Daemon detection experiment

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Abstract
A month-long observation of two horizontal ZnS(Ag) scintillating screens,
1 m² in area and located one above the other a certain distance apart,
revealed about 10 correlated signals, whose time shift corresponds to an
average velocity of only \(\sim 10^{-15}\) km s\(^{-1}\). We assign the origin of these
signals to the negative daemons, i.e. electrically charged Planckian par-
ticles, which supposedly form a part of the DM in the Galactic disk and
were captured into the near-Earth orbits. The estimated flux of daemons
is \(\geq 10^{-4}\) m\(^{-2}\)s\(^{-1}\). The key part in the detection of daemons is played
apparently by two processes: (i) the daemon shedding the captured heavy
nucleus in a few tens of \(\mu\)s as a result of a relatively rapid decay of the
daemon-containing nucleons, and (ii) emission of numerous Auger elec-
trons and nuclear particles occurring in the next capture or recapture of
a (heavier) nucleus by the daemon.

1 Introduction. The daemon hypothesis

Our Universe started from Planckian scales, and it appears only natural to sug-
gest that the major part of its mass, i.e., the DM, is contained in primordial
Planckian particles with \(M = (\pi \hbar c/4G)^{1/2} \approx 2 \times 10^{-5}\) g and \(r_g = 2GM/c^2 \approx 3 \times 10^{-33}\) cm [1]. Such elementary black holes can be stable and eternal [2].
Multidimensional (>4) theories (e.g. [3]) allow the existence on them of stable
electric charge of up to \(Ze = G^{1/2}M \approx 10e\). We assume that such DArk Electric
Matter Objects, i.e. daemons, carrying a charge of any sign (including possibly
the zeroth one) constitute a hierarchy of populations, viz. intergalactic, Galactic
halo (or crown), Galactic disk etc, with continuously increasing concentration
and decreasing mean random velocity. In the disk, the DM makes up about 1/2
its total mass [4]. If it consists of daemons, their density here is \(\sim 10^{-12}\) m\(^{-3}\).
Due to their extremely low concentration, negligibly small dimensions and a
giant inertia, the daemons, by themselves, constitute a non-collisional plasma
and, thus, do not capture and coalesce with each other. The negative daemons'
bulldozer inside the Sun is capable of accounting for its energetics through catal-
ysis of the proton fusion reactions, and for the deficiency of the electron-capture
neutrinos [5].

Because of their large mass, daemons have a giant penetrating power. That is
why Markov [6] was skeptical concerning a possibility of detecting such particles.
A charged daemon falling from infinity onto the Sun acquires \(\sim 10^{23}\) eV, while
losing \(10^{19} – 10^{22}\) eV in passing along the Solar diameter [6]. Prior to becoming
trapped, a daemon traverses many times the Sun along gradually contracting,
strongly elongated orbits, whose perihelia lie within the Sun. If, in the course of this process, the daemon enters the Earth’s sphere of influence, its path will change slightly, and the perihelion of the orbit will leave the Sun with a high probability. This is how the daemons can populate strongly elongated Earth-crossing heliocentric orbits (SEECHOs). The flux of this population at the Earth is estimated to be \( f_{\oplus} \sim 10^{-3} - 10^{-6} \text{ m}^{-2}\text{s}^{-1} \) at \( V \approx 35-50 \text{ km s}^{-1} \). Part of this population will be gradually transferred into the near-Earth almost-circular heliocentric orbits (NEACHOs), including those crossing the Earth’s surface. If the Sun moves relative to the daemon population of the Galactic disk, these fluxes may undergo seasonal variations at the Earth. The original goal of this work was to detect the most dense (as we believed) SEECHO population. In our opinion, such an approach should be more productive than the standard searches for the strongly rarefied, Galactic halo DM population (e.g. \[8, 9\]).

One may conceive the following consequences of the negative daemon interaction with matter on the atomic and subnuclear levels:

1. When capturing (or recapturing) a nucleus, the daemon first captures the ion of the atom, so that as it is dropping to ever lower-lying levels, all the electrons of the captured ion are emitted in the Auger process. Because the binding energy of the daemon to the nucleus is measured in tens of MeV, the energy of such Auger electrons may be as high as \( \sim 0.1-1 \text{ MeV} \):
2. Catalysis of the fusion of light nuclei \((Z_n < Z)\), including protons \[5, 6\]. As a result of internal conversion, the energy of fusion in the vicinity of a heavy charged particle is converted, as a rule, to the kinetic energy of the resultant nucleus;
3. Capture of heavy nuclei \((Z_n \geq Z)\). At \( Z = 10 \), it occurs in solid Fe, Zn, Sn in \( \sim 2 \mu\text{m} \) at \( \sim 50 \text{ km s}^{-1} \), and in \( \sim 0.1 \mu\text{m} \) at \( \sim 10 \text{ km s}^{-1} \). This ‘poisons’ the catalytic properties of the daemon. However, straightforward estimates based on the solar energetics, if it is provided by daemon-assisted catalysis of proton fusion, suggested that the daemon should free itself of a captured heavy nucleus in \( \tau_{\text{ex}} \approx 0.1-1 \mu\text{s} \), apparently as a result of the decay of the daemon-containing proton \[7, 10\] (for \( Z_n > 24/Z \) the ground level of the daemon in a nucleus lies inside one of its constituent nucleons). Note that the uncertainty in the values of the parameters used in these estimates permits one to shift \( \tau_{\text{ex}} \) in either direction at least by an order of magnitude.
4. If the ‘poisoned’ daemon with \( Z - Z_n \geq 0 \) encounters a heavier nucleus, due to great difference in binding energies, it captures the latter while losing the previous one if at the moment it is (or becomes) noticeably lighter than the anew met nucleus (at \( Z - Z_n = 0 \) this ‘recapture’ is an analog of the charge exchange of ions moving through a neutral gas);
5. Finally, the capture of a nucleus strongly excites its internal degrees of freedom, which should stimulate the emission of nuclear radiations (numerous nucleons and their clusters, \( \gamma\)-quanta). Nuclei with a high \( Z_n \) have a higher probability for the initiation of these processes.

