Dark Matter and sterile neutrino: a new Z-Burst road map

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Neutrinos right handed decouple earlier in Universe

- The right handed neutrinos are «colder» and clusterize first than left handed ones.
- Difference in neutrino masses lead to differences in Fermi like degenerance configurations: colder and smaller size for the heavier ones.
- Different Galactic populations? (DF 1981-83)
- There may be key consequences: 1-2 eV for ZeV resonances to overcome GZK cut off (DF 1997-2001)
- The sterile at 100 eV might be barely present and form clouds of dark warm matter able to reveal EeV UHECR
- Tens KeV sterile neutrinos may fit to explain puzzling Quasars early birth

NEUTRINO MASS AND RIGHT HANDED (STERILE) NEUTRINOS

Right-Handed and Left-Handed Neutrinos
and the Two Galactic Populations of the Universe.DFargion, 1981

- ***Right-Handed Neutrino Interactions in the Early Universe.***
- ***17. ANTONELLI and R. KONOPLICH (*) , D. FARGION (1981)***
- ***Only above tens KeV neutrino mass there***
- ***is a full thermal equilibrium for right***
- ***handed neutrinos: WARM or HOT DARK MATTER***

(1.7) are described in fig. 1 in units of $4\pi(kT_L/c)^3 h^{-3}$ for an assumed ratio $T_L/T_R \simeq 2.2$, $T_L \simeq 1.9$ K.

