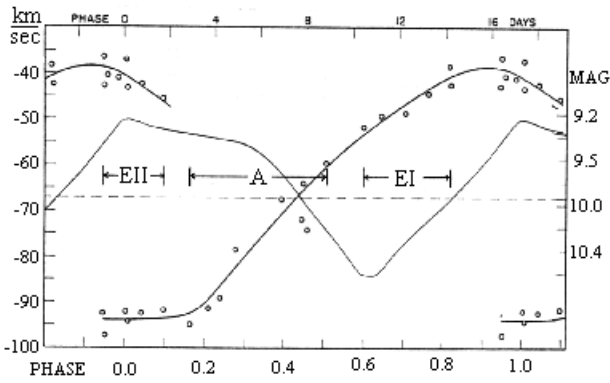


Fig. 12.43

Circles are absorption-line velocities of W Vir. One complete velocity curve is shown, together with the end of the preceding and beginning of the following velocity cycle. The Gordon and Kron's light curve is shown by a thin line, the systematic velocity is shown by a broken line.

Fig. 12.44 shows absorption line doubling for W Virginis (II type of cepheids) by Wallerstein (1959).

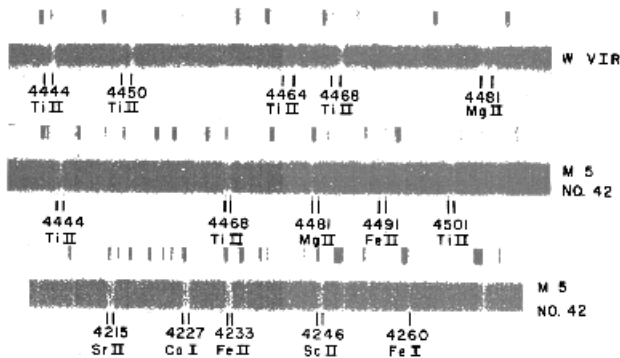


Fig. 12.44

Selected region of the spectra of W Vir and M5 No. 42 near maximum light

Abt (1954, pp. 86-87) shows that the excitation temperature derived from the violet component is always higher than that the temperature derived from the red component. This is suggestive that the violet component must be formed at a greater depth (comment of Wallerstein (1959)). Wallerstein (1958) shows that H_γ emission component detected in W Virginis stars is missing in the classical cepheids.

12.B.7.2.2 BSM concept of the processes in cepheids of II population:

If a star from a GB quits the cluster it must carry its own surrounding space, but the radius of this CL space is much smaller than the stars of I-st type population. Its total system energy is also smaller. It begins a reverse evolution leading to a phase of instability, so it converts to a cepheid of II-nd type. The kaon nucleus increases in steps, accompanied by crashing the external shells of the protons and neutrons that contributes to the release of RL nodes (consisted of 6 prisms). These nodes fly through the external atomic matter as folded nodes. They cause a broad band emission from the internal gas layers of the star. We may detect a signal not only from this layer, but also some absorption signal from the external gas layers. Some of the external layers are dragged by the flying folded nodes. So they may have a Doppler component but, we can not ignore the contribution also from the cosmological component, caused by the high velocity RL nodes (explained below). Due to the multiple periods of this phenomena some of the upper layer material could be dragged beyond the GSS (between CL spaces of GC and the host galaxy). Let us use the data shown in Fig. 12.30. The curve (1) could be from the layer inside of GSS, while the broken curve (2) - from the layer thrown outside GSS. It is quite reasonable to assume that the gas layers, whose absorption is observed, are optically thick. From phase 0.1 to 0.95 the flying nodes are still inside GSS and the absorptive features of the internal layer are only observed. From a phase 0.95 to 0.1 the flying nodes (passed through GSS) activate emission and absorption in the external layers, which are outside of the GSS. The spatial distribution of the flow of flying RL nodes could not have a spherical symmetry, because of the extended shape of the kaon nucleus. Then in a phase range of 0.95 to 0.1 we may observe absorptive lines simultaneously from layers inside and outside GSS. This means a simultaneous observation of two lines or line doubling. The line doubling is caused by the energy difference of the photon generating and photon propagating mechanism described below.

