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THE POSIBILITY OF TRIPLE DETONATION IN WHITE DWARFS

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ABSTRACT. The induced γ-ray emissions are considered in contact cataclysmic binary systems with strong magnetic fields near white dwarfs and companion's stars' components. He-C-O atoms in white dwarf's atmospheres collide with flows falling to poles as a magnetic column. Near white dwarf's surface the falling flows with speed reaches $3 \cdot 10^6\ m/s$ and creates sufficient conditions for nuclear γ-radiation emission. The cross sections of nuclear γ-radiation emission are presented in 0.1 – 150 MeV energy intervals depending on the colliding atoms and particles. The mass loss from binary components is of the order of $\dot{M} \approx (10^{-11} - 10^{-7}) M_{\odot}$. We considered the collisions of p – He, α – He, p – C, α – C, p – N, α – N, p – O, α – O, C – He, C – C, C – N, C – O, N – He, N – C, N – N, N – O, O – He, O – C, O – N, and O – O types. Monochromatic energy luminosities Lγ in the above energy intervals for different modes in cataclysmic systems were calculated taking into account the loss of mass $\dot{M}$, chemical composition and dynamics of fluxes incident on the magnetic poles. We found the dependencies between L_γ and chemical composition and calibrated the synthetic γ-spectra in the above pointed energy intervals. It has been concluded that power flyers are detected from p-p detonation in surface layers in white dwarf's atmospheres. From calculation we estimated that p-p detonation time scale is in frame of the 0.07-0.1 sec. From which it is concluded that in some surface p-p explosions in the column of the magnetic field are produce significant number of positrons who has a sufficient probability to inject beyond the atmosphere of a white dwarf. It has been shown that the induce γ-ray spectroscopy together with positron spectroscopy are opens new possibilities for diagnostics of the flayers in AM Her polar system. The mechanism of triple detonation, which leads to the explosion of type I supernovae, is proposed. In this context, it is assumed that SN I type explosions occur in white dwarfs with masses not reaching the Chandrasekhar limit. The neutron formation in the matter that are in an explosive state after p-p detonation is considered separately.

Keywords: AM Her type polar, p-p explosions in white dwarf's, induce γ-ray spectroscopy, positron spectroscopy, triple detonation and phenomena of SN type I explosions, cross sections for induced γ-rays and neutrons production.

АНОТАЦІЯ. Індуковані випромінювання γ-променів розглядаються в контактних катаклізмічних бінарних системах з потужними магнітними полями поблизу білих карликів та компонентів зірок-компаньйонів. Атоми H-He-C-O в атмосфері білого карлика стикаються з потоками і падають на полюси у вигляді магнітного стовпа. Біля поверхні білого карлика швидкість падаючих потоків досягає $3 \cdot 10^6$ м/с і створює достатні умови для формування ядерного γ-випромінювання. Перерізи ядерного γ-випромінювання у наслідок зіткнень представлені в енергетичних інтервалах 0,1-150 МеВ залежать від взаємодії атомів і частинок. Втрати маси від двійкових компонентів мають порядок $\dot{M} \approx (10^{-11} - 10^{-7}) M_{\odot}$. Ми розглянули зіткнення між p – He, α – He, p – C, α – C, p – N, α – N, p – O, α – O, C – He, C – C, C – N, C – O, N – He, N – C, N – N, N – O, O – He, O – C, O – N і O – O ядрами. Монохроматичні енергетичні світності L_γ у зазначених вище енергетичних інтервалах для різних режимів у катаклізмічних системах були розраховані в залежності від втрати маси $\dot{M}$, хімічного складу та динаміки потоків, що падають на магнітні полюси. У роботі вивчено залежності між L_γ, хімічним складом та відкалібрували синтетичні γ-спектри у зазначених вище енергетичних інтервалах. Було зроблено висновок, що енергетичні спалахи виявляються внаслідок p-p детонації у поверхневих шарах в атмосфері білого карлика. За підрахунками ми оцінили, що шкала часу p-p детонації знаходиться в межах 0,07-0,1 с. З чого зроблено висновок, що в деяких поверхневих p-p вибухах у стовпі магнітного поля значна кількість позитронів володіє достатньою імовірністю для їх виходу за межі атмосфері білого карлика. Показано, що індукційна спектроскопія γ-випромінювання разом із позитронною спектроскопією відкриває нові можливості для діагностики γ-спалахів в полярах типу AM Her. Запропоновано можливий сценарій, коли після p-p спалахів зініціюється вибух у гелієвому шарі, а він свою чергу, вибух в центральній C-O зоні ядра білого карлика. Запропоновано механізм потрійної детонації, який призводить до вибуху наднових типу I. У цьому контексті передбачається, що вибухи типу SN I відбуваються в білих карликах з масами, не встигаючими межі Чандрасехара. Окремо розглянуто нейтронізацію речовини, яка знаходиться у вибуховому стани після p-p детонації.

Ключові слова: Поляри типу AM Her, p-p вибухи у білих карликах, індукована спектроскопія індукованих γ-променів, позитронна спектроскопія, потрійна детонація та явища вибухів наднових I типу, перерізи для виробництва індукованих γ-променів та нейтронів.

1. Introduction

The hard radiation activity in binary cataclysmic systems was found by ROSAT missions to be an independent indicator of compact white dwarf companion's presence. The soft and hard X-ray emissions have been used for diagnostics of physical processes in accession disks or in upper parts of the flows falling to magnetic poles (Thorstensen, J. R., Halpern J, 2013), (Mizusawa, T., Merritt, J., Bonaro, M., et al., 2009), (Newall, H. F., 2003). The induced γ-ray method for the diagnostics of columns in the near surface of white dwarfs where the formation of reverse shock wave begin was developed. The motivation for induced γ-ray using we received after the investigation of Active Galactic Nucleus (therefore AGN-s) peripheral zones (Doikov, 2020). In case of cataclysmic binary systems, the gas flow from the second companions was used instead of cosmic rays. The physical conditions for colliding zone are considered to be sufficient for the possibility of nuclear fusion reaction during blow of accretion gas stream across strength magnetic lines ($10^7 Gs$). The compressed and accelerated matter in hard gravitational and magnetic fields near surface interaction zone possesses the possibility to launch nuclear reaction and creates same kinds of detonation zones (Tanikawa A., Nomoto K., Nakasato N., et al., 2019), (García-Senz, D., Cabezón, R. M., Domínguez, I., 2018), (Tanikawa A., 2018), (Shen K.J., Kasen D., Miles B. J. et al., 2018), (Boyle, A., Sim S.A., Hachinger S. et al., 2017). We investigate the conditions after soft γ-and hard X-rays illumination un the nuclear interactions.