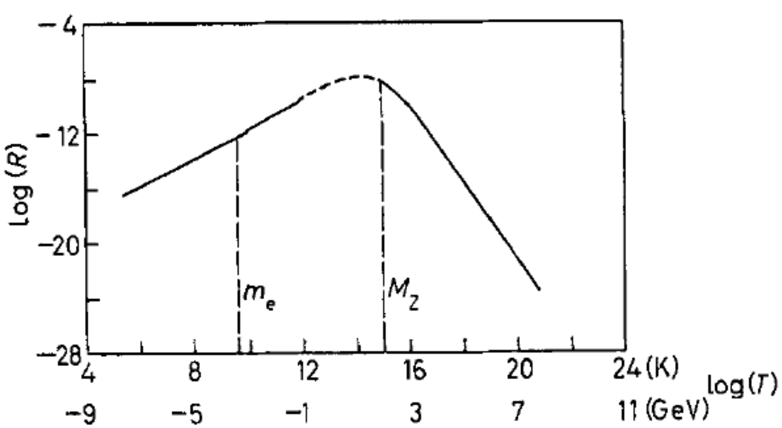


Fig. 3. – Equilibrium ratio for right-handed neutrinos as a function of the e

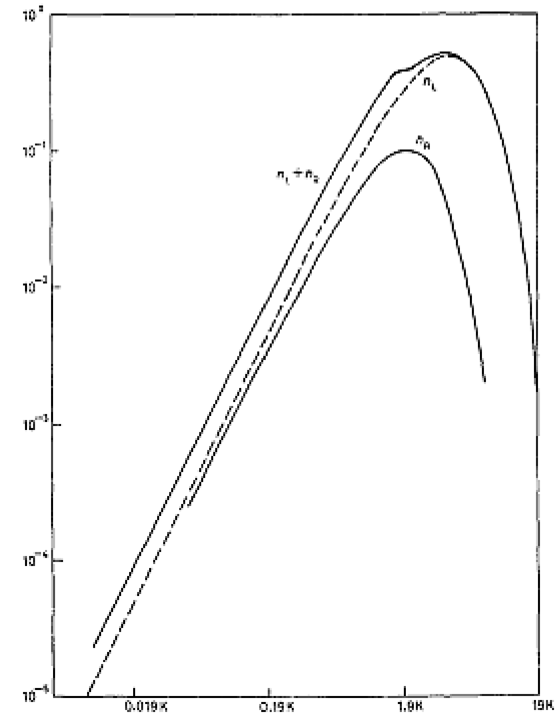
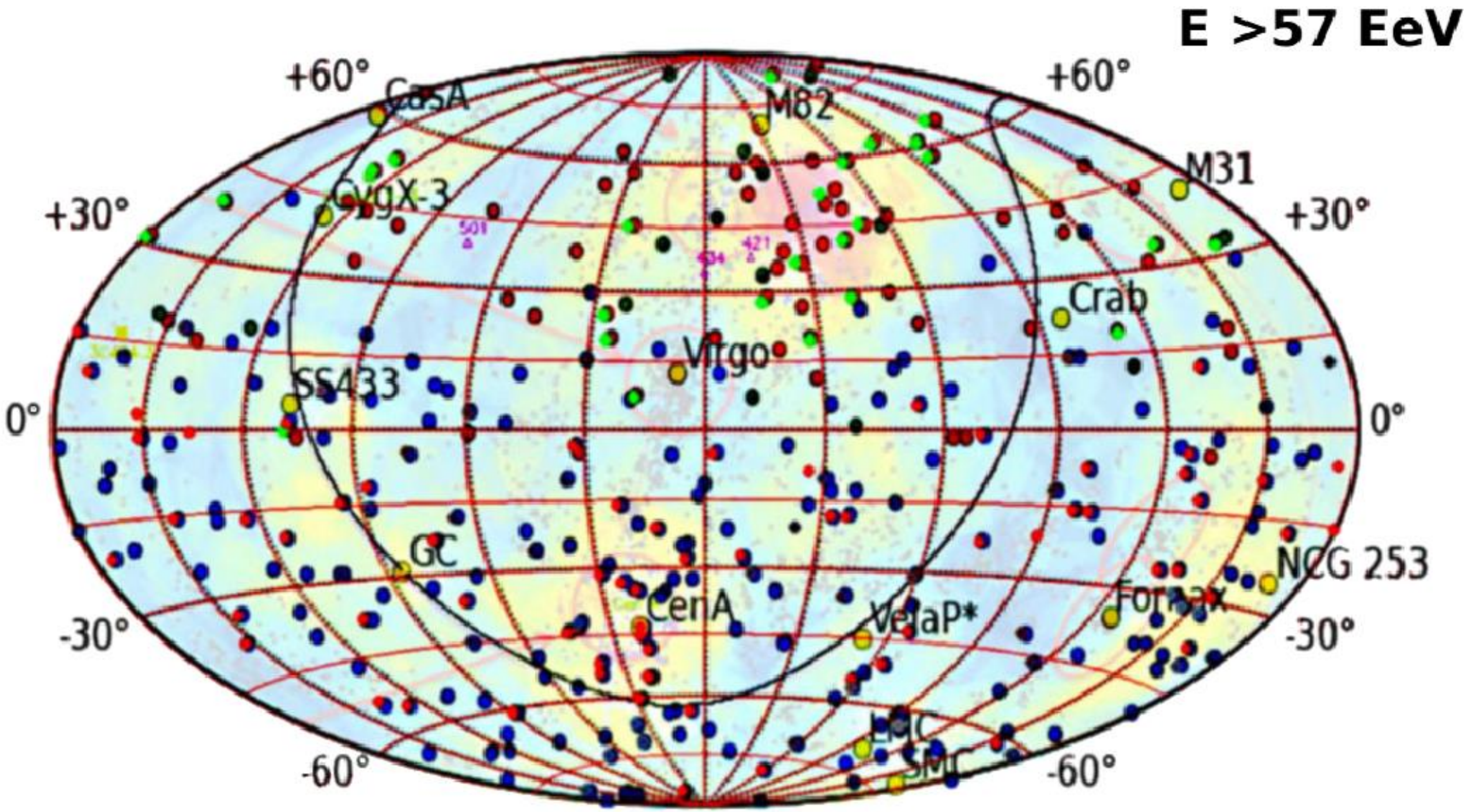


Fig. 1. – The massless Fermi distributions n_L and n_R defined in (1.6) and (1.7) and their sum (which is easily proved to have only one maximum and two points of inflexion) expressed in units of $4\pi h^{-3}(kT_L/c)^3$, $T_L = (4/11)^{\frac{1}{3}} T_\gamma = 1.9$ K.

Dark huge (Mpcs) halos of 1-2 eV neutrinos, hot dark halo, may allow to overcome GZK cut off in UHECR at AUGER and TA: Scattering ZeV neutrinos on relic ones



Neutrino scattering on relic ones (1997)

THE ASTROPHYSICAL JOURNAL, 517:725733, 1999

Ultra-High-Energy Neutrino Scattering onto Relic Light Neutrinos in the Galactic Halo as a Possible Source of the Highest Energy Extragalactic Cosmic Rays