The photon emission and absorption process that takes place inside the GSS is optimized by the own CL space parameters of GC. So the observed

photons from the layer inside GSS cross once this surface and exhibit a cosmological z-shift. The absorption layers outside GSS are formed of atoms, possessing own FOHS CL space but operating in foreign CL space. The proton and neutron are closed helical structure and could not exhibit a geometrical change in the foreign CL space. The electron is an open structure, adjustable to CL space, but the electrons originated in GC are from the previous galactic life with different length to diameter ratio.

It becomes evident that the process of photon emission and absorption in the layer outside of GSS will be less effective than the same processes in the host galaxy. **Consequently, it will exhibit a specific cosmological z-shift.** This shift could be even larger than the z-shift of a photon generated inside GSS (in own CL space), and passing through GSS.

According to the above considerations the detected absorption signal should be comprised of:

(a) photons generated inside GSS with missing strong absorption lines (both processes in own CL space), exhibiting a Z-shift

(b) photons generated inside and outside GSS with missing absorption lines from a photon absorption outside of GSS (absorption in foreign CL space)

The physical process causing a z-shift from the GSS of GC is identical to the z-shift process between the galaxies. So with some approximation we may accept that the quasirefractive index of GSS of GC is equal to the mean quasirefractive index of GSS, \bar{n} , (see §12.B.4.2.4). The relation between \bar{n} and Z-shift was given by Eq. (12.29)

$$(\bar{n})^N = Z + 1 \quad [(12.29)]$$

Let assuming that the z-shift from GSS of GC is approximately equal to the normalized GSS quasirefractive index (normalized to one pass of GSS) discussed in §12.B.4.2.3.

Then we may find the quasirefractive index of GSS of GC as an energy ratio between the red and the violet component of the observed lines from the spectrum shown in Fig. 12.31. Using Ti II lines of M5 spectrum we get

$$\frac{E_1}{E_2} = \frac{\lambda_2}{\lambda_1} = 1.0002 = 0.02 \% \quad (12.45)$$

The obtained value of the quasirefractive index is quite approximate, because a possible Doppler shift could be indistinguishable from the cosmological z-shift in this simple interpretation. However, it still may indicate that the quantum efficiency of the process of emission/absorption of GC matter in foreign CL space is different than in own CL space. Some useful insight into the process could be obtained also by the analysis of the hydrogen emission component H_γ .

The cepheids of type II exhibit much shorter period than the classical cepheids. Their evolution, however, may lead to a pulsar as the dying star from a I-st population.

12.B.7.3 Summary:

(a) **The globular clusters are remnants from the previous life of the host galaxy**

(b) **Every GC is separated from the host galaxy by a GSS**

(c) **The similarity between the GC and a small galaxy is that both have a GSS, but the GC lack of galactic nuclei as a source of energy and its CL space volume is much smaller.**

(d) **The star evolution in the GC may go partly in a reverse direction (from the point of view of the ferromagnetic hypothesis)**

(e) **If some star is released from a GC it may occur in a foreign CL space. In a such environment it may undergo again through a phase of instability and become a cepheid of type II.**

(f) **The main distinguished features between the classical cepheids and those of type II are the differences in their metallicity, their period range and the slope of luminosity- period relation.**

12.B.7.4 Conglomeration of remnants from the previous galactic life

In the previous paragraph we see, that individual GCs are formed of islands, which have escaped the former galactic collapse. Some of this islands could be quite large with not uniform matter distribution. Having such shape they may not convert to a compact individual GCs during the recycling phases. As a result, they may form an irregular looking galaxy in which some individual GC's could be identified. Congregation of isolated is-

lands into one common island is also possible during the phases of the galaxy recycling. Irregular galaxy with such signature is the Sagittarius Dwarf galaxy (SagDEG) discovered in 1994 by R. Ibata, G. Gilmore and M. Irwin. Its shape is shown in Fig. 12.45.