If we overview the history of investigation of other types Nova binary systems, we can point that the observation of the U Sco from X-rays telescope missions shows soft X-rays illumination during 1-6 days after the thermonuclear explosions in hydrogen surface layers. But the INTERGRAL mission hard X-ray and soft γ-ray was not detected in cases of this explosion. It can be explained as the result of accretion disk disappearing under the influence of hard conditions during the discussed event. That is why the possibility of observation of induced γ-ray radiation is significant only at the moment of white dwarf's surface thermonuclear explosion or at the moment between shock wave after explosion and accession disk. This are the first ours of outburst. It seems possible that the hard X- and soft γ-ray's diagnostics are preferable for AM Her type systems. The pre explosion interaction between accession flows with the white dwarf's surface produce the induced γ-ray emission.

This paper consists of Introduction, 3 Chapters, Conclusion, and Discussion. In Chapter 1 we present cross sections in mbn ($10^{-27} cm^2$) for all collision types where the first elements are projective particles and the second are targets elements. In Chapter 2 we found the cross sections for calculation of synthetic γ-spectra, and develop the plasma thermodynamics in hard radiation fields. Chapter 3 proposes the method for calculation of chemical composition from induced γ-spectra during energetic flyers. Discussion compares the induced γ-spectra with other no thermal spectral kinds. Conclusion presents new diagnostic methods to study different types of cataclysmic processes.

2. Nuclear γ-ray emission after pseudo hard collisions

One of the sources of γ-emission is the pseudo hard collisions regime between projective and target particles. In this case the target particle may be we shown in the form of nuclear oscillator with radiative (soft γ – or hard X-ray) transitions. If so, then one should expect a correlation between X-ray and γ-ray bursts in AM Her type stars. It can be expected when thermonuclear reactions flare up at the base of the accretionary column of a polar. In this chapter we present physically important collisions channels and cross sections of these collisions. The cross sections are presented for elements, important for the events under consideration. For different chemical composition of the donor star companion (progenitors) the correspondent data from Figs. 1-11 were used to calculate the induced γ-ray emission from cataclysmic binary systems. The field of our interests includes only binary systems with compact relativistic objects and hard magnetic fields ($10^7 H$). At the bottom of accretion column in contact with the surface of such a companion the start of thermonuclear reactions can be expected in the form of a local thermonuclear explosion. The flux of hard radiation flares depends from the sum of gas plasma stream kinetic and magnetic field energy, used for thermonuclear reaction on the white dwarf surfaces. The part of this energy belongs to induced γ-ray radiation. In this case it could be accepted that the explosion can be considered to be the point explosion and the geometry characteristics can be excluded for simplification. We take into account the mass fragments important for flayer activity att the time scale of one week. Than for observed mass loss in AM Her types systems $\dot{M} \approx 10^{-11} M_{\odot}$ (per year) or per one week full column mass is $M_{collumn} \approx 2 \cdot 10^{-13} M_{\odot} \approx 2 \cdot 1{,}989 \cdot 10^{17} kg$. This is near one Jupiter mass. Than the full consumed kinetic energy during one week is

$$E_{kin} \approx M_{collumn} \frac{v^2}{2} \approx 4 \cdot 10^{30} J \; or \; 4 \cdot 10^{37} erg \qquad (1)$$

The magnetic field energy spent for the sharp compression of the plasma falling on the surface of the white dwarf. The geometry of this column is close to conus. After the onset of thermonuclear reactions on the surface, the extreme intensity can last for weeks. In other words, during the noted period, the γ-rays of nuclear origin are formed. In accordance with our expectation it includes the induced γ-radiation. The probabilities of production P_i and the optical depth τ of the induced γ-rays from AM Her type systems depends from cross sections (Figs 1–11) and for correspondent nuclear number densities – n_i (i is the element number) and geometric lengths τ of the exploded zone R can be expressed by formulas:

$$\tau_i(\mathrm{E}) = \sigma_\iota n_i \mathrm{R}; \;\; P_i \approx e^{-\tau_\iota} \qquad (2)$$

In white dwarf the surface mass densities start from $10^4 g \cdot cm^{-3}$ or $10^{29} cm^{-3}$ and decrease to zero in very thin zone. Usually the depth of this zone is $\propto 10^3 - 4 \cdot 10^4$ cm. $\nabla n \approx 10^{26} g/cm$. In these conditions all kinetic and magnetic energy should be transformed to initiate thermonuclear flayers. Usually, the geometric atmospheric depth are several tens of meters and to simplify the problem the white dwarf's atmosphere is accepted to be in hydrostatic equilibrium. The beginning of variable depth is from the depth where $n_0 \approx 10^{29} cm^{-3}$. The first approach for the number densities n can be taken from classical barometric formula:

$$n = n_0 e^{-\mu g h/RT} \tag{3}$$

$g = 1.5 \cdot 10^8\ cm/s^2, T = 2.5 \cdot 10^5 K$ then $\mu g/RT \approx 7{,}22 \cdot 10^{-3} cm^{-1}$. To the right of the point with coordinates (15, 24) on the Fig. 1 contains information about the formation zone. In the horizontal line level begins blocking of the induced γ-ray quanta this is upper horizontals. More exact $h \geq 16\ m; log10(n) \leq 24$.