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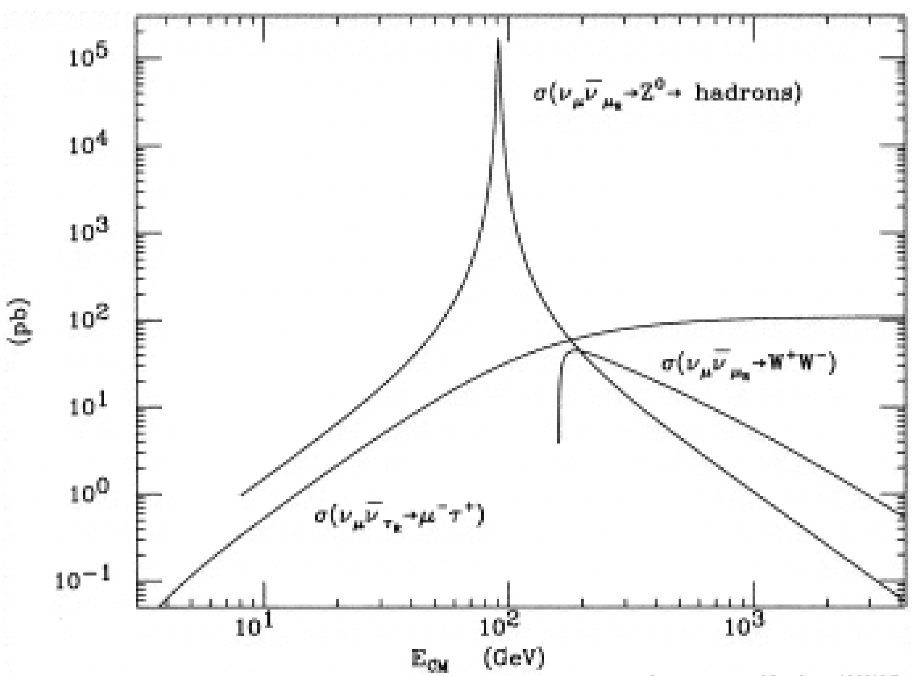


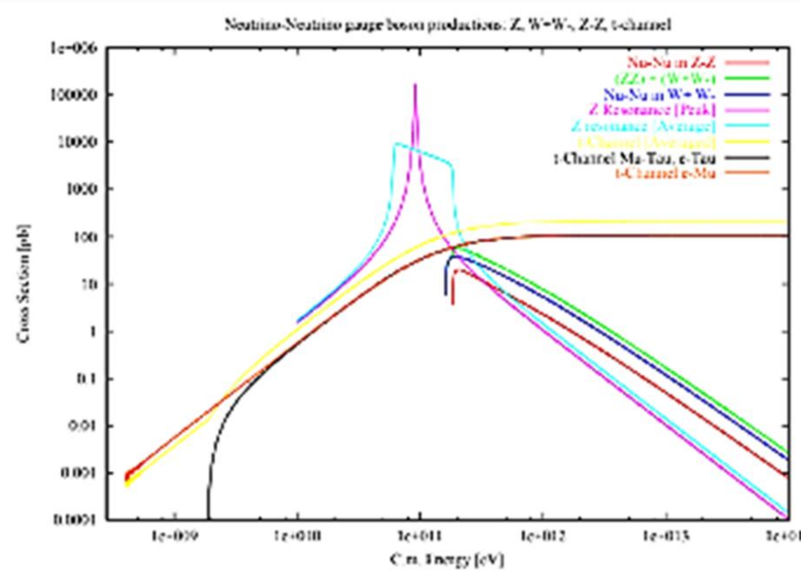


Fig. 2. The $\nu\bar{\nu} \to Z, W^+W^-, ZZ, T$-channel, cross sections as a function of the center of mass energy in