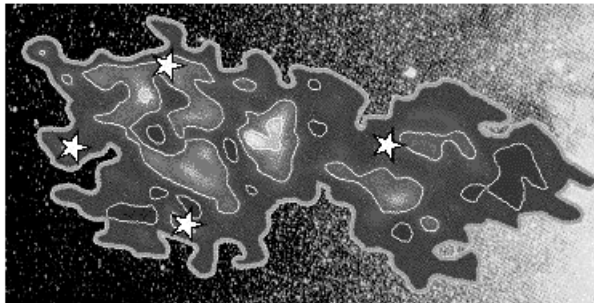


Fig. 12.45
Sagittarius Dwarf galaxy

Sagittarius Dwarf is inside the Milky way CL space about 80,000 LY from the solar system. The M54 coincides with one of the galactic two bright regions and exhibits the same Z-shift. Another three GC's from the galaxy are identified (Arp2, Terzan 7 and Terzan 8).

The researchers who studied the Sagittarius dwarf found a large velocity corresponding to galaxy circling inside the Milky way in an almost a "polar" orbit (if accepting that the Milky way galaxy disk defines the equator), while the galactic disk matter rotates in the equatorial plane. Since the discovery of SagDEG, researchers have noticed that some of its stars are strikingly similar to stars in the Large Magelanic Cloud (LMC), another nearby satellite galaxy that is located slightly farther out from the Milky Way. A team led by Patrick Cseresnyes of the Paris Observatory found strong similarities in a certain class of highly evolved, old stars seen in both of these satellite galaxies. An opinion is expressed that both satellites may have a common galactic ancestor. The bulk of the SagDEG stars were recently found to be relatively metal-rich and determined to be around 10 to 14 billion years old (Fahlman et al., 1996). This age value contradicts to the estimated age of the Universe that appears smaller. Number of theories exist trying to solve this problem but their arguments are not enough strong

(see http://map.gsfc.nasa.gov/m_uni/uni_101age.html).

The explanations of the observed strange behaviour of the SagDEG from the point of view of BSM theory is the following:

Firstly, the SagDEG is not a separate galaxy, but a formation from the former life of the Milky way galaxy, which has escaped the collapse. In favour of this conclusion are the following considerations: the different angular momentum (in respect to the matter in the galactic disk) is perhaps obtained during the explosion of the protogalactic egg; the GCs are contains; the very old age stars and the fact that they have not been disrupted. The similarity between the SagDEG and the very close irregular galaxy of Magelanic Clouds leads to the hypothesis that they both are remnants from the former life of a galaxy in the space of the present Milky way and Magelanic clouds galaxies.

12.B.7.5 Effect of GC detectability in distant galaxies

Why the GCs from distant galaxies are detectable?

The line emissions from the GCs after passing through the GC GSS appear slightly red shifted in respect to the lines that could be emitted or absorbed in their host galaxy. In such way the photons with shifted wavelengths escape from the strong absorption. The absorption is mainly due to the Doppler broadened line profile so it is not eliminated but reduced. This is valid also for the broad band emission, because it is consisted of numerous individual lines. Passing through consecutive GSS the emitted lines are additionally red shifted. This effect however is quite useful for observation. It allows observation of GCs from very distant galaxies. This provides excellent opportunity for determination of Hubble constant for distant galaxies by distinguishing the light from the I-st and II-nd type population and applying the knowledge of the difference in the luminosity functions, determined by the Milky way and neighbouring galaxies. The method is proposed by William Harris (1988) and successfully used by Tonry et al (1990).