2. Point thermonuclear detonation and secondary γ-ray emission

The bottom of magnetic tube column is considered to be the initial stationary condition. In some cases the mass fragments falls and hard compression from anomalous magnetic fields should exist. Together with thermonuclear collision the reactions between the marked nuclei for elements indicated in Figs. 1-11 should be the cause of secondary induced radiation. There are several scenarios of the interactions. Let the fall stream is the hydrogen-helium mixture and white dwarf's atmosphere is H-He – C-N-O mixture. In second case H-He stream is collided with H-He atmosphere (above the separated C-O core). The diagnostic of pre-detonation period needs the information about processes located in white dwarf's surface and brings back our attention to the loss of white dwarf's stability. For future calculation in this chapter we present the full number of the collision types with cross sections. In binary systems under investigation the accretion to white dwarf's thin atmosphere accumulates hydrogen layer. Then condition for the thermonuclear hydrogen explosion consist in the fulfillment of the densities and temperature conditions. In our case this are the conditions of the column's bottom.

2.1 Proton-proton detonation

The conditions for pre-Novae p-p point explosions we will consider only in small polar region. The interlaying period is necessary for hydrogen mass accumulation. In our case the mass loss from red dwarf components is $\dot{M} = 10^{-11} M_{\odot}$.

$$\frac{D}{\rho_1} = \frac{v}{\rho_2} \tag{4}$$

Where D is the speed of detonation (m/s); v – the speed of ion sound (m/s); $\rho_1\ and\ \rho_2$ are the specific densities (kg/m^3). In accordance with the low of momentum:

$$p_1 + \rho_1 D^2/2 = p_2 + \rho_2 v^2/2 \tag{5}$$

and the low of specific internal energy E (J/kg)

$$E_1 - E_2 = Q + (p_1 + p_2)(\frac{1}{\rho_1} - \frac{1}{\rho_2}) \tag{6}$$

Q is the specific internal and nuclear energy (J/kg); p_1, p_2 is the pressure before and after the shock front. Final equation for D and v is:

$$D = \sqrt{2Q(\gamma^2 - 1)}; v = \sqrt{\gamma z k T_i/m_i}; Q = \frac{feE\tau}{nm_p} = \frac{1}{4} n^2 eE \cdot \langle \sigma v \rangle \tau / nm_p \tag{7}$$

The detonation conditions is $D \geq v$. Or after substitution of all parameters in this inequality we have:

$$n\tau \geq \gamma z k T/(\gamma^2 - 1) E \langle \sigma v \rangle \tag{8}$$

Where f, $\langle \sigma v \rangle$ is the speed of reaction and its cross section, k – Boltzmann constant, e - dimension coefficient for transforming J in eV, n – the density number of reagents (in our case this is hydrogen) in white dwarf atmosphere. For pure hydrogen atmosphere we have simplified condition:

$$n\tau \geq T(eV)/E\langle \sigma v \rangle \tag{9}$$

Consider real conditions near the bottom part of the magnetic column. The accreted hydrogen atoms which have been accumulated in the star's surface between the power flyers are occupied the full upper part of dwarf's surface. Most likely the explosion begins from column bottom and extended to the other part of the surface in form of detonation Less likely - in the form of deflagration. This process depends from sound speed in white dwarf's atmosphere. In these conditions relations $D \geq v$, (7) and (8) can be written as:

$$D = \sqrt{2Q(\gamma^2 - 1)}; v = \sqrt{\frac{\partial P}{\partial \rho}} \approx 1.004 \cdot 10^{13} \mu_e^{-5/3} \rho^{1/3}; Q = \frac{feE\tau}{nm_p} = \frac{1}{4} n^2 eE \cdot \langle \sigma v \rangle \tau / nm_p \tag{10}$$

or

$$\frac{1}{4} n^2 eE \cdot \frac{\langle \sigma v \rangle \tau}{nm_p} \geq 1.004 \cdot 10^{13} \mu_e^{-\frac{5}{3}} \rho^{\frac{1}{3}}\ or\ n\tau \geq 4 \cdot 1.004 \cdot 10^{13} \mu_e^{-\frac{5}{3}} \rho^{\frac{1}{3}} m_p / eE \cdot \langle \sigma v \rangle \tag{11}$$

These relations for $n\tau$ value show almost instantaneous thermonuclear reaction flow along the entire surface of the dwarf then so name AB criterion from (10), (11) is completed. In combination with flows speed ($v_f \approx 3 \cdot 10^9\ cm/s$) the detonation time τ is very small with respect to full flyer processes time and the detonation speed v from formula is near the light speed. The secondary γ-ray's formation consists from positrons γ-ray lines on 0.511 MeV for two photons and 1.022 MeV for one photon annihilation. The other sources are the collisions between protons and α-particles with other atoms in white dwarf's atmosphere.

2.2. The possibility of γ-ray emission

In the history of the polar white dwarf's binary stars' system observation the γ-ray emissions were not detected. In our opinion, the reason is the rather small values of the characteristic time τ of the near-surface detonation of hydrogen. The second reason is blocking of γ-rays in dense atmosphere. In this case the main part of all energy of the explosion is transformed to the energy of shock waves. At the other case during the p-p or C-O flayers the positrons are produced. Let the start hydrogen mass in white dwarfs' atmosphere is M_H then full number of positrons is $N_{e^+} = \nu \cdot N_A$ particles. The Dirac formula for cross sections of the electron-positron annihilation reactions is:

$$\sigma_\gamma = \frac{\pi r_0^2}{\gamma+1}\left[\frac{\gamma^2+4\gamma+1}{\gamma^2-1} ln\left(\gamma+\sqrt{\gamma^2-1}\right) - \frac{\gamma+3}{\sqrt{\gamma^2-1}}\right] \qquad (12)$$