UHECR SECONDARIES by neutrino scattering

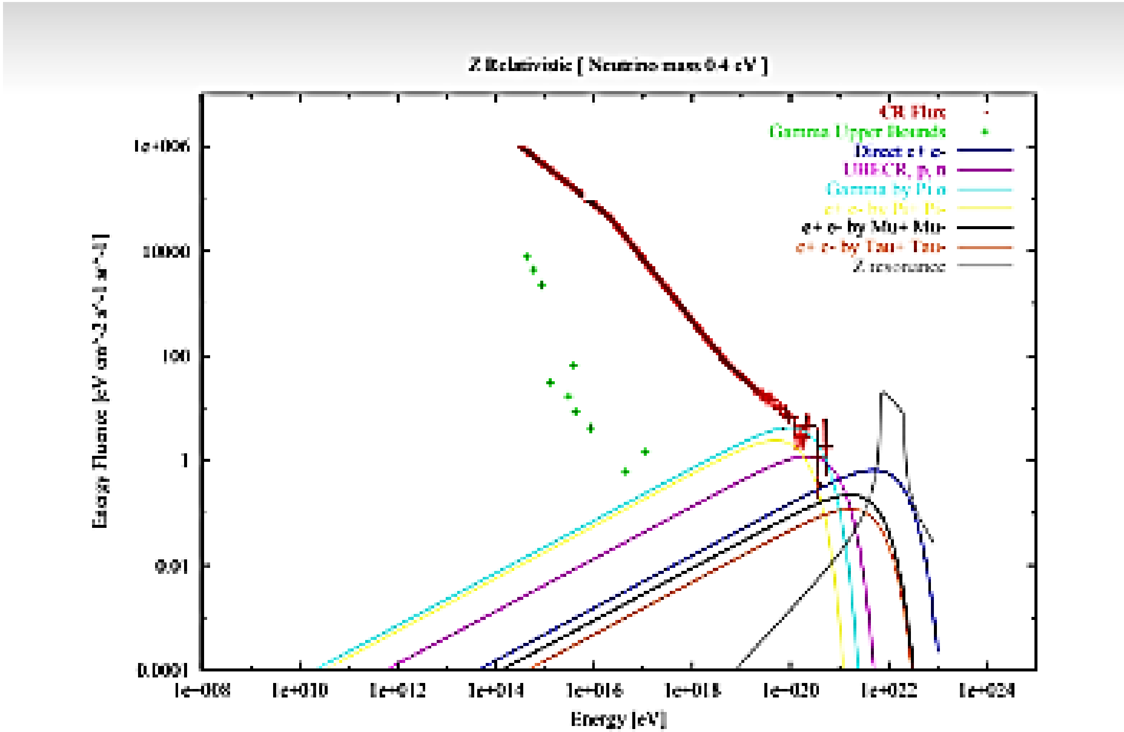


Fig. 3. Energy Fluence derived by $\nu\bar{\nu} \to Z$ and its showering into different channels: direct electron pairs UHECR nucleons n p and anti-nucleons, γ by π^0 decay, electron pair by $\pi^+\pi^-$ decay, electron pairs by direct muon and tau decays as labeled in figure. The relic neutrino mass has been assumed to be fine tuned to explain GZK UHECR tail: $m_\nu = 0.4eV$. The Z resonance ghost (the shadows of Z Showering resonance[14]) curve), derived from Z cross-section in