In §12.B.13 a BSM method is presented for determination of distance to very distant galaxies in the stationary Universe. In this method the Hubble constant is implicitly involved, so it appears useful

even for the concept of a stationary universe. Only its meaning is changed: instead of “velocity per distance” it obtains the meaning “red shift per average galaxy size”.

12.B.7.6 Energy loss effect of GC

The mismatch of the emission and absorption lines between GC and the host galaxy leads to a constant energy imbalance between them. But in own CL space the GC the quantum interactions are optimized. The GC, however, may lose faster energy in comparison to the host galaxy, because the lack of own galactic-like nucleus. The continuous starvation for energy might be fed by two mechanisms:

- (a) dropping some peripheral stars whose energy is sucked by the system
- (b) decrease of the binding energies of the atoms (decay nuclear reactions)
- (c) obtaining of energy stored in the atomic particles by crashing some atomic material

The case (a) is observable phenomena

The case (b) means disintegration of heavy elements

The case (c) is related with growing of kaon nucleus and release of RL(T) structures from crashed FOHSs. It starts from the phase of the variable stars and ends with the phase of the dying star and release of a free kaon nucleus.

12.B.8 Interacting galaxies

The case of interacting galaxies is considered as deviation from the normal galactic cycle. Their percentage is relatively small. The possible conditions leading to interaction between the galaxies are the following:

- (a) uneven collected matter during the galaxy collapse
- (b) some defects of the galactic nucleus.

The case (a) means that the spherical symmetry of the collapsing events is so severely disturbed that it may lead to form of GCs and escaped islands only in a small spatial angle around the galactic nucleus than in the full 4π angle. This may happen if the CL space is separated unevenly from the neighbouring galaxies during the collapse. This may affect both: the position of the protogalactic egg (with included inside nucleus of bulk matter)

and the directions of the expanding new born matter after the explosion of the protogalactic egg. Then a portion of the released new matter, together with the new CL space may trespass in the CL space of one of its neighbouring galaxies. **This concept provides an answer why most of the observed colliding galaxies are of odd shape.** One example of colliding galaxies with irregular shape is the Antennae galaxies.

In a normal case the prisms from different galaxies have different length to diameter ratio. So their CL spaces and matter are incompatible. Any matter (atomic structure) will operate in a foreign CL space with lower quantum efficiency (this has been shown for the cepheids from the GCs). Then the congregation of atomic matter is not so effective. It may not lead to formation of stars as in the case of main sequence of H-R diagram. From a cosmological point of view the CL spaces and matter from different prism formations will exhibit a feature of not mixability. This means that two colliding galaxies may form a manifold of CL spaces separated by GSS. The image from such galaxies will look as they have multiple separation surfaces. Such features are observed in the colliding galaxies. Fig. 12.46 shows the image of Antennae colliding galaxies obtained by the Hubble Space telescope. The enclosed part of the lower resolution left image is shown as a high resolution image in the right side of the figure

(from: <http://astrowww.phys.uvic.ca/~patton/openhouse/antennaehst.jpg>).

The low resolution image shows radiation from regions quite away from the large mass concentration. This is a signature of CL space interactions. In fact it is from a gas substance around the regions adjacent to the GSS. The high resolution image unveils nonmixability of the two CL spaces. Multiple stripes with sharp contrasts are quite distinguishable. They correspond to penetration of matter from one galaxy into the CL space of another one. Note that the stripes are quite extended and look connected. The interpretation of the dark stripe as a dust is not reasonable. A possible dust component could not exhibit such spatial features with a sharp contrast.