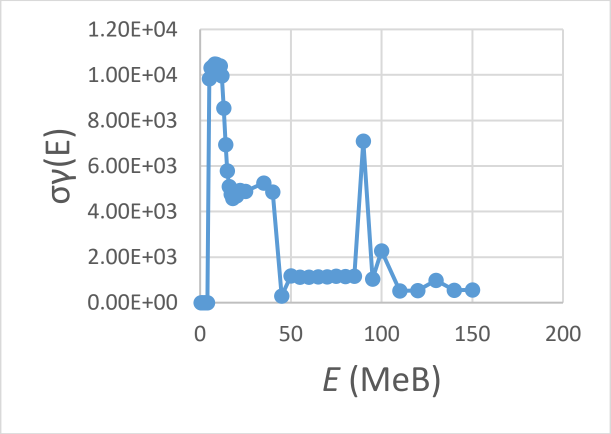

Figure 1: Reaction $\alpha + {}^4_2He \rightarrow \gamma + \cdots$

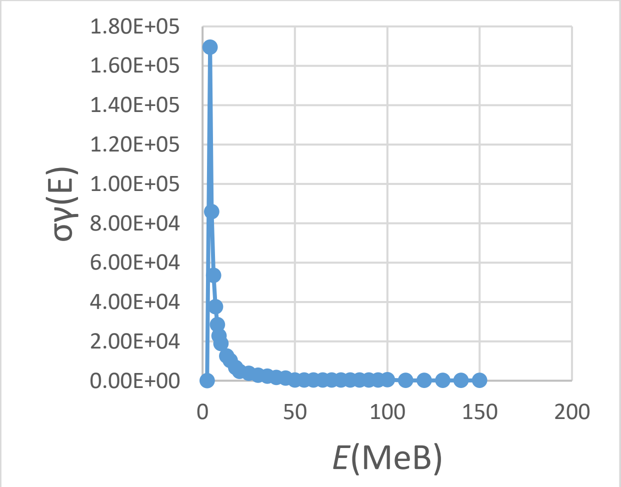

Figure 2: Reaction p $+{}^4_2He \rightarrow \gamma + \cdots$

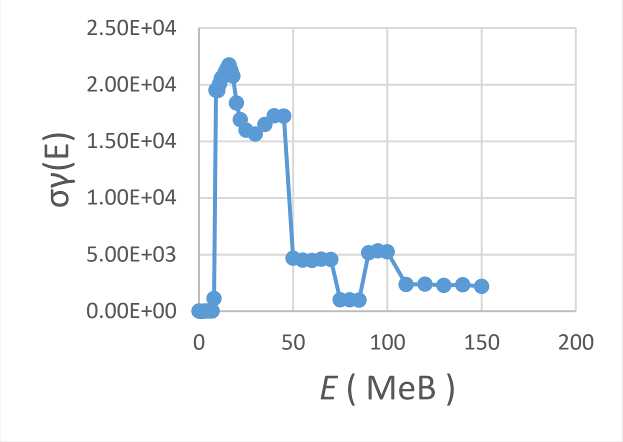

Figure 3: Reaction $p + {}^{12}_6C \rightarrow \gamma + \cdots$

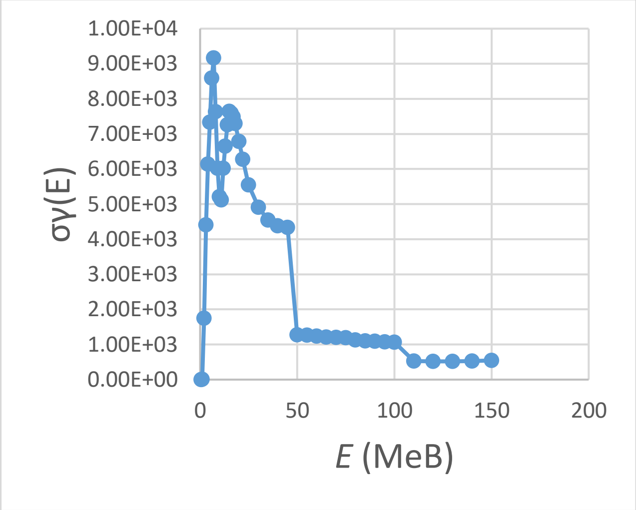

Figure 4: Reaction $p + {}^{13}_6C \rightarrow \gamma + \cdots$

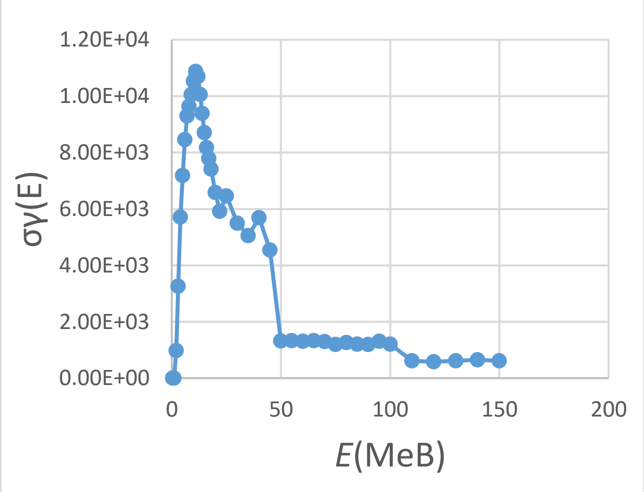

Figure 5: Reaction $p + {}^{14}_7N \rightarrow \gamma + \cdots$

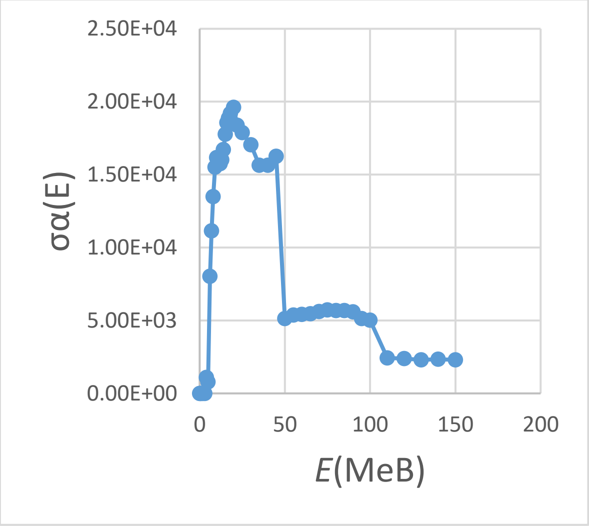

Figure 6: Reaction $\alpha + {}^{14}_{7}N \rightarrow \gamma + \cdots$

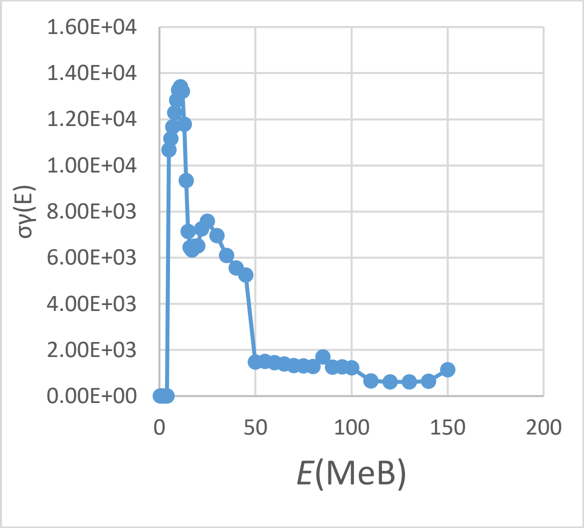

Figure 7: Reaction $p + {}^{16}_{8}O \rightarrow \gamma + \cdots$

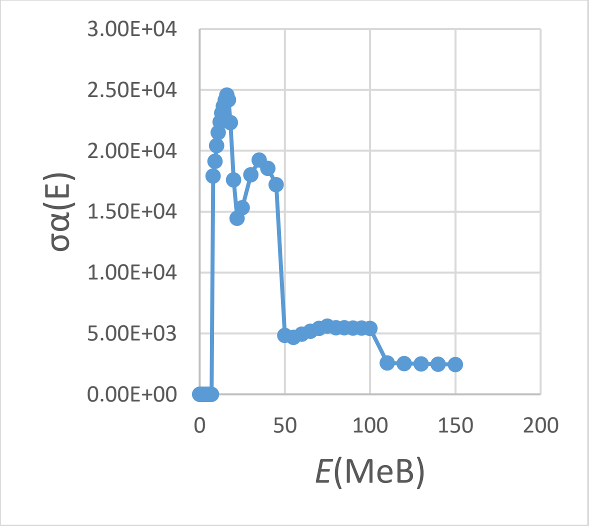

Figure 8: Reaction $\alpha + {}^{16}_{8}O \rightarrow \gamma + \cdots$

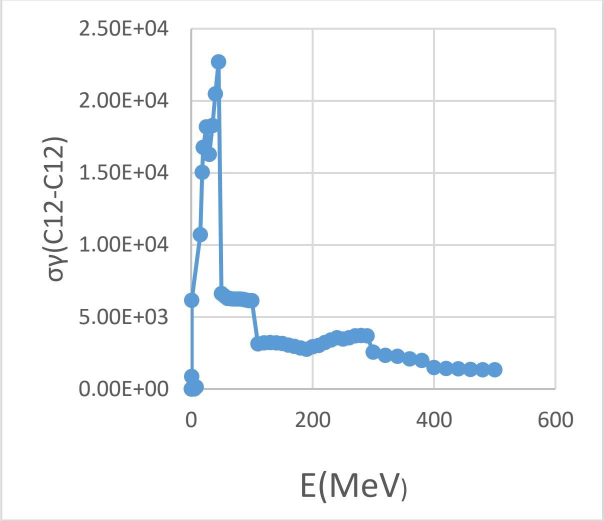

Figure 9: Reaction ${}^{12}_{6}C + {}^{12}_{6}C \rightarrow \gamma + \cdots$

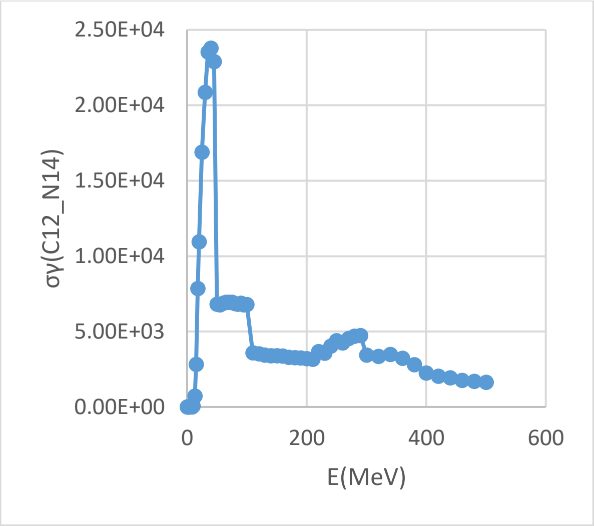

Figure 10: Reaction ${}^{12}_{6}C + {}^{14}_{7}N \rightarrow \gamma + \cdots$

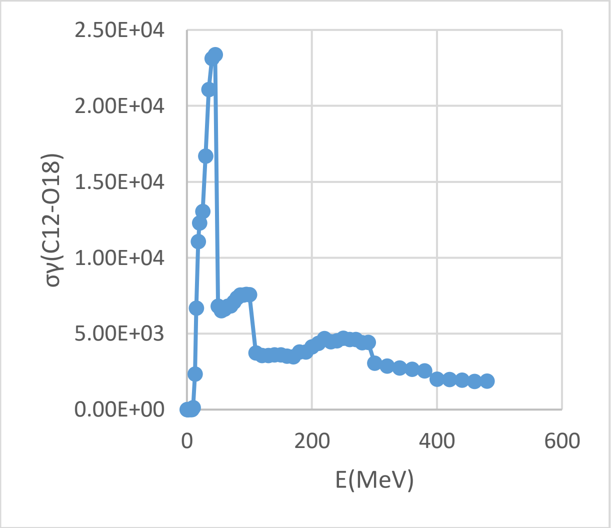

Figure 11: Reaction ${}^{12}_{6}C + {}^{16}_{8}O \rightarrow \gamma + \cdots$

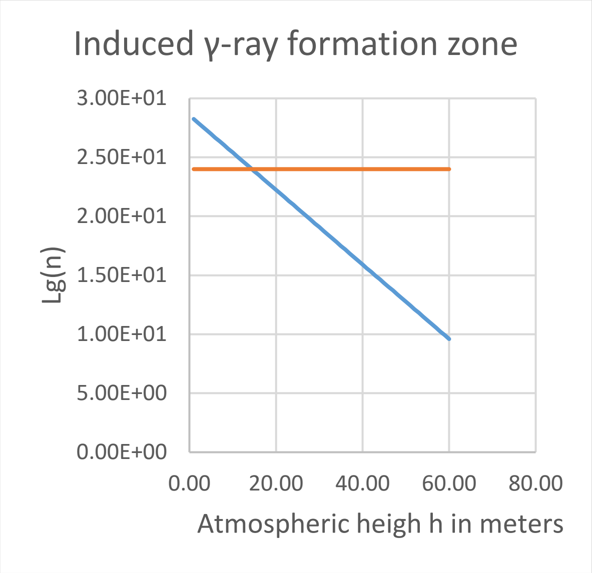

Figure 12: White dwarf's hydrostatic atmosphere with $1M_{\odot}, T = 2{,}5 \cdot 10^5 K, n_0 \approx 10^{29} cm^{-3},\ 10^8\ cm/s^2$