Differet masses , splitting Z resonances

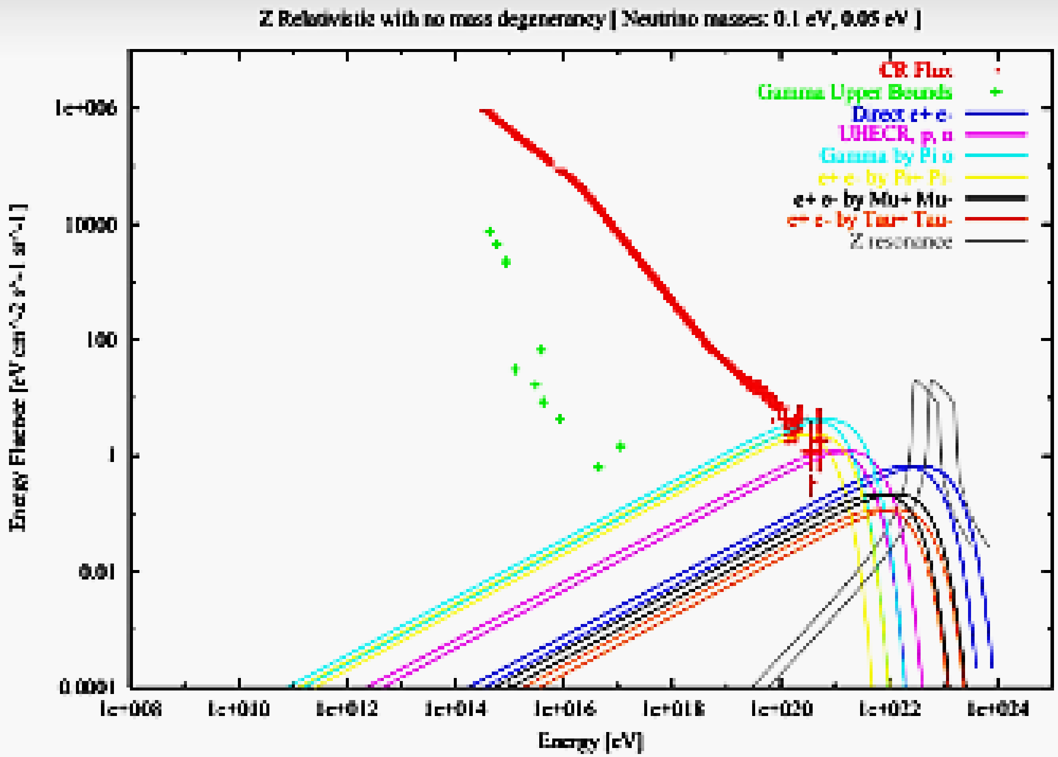
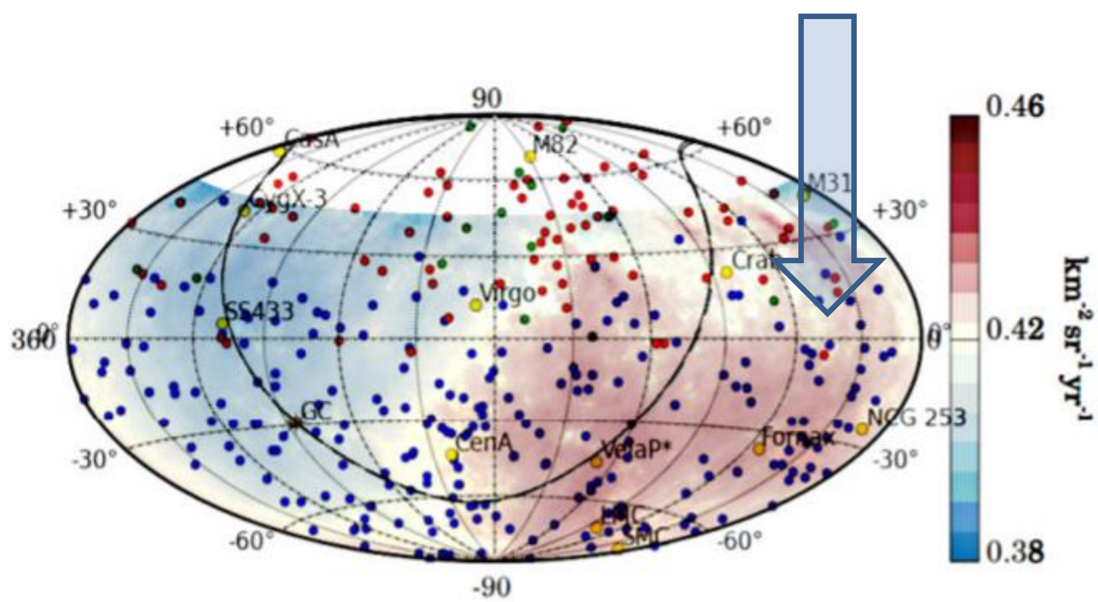


Fig. 5. Energy Fluence derived by $\nu\bar{\nu} \to Z$ and its showering into different channels: direct electron pairs UHECR nucleons n p, γ by π^0 decay, electron pair by $\pi^+\pi^-$ decay, electron pairs by direct muon and tau decays as labeled in figure. In the present case

Astrophysical consequences2

- ***The 100 eV may be forming wide dark galaxy near us. Their presence might be able to explain the «strange» dipole anisotropy at EeV UHECR:***

Where are the UHECR originated? Daniele Fargion



https://pos.sissa.it/395/402/pdf

Figure 3: The very recent dipole anisotropy shadow found at $8 \cdot 10^{18}$ eV by Auger over the other UHECR at GZK energies, $6 \cdot 10^{19}$ (by Auger, blue dots, TA, red and green dots) on last decade [21]. The presence

Last 3° amazing case for a heavier sterile neutrino, at tens KeVs mass

- ***The corresponding resonant degenerated «ten KeV eV» sterile neutrino mass corresponds to ten billion Mass dark object.***
- ***The size (0.003 parcec) and the mass (ten billion) of such a peculiar dark object , its earliest clustering in early universe, is correlated to the unexplained presence of such huge objects in early Universe: the AGN black holes in Quasars.***

Conclusions

- ***Sterile neutrinos at eV may overcome GZK cut off via Z burst and UHECR secondaries at hundred EeV.***
- ***Sterile neutrinos at 100 eV and their dark clouds may explain EeV puzzling anisotropy (un correlated to Virgo or nearby visible cluster) via Z burst leading EeV UHECRs.***
- ***Sterile neutrinos at ten KeVs might be the gravity location for AGN and Quasars birth.***

Thank you for the attentions

Earliest Neutrino mass consequences in astrophysics (1981)

Time Delay Between Gravitational Waves and Neutrino Burst From a Supernova Explosion: a Test for the Neutrino Mass.