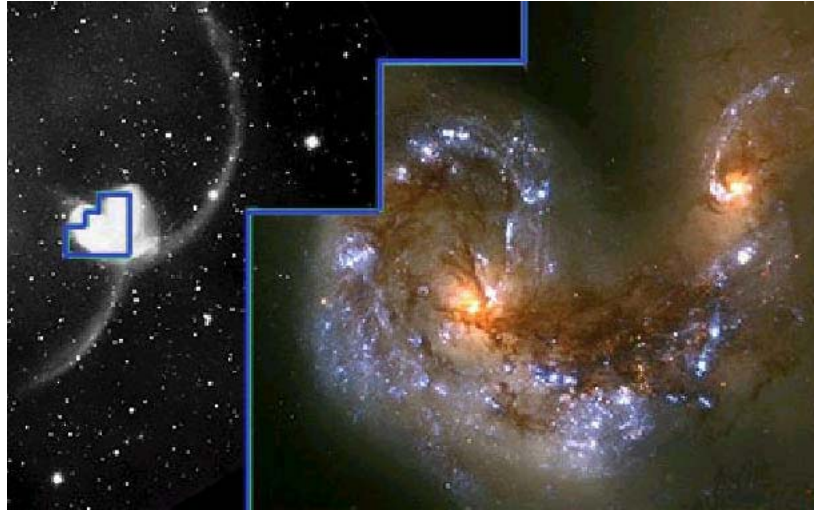


Fig. 12.46

12.B.9 Cosmological anisotropy.

The pancake shape of the galaxy is predetermined by the axial rotational symmetry of the clusters in the galaxy egg. It defines the preferable direction of expansion of the new formed CL space. The shape of new CL space is restricted by the existing empty space, but the study of the signals from a new born galaxies (GRB) indicate, that some small motions of the neighbouring galaxies is possible. Then in the time range of multiple galactic cycles, the neighbouring galaxies may get preferential orientation of their minor axes. In such case larger formation of galaxies will show spatial anisotropy. Such anisotropy is really observed.

The spatial anisotropy provides one specific feature of the observed radiation from the distant quasars. The photons from any quasar with high z -shift passes through multiple GSSs, exhibiting small energy loss from any one. The multiple refurbished wavetrain of the photon may carry accumulated features from the incidence angle on every GSS. The alignment between galaxies is valid up to some range, but once the passing quantum wave is polarized it could not be depolarised if a scattering is not involved. Only the vector of polarization will have different angle for different distances from the source. In such case the detected signal will get polarization that will show increase with the Z -shift. The polarization dependence from Z -shift is observed in the radiation from distant quasars.

12.B.10 Crab nebular and pulsar

The bright pillar structure of the Crab Nebular was one of big mysteries, until the explanation provided by BSM.

The Crab nebula is a remnant of supernova explosion observed by the Chinese as a “guest star” in 1054 a. d. Figure 12.47 shows clearly the emitting pillars in a red light photography (Courtesy of Lick Observatory).

The Crab nebular and its pulsar are result of explosion of supernova of second population star (or more than one star). The released kaon nucleus exhibits all the features of a double jet pulsar described in §12.B6.4.9: a lack of proper motion, a very short period, a comparatively fast aging (estimated by the increasing rate of the secular period).

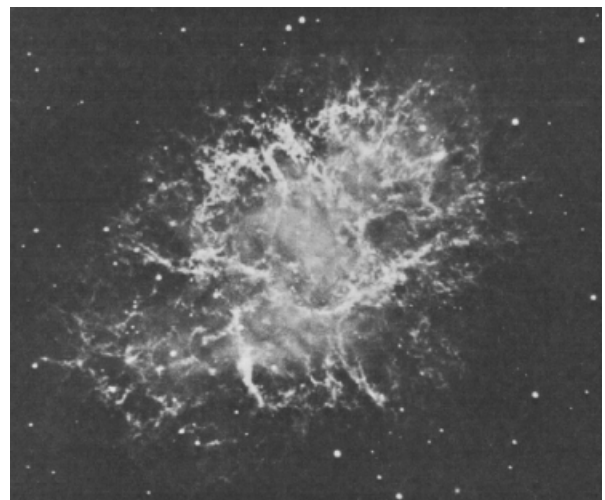


Fig. 12.47 The Crab nebula photographed in red light [Courtesy of the Lick Observatory]

In many scientific articles the strange behaviour of the Crab Nebula with its pulsar is identified as a natural synchrotron.