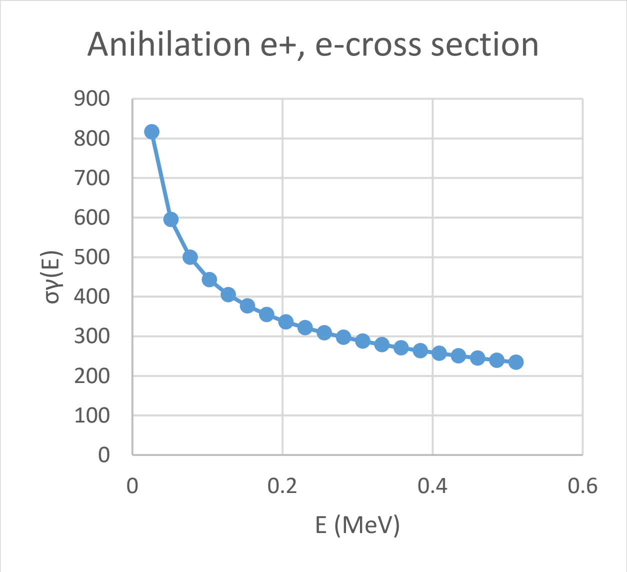

Figure 13: Annihilation cross sections σγ(E) in mbn from positrons kinetic energy in MeV. $g = 1.510^8\ cm/s^2$

Where γ is the energetic factor $\gamma = \frac{E}{mc^2}$ for positron with energy E, $r_0 \approx 2{,}82 \cdot 10^{-13} cm$ is the electrons classical radius. We considered only the part of classical p-p reaction in the form important for γ-ray production.

$$\begin{cases} {}^1_1H + {}^1_1H \rightarrow {}^2_1H + \boldsymbol{e^+} + \nu_e + \cdots \\ \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \\ {}^2_1H + {}^1_1H \rightarrow {}^3_2He + \gamma(5.49\ MeV) + \cdots \\ {}^3_2He + {}^4_2He \rightarrow {}^7_4Be + \gamma(1.59 MeV) + \cdots \\ {}^7_4Be + {}^1_1H \rightarrow {}^8_5B + \gamma(0.14 MeV) + \cdots \\ {}^8_5B \rightarrow {}^8_4Be + e^+ + \nu_e + \cdots \\ \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \end{cases} \quad (13)$$

In all presented thermonuclear links of p-p circle, γ-quants are produced from radiative nuclear transitions with fixed energies in soft γ-ray interval of 0.1 – 6 MeV. The ellipsis parts in (12) consists of kinetic energies of the nuclear fragments after the collision, It leads to the formation of induced γ-radiation. Without flyer's time we expect soft γ-ray with $E_\gamma \leq 10\ MeV$. Level of this radiation depends on the flow's parameters.

3. Point thermonuclear detonation and secondary neutron production in the white dwarf's atmospheres with magnetic poles

As it was pointed in the introduction, the condition in the accreting plasma flow along the strengths lines of the magnetic field is fit to be hard X-rays burst which have already been observed. That is whys, in the first section it was proposed to consider the formation of an induced emission of nuclear origin, and the cross sections for its distribution were obtained in the energy range 0.1 - 150 MeV. Simultaneously, for these physical conditions we proposed to consider neutron production during collisions of the accretion flows with stationary white dwarf's atmospheres. For the same collisions types in this chapter we considered the cross sections functions with energy sufficient for the neutron production. The energy distribution of the neutrons has been used in thermonuclear detonation reactions. In Figs.14-21 we present these cross sections. Neutrons often take part in thermonuclear reactions as a catalyst. In the intensive investigation of nuclear reactions with neutrons published by Tanaka et al, (1994) it was postulated higher concentration of non-stable elements in this case. Adding the decays reactions leads to the increasing of exploded energy.