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$$\Delta\tau \simeq \frac{L}{2c}\left(\frac{m_\nu}{E_\nu}\right)^2 = 0.5\,\eta^2\,\mathrm{s}\,.$$

Deflection of Massive Neutrinos by Gravitational Fields.

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(ricevuto il 10 Febbraio 1981)

$$\Delta\varphi = \frac{2m}{b\beta_\infty^2}\,.$$

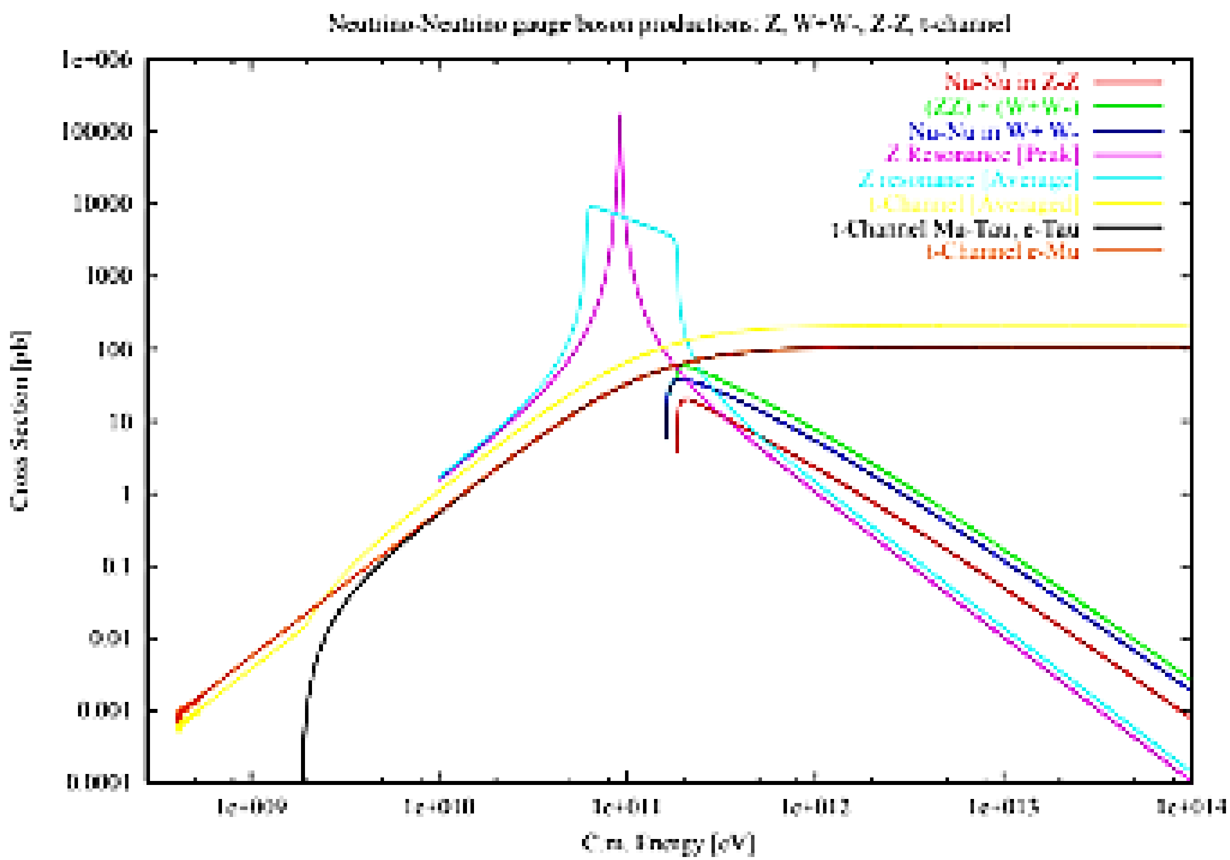

Fig. 2. The $\nu\bar{\nu} \to Z, W^+W^-, ZZ, T$-channel, cross sections as a function of the center of mass energy in $\nu\nu$. These cross-sections are estimated also in average (Z) as well for each possible t-channel lepton