From the point of view of BSM, many features of the Crab Nebula indicate that it is a remnant from one of the previous lives of our galaxy. The exploded star probably is from a globular cluster, containing own CL space. The prisms of this CL space are from the old formation (having slightly different diameter/length ratio). Such CL space structure is not mixable with the Milky galaxy CL space. For this reason it is spread in form of pillars. Many of these pillars perhaps are interconnected forming a spatial manifold. Some quantity of the remnant atomic matter could be settled inside the pillars, other - outside of them. The atomic matter outside of the pillars has to operate in foreign CL space, with significantly decreased quantum efficiency. The matter inside the pillars operates in own CL space with a normal efficiency. Many observational properties of the Crab pulsar indicate that it is a double jet kaon nucleus. Some observers accept that the pulsar rotates around some massive object. Then, according to BSM, it will have an wobbling motion and its two jets will irradiate the spread atomic matter. The jets containing high velocity RL nodes not only irradiate the pillars, but supply them with a constant flow of flying RL nodes until they are refurbished into folded CL nodes. The latter will create a halo of own CL space in a region surrounding the pulsar that continuously increases. In such way the remnant matter that is in this halo operates in own CL space and could be observable as a diffuse radiating region.

Figure 12.47.A shows an X-rays image from the Crab nebula obtained by Chandra X-ray Observatory in 1999. The analysis of the observed image is in agreement with the above presented concept

The pillars of Crab nebula are more distant from the central halo region but the intensity of their radiation is higher. Their radiation mechanism is different. Let suppose that the radiating pillars are connected in manifolds. The manifold sections nearer to the pulsar will be stronger irradiated by the jets than the more distant sections. Consequently, the wobbling rotation of the pulsar will supply different energy to the connected pillars maintain-

ing in such way a constant ZPE potential difference. This will cause a continuous motion of atomic matter inside the connected pillars. In such process it could be highly ionized and will emit a broad spectrum. **Then the system of the manifold structure in the Crab Nebula pillars and the Crab pulsar may provide a synchrotron-like radiation.**

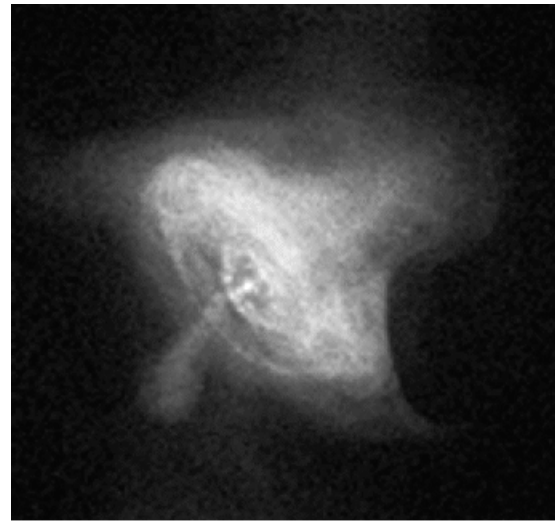


Fig. 12.47.A. The Crab nebula in X-rays
 Credit: Chandra X-ray Observatory, NASA
 (<http://antwrp.gsfc.nasa.gov/apod/ap990929.html>)

The ZPE potential between the closer and the distant pillars in respect to the pulsar will contribute also to the gradient of the cosmological shift between inner and outer regions of the nebular. This is the reason for identification of larger expansion velocity in the more distant pillars, when considering that the observed red shift is only of Doppler effect.