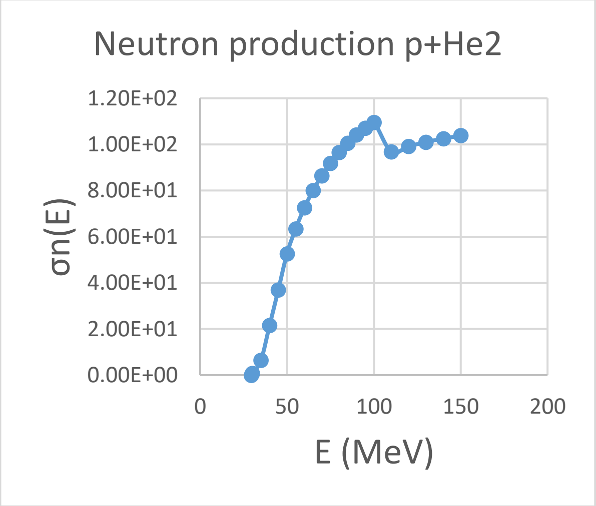

Figure 14: Neutron production cross section (in mbn). Reaction $p + {}^4_2He = n + \cdots$

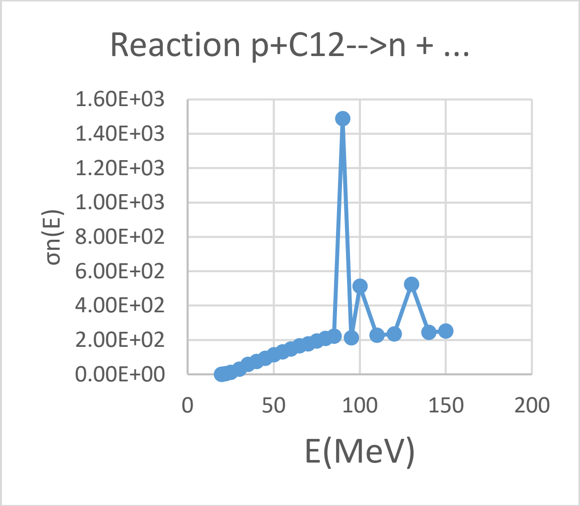

Figure 15: Neutron production cross section (in mbn) from reaction $p + {}^{12}_{6}C = n + \cdots$

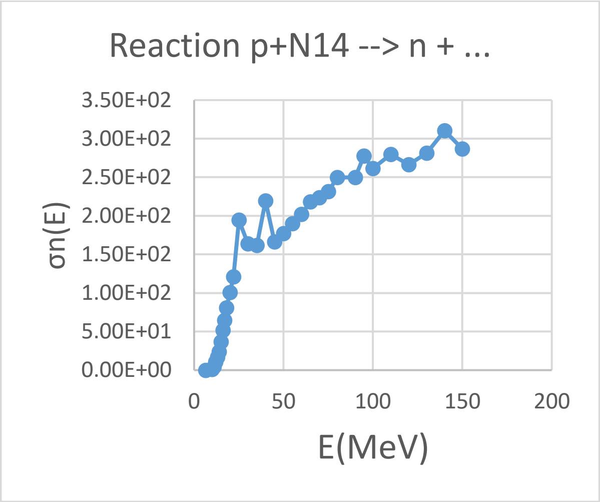

Figure 16: Neutron production cross section (in mbn) from reaction $p + {}^{14}_{7}N = n + \cdots$

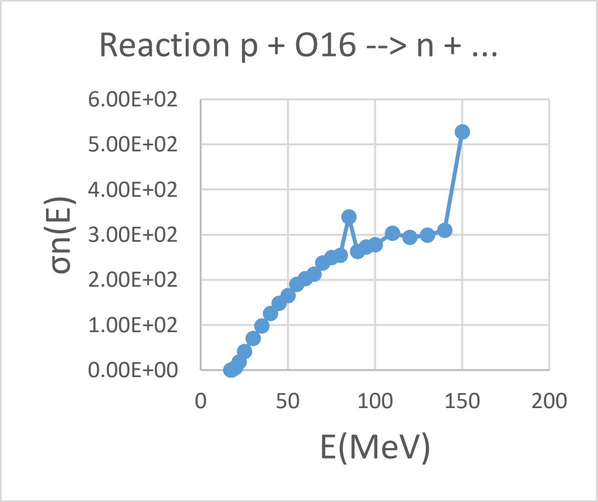

Figure 17: Neutron production cross section (in mbn) from reaction $p + {}^{16}_{8}O = n + \cdots$

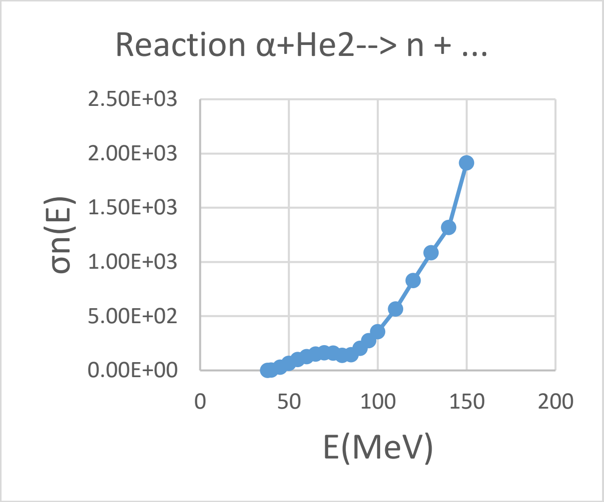

Figure 18: Neutron production cross section (in mbn) from reaction $\alpha + {}^{4}_{2}He = n + \cdots$

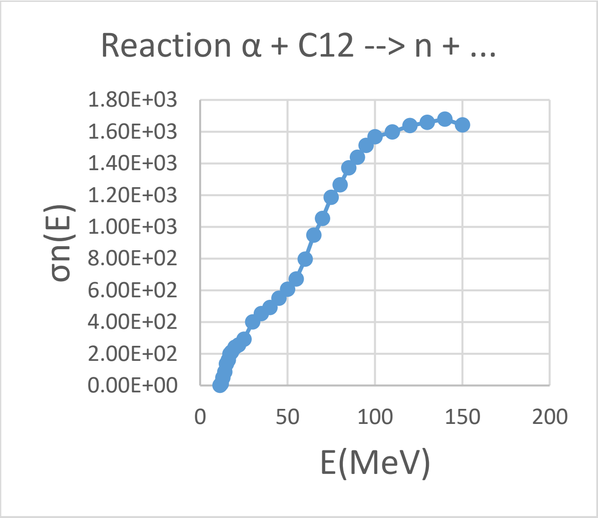

Figure 19: Neutron production cross section (in mbn) from reaction α+${}^{12}_{6}C = n + \cdots$

