HOW TO FIND POSITRONS IN SPACE

Ya. Istomin, *Lebedev Physical Institute*

Usually we deal with the square correlation function $\langle E_\alpha E^*_\beta \rangle$, which called the polarization tensor. The angular brackets $\langle ... \rangle$ means the averaging over the field realization. The polarization tensor gives all Stocks parameters I, U, V. Because of the electric field E is proportional to the value of charge q of the radiated particle the polarization tensor does not contain the information about the sign of the q. But the odd correlation functions more high orders are proportional to the sign of q. The simplest is the third order correlation function $\langle E_\alpha E_\beta E^*_\gamma \rangle$. Let us suggest the radiated system consist of the N particles of q charge radiated independently. The single particle radiates the broad frequency spectrum. It is valid for the free radiation of the particle in an electromagnetic fields (synchrotron radiation, bremsstrahlung ...). Let choose the fixed frequency ω so that a particle radiates also at the frequency 2ω. The electric field of i-th particle at the frequency ω is $E(\omega)\exp\{i\varphi_i\}$, where the value of φ_i is the phase of the radiation of i-th particle. The electric field at the frequency 2ω is $E(2\omega)\exp\{2i\varphi_i + i\varphi_2\}$. Here the value of φ_2 is the phase of the particle radiation on the frequency 2ω with respect to the radiation on the frequency ω. This value depends only on the mechanism of the particle radiation and is independent of its phase φ_i. After the averaging over the phase φ_i we obtain for the third correlator of the electric field polarized in one direction (say in x)

$$\langle E_x E_x E^*_x \rangle = N E^2(\omega) E(2\omega) \exp\{-i\varphi_2\}$$

I suggest to calculate the value of $E^2(\omega)E(2\omega)$ using the multiplication by the computer, but not by the electronic device. For that we have to measure the electric field simultaneously at the frequencies ω and 2ω. If the radiation is produced by the electrons we have one sing of the value of $E^2(\omega)E(2\omega)$, if it is produced by the positrons then this value have to have the opposite sign. But if the radiation is produced by the equal amounts of electrons and positrons then this value must be zero. Best objects are relativistic sources of positrons: neutron stars (radio pulsars, magnetars), active galactic nuclei (AGN), micro quasars.