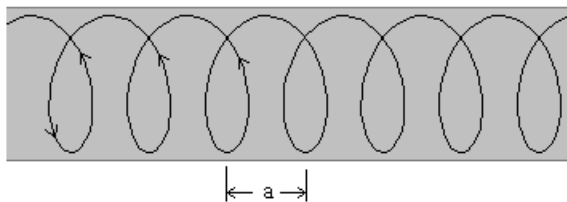
12.B.11 Quasars

Fig. 12.36 shows that the number of pulsars detected in the Milky way galaxy is quite large. All they are in motion due to own propulsion mechanism suggested in §12.B6.4.2. and illustrated by Fig. 12.29. Cepheids of type II are typical for the GCs. From the concept presented in §12.B.7.2.2 it is evident that their evolution also leads to formation of pulsars. The released nodes of kaon nucleus RL(T) structures from the moving pulsar will be refurbished to CL nodes, but they could not mix with the CL space of the host galaxy. So they will

form some kind of pipe in the place of the pulsar's trace. It is possible one pulsar born from a cepheid from one GC to arrive to another GC. In such case the CL spaces of both GCs could be connected by a pipe of CL space from their own type of prisms. The pipe could be quite long in order of kpc.

Let analyse the case of two GCs that has been isolated and in some moment they get a connection through a pipe of own CL space, provided by a moving pulsar. As a result of their previous individual evolution in foreign CL space of the host galaxy, they may have different total energies. This difference could be valid also for the zero point energy of their CL space. Then in the moment of their interconnection by a pipe an energy potential will occur between them. This potential will cause an energy transfer that will be carried by accelerated atomic matter. The transferred atomic matter may rotate inside the pipe and the atoms and ions might be excited. This will provide an emission, characterized by Doppler broaden lines.

The cosmological length of the pipe and the rotational motion of the transferred atomic matter may cause appearance of longitudinal modes with long wavelength coinciding with the emission of the hydrogen or some other atoms in the radio spectral range. In such case the emitted radiation obtains some kind of coherence. This feature provides and opportunity the radiation from the flowing matter to be effectively observed by technique known as a Very Long Base Interferometry. Let assume that the flowing and excited atomic gas which is closer to the pipe wall has a helical trace. This is illustrated in Fig. 12.48.



12.48

Atomic motion in the pipe

It is obvious that for the distant observer such type of motion will exhibit a large Doppler broadening of the emitted lines. If accepting a laminar flow we may expect that the emitted radiation in

the radiowaves frequency range may appear synchronized. The longitudinal mode defined by the helical trace step a may become a whole number of some wavelength of some of the transitions of the atoms (or molecules) involved in the gas flow. In such case the helical trace is stabilized and may provide a coherence radiation. Such signal could be easily detected by a long based interferometry.

The described phenomenon is a quasar. The emitted lines from all quasars are broaden. Compared with the variable stars the quasars are comparatively rare phenomena. For these reason they has been observed preliminary in large distances (large cosmological z-shift). In 1994, however, a similar phenomena has been observed in the radiogalaxy Cygnus A only at 600 million light years from us. The emitted spectral lines from this quasar are also broadened, but not polarized, as from the more distant quasars. This difference, according to BSM, is a result of smaller number of intercepted GSSs (see the explanation in the previous paragraph) from the closer quasar. Figure 12.49 shows the image of Cygnus A quasar.

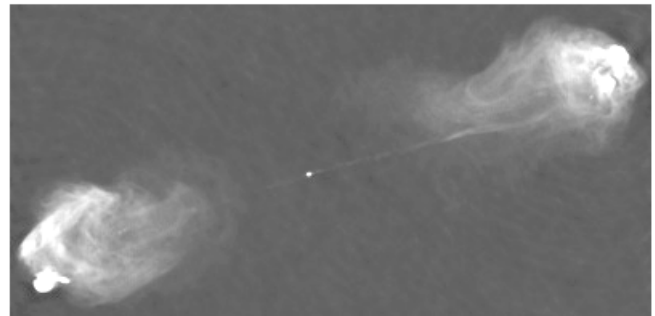


Fig. 12.49

Signus A quasar (BSM interpretation)
<http://home.achilles.net/~jtalbot/news/3C405.html>