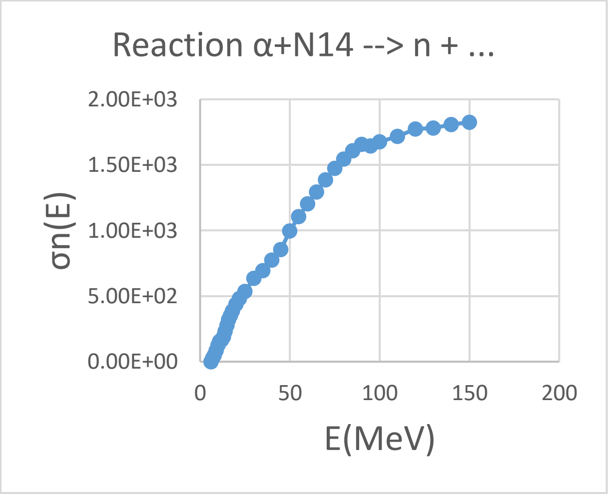

Figure 20: Neutron production cross section (in mbn) from reaction $\alpha + {}^{14}_{7}N = n + \cdots$

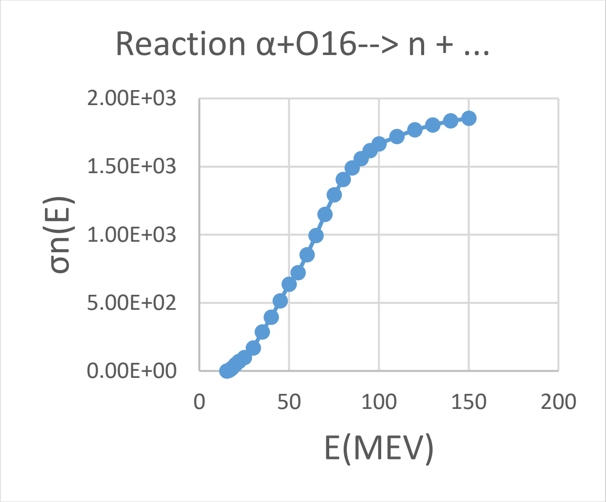

Figure 21: Neutron production cross section (in mbn) from from reaction $\alpha+{}^{16}_{8}O = n + \cdots$

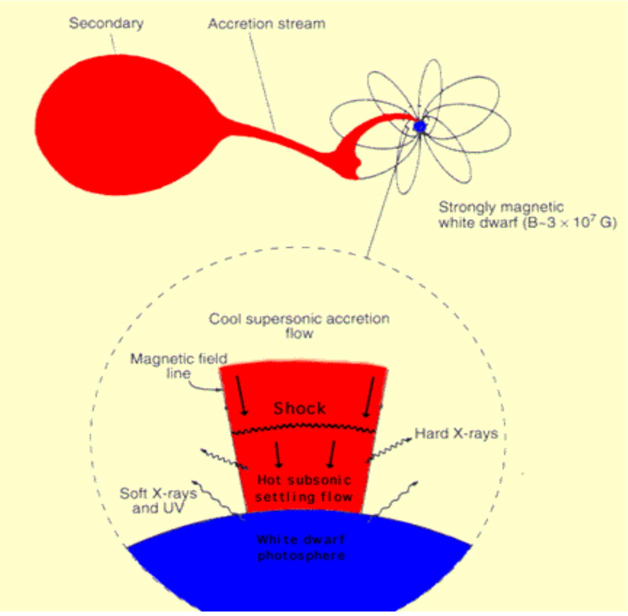

Figure 22: The classical picture of the AM Her polars type binary system (picture has been rewrites from popular internet resource).

In colliding zone (Fig. 22), the atmospheric H-He-C-O – mix is more effective to produce neutrons after collisions with accretion gas stream. The number densities of the induced neutrons can be as high as $10^7 - 10^8 cm^{-3}$. In combination with hydrogen atoms in the stream in consistence with other conditions for detonation burning of the upper layers in white dwarf's atmosphere it has catalytic effect.

4. Conclusion

The induced γ-ray spectroscopy opens new possibilities for diagnostics of the conditions in magnetic column bottom zone where we wait the formation of γ-ray's quanta.

1. Specific conditions for formation of the induced γ-ray emission are expected in white dwarf atmospheres with specific physical conditions. In this local point the white dwarf's atmospheres can induce γ-rays. As it was shown in Chapters 2,3 the "pure" synthetic induced γ-ray spectra show the adequate chemical composition in this local point.

2. The other side of γ-ray spectroscopy is the positron spectroscopy of AM Her polar. If down accretion stream in magnetic tube can induce p-p reaction during the flyers period than we wait for positron formation during classical p-p-reactions and annihilation lines with the energies 0.511 and 1.022 MeV. The hard densities required for the formation of these lines point its location in the same atmospheric area.

3. The flyers statistics of AM Her type stars can be used to predict the observed fluxes. In white dwarf's all magnetic tubes are concentrated in the polar region. That is why we wait to observe all accretion streams from normal companion of the binary system to the white dwarf's poles.

5. Discussion

The flyers in polar AM Her star's type is important for γ-ray diagnostic of physical conditions in white dwarf's atmospheres. Despite the extreme condition in explosion zone (degenerate superdense plasma, extreme accretion flows) the possibilities of registration of detonation period during the flyers demand γ-ray monitoring of this objects in the first moments of the flyer. More probable is the observation of annihilation lines. Because in this conditions the cross section of the annihilation is drastically small.

Only after some time after explosion the annihilation lines can be detected. The preferable energetic interval for observation is 0.1-150 MeV. Finally, in some cases, especially for massive white dwarf's the detonation in polar atmospheric zone induce the detonation around full surface. If He-zone is thin and dwarf is mainly occupied by C-O zone we have the possibility to consider induce of C-O detonation. Assuming the convection mixing in near surface layer we considered these processes after p-p explosion.

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