Thus, all the above processes stimulate the emission of radiations capable of producing scintillations, and this may be used to detect the slowly moving daemons, whose direct impact cannot generate a scintillation.

Earlier, we attempted to use the catalysis of light nucleus fusion to detect the daemons. We employed an acoustic method with two Li plates \[1\]. The basic idea here was that the material surrounding the trajectory should be rapidly heated by the products of the \(^2\text{Li} \to ^{14}\text{C} \) reaction. The thermal expansion
of the material should generate a sound wave, which then would be detected by piezoelectric sensors. Their output signals would trace the daemon trajectory. Our experiments revealed, however, an unexpectedly strong damping of ultrasound in Li, and the experiments were stopped.

The measurements made with thick Be plates (4.5 cm), 0.12 m² in area, coated on both sides with ZnS(Ag) scintillator, were actually a continuation of the above experiments along the same lines. It was assumed that the products of the $^{29}\text{Be} \rightarrow ^{18}\text{O}$ reaction escaping from thin near-surface regions, i.e. the points of entrance into and egress from the Be plate of a daemon moving along a SEECHO, would produce scintillations $\sim 1\ \mu\text{s}$ apart. 500 h of exposure did not yield any result \[7\]. The latter experiment, however, prompted us to consider other possible modes of daemon interaction with matter, particularly the possible role of their ‘poisoning’ by heavy nuclei [Fe, Si impurities in Be, and the ZnS(Ag) nuclei].

Shedding the nucleus poisoning the daemon, combined with the above-mentioned processes (1)–(5), suggest a variety of methods for detection of slow daemons. Because of their large number, both the Auger electrons and the radiations from heavy nuclei excited in the capture are the most efficient in this respect.

2 Description of the setup and assumed sequence of events triggered by a daemon

These considerations served as a basis when developing an ideologically new and very simple setup of four modules.

Each module contains two parallel transparent polystyrene plates 4 mm thick and $50 \times 50$ cm in size. The distance between the plates was 7 cm. One of the polystyrene plate surface was coated by type B3-s ZnS(Ag) powder $\approx 3.5\ \text{mg cm}^{-2}$ thick. Its average grain size is $12\ \mu\text{m}$. The choice of this classical phosphor, besides its availability, simplicity in use, and a high light output, was motivated also by the fact that it consists of medium-Zn elements. And conversely, the choice of polystyrene as a plate material was stimulated by its low Zn, in order to reduce to a minimum the possibility of heavy-nucleus poisoning of the daemon before its traversal of the ZnS(Ag) layer. Each plate was viewed from a distance of 22 cm by one FEU-167 PM tube with a dia. 100-mm photocathode. The plates were separated by a sheet of black paper. To be able to judge the essential features of the possible incoming daemon flux, the ZnS(Ag)-coated surfaces of the polystyrene plates were set facing the same side (down). As a result, the light entering the top PM tube passed also a 4-mm thick transparent polystyrene plate on the way. The polystyrene plates and the PM tubes viewing them were placed in a cubic case 51 cm on the edge made of 0.3-mm thick iron sheet with double-sided thin ($\approx 2\ \mu\text{m}$) facing of tin. The upper horizontal case face was made of two sheets of black paper. The PM photocathodes were arranged flush with the horizontal case faces. All the four modules were placed side by side in one horizontal plane. The total area of the four-module detector was 1 m².

The PM tubes were powered by a voltage corresponding to their sensitivity of 10 A lm⁻¹. A 4.5-kΩ resistance served as a load. The signal from the load was
supplied through a 1 mH inductance and a cable of total capacity 550 pF to an oscilloscope. The purpose of this $L - C$ circuit was to stretch the leading edge of the pulse so as to facilitate discrimination of the long scintillations produced by heavy nonrelativistic nuclei like $\alpha$-particles (Heavy-Particle Scintillations — HPS; for their characterization the $^{238}$Pu $\alpha$-source was used) against PM tube noise and short scintillations caused by low-mass and relativistic particles (cosmic rays etc) (the Noise-Like Scintillations — NLS). Signals from the two PM tubes of the same module were fed for comparison into two inputs of one S9-8 dual-trace digital oscilloscope. The latter was triggered by the output signal of the upper PM tube if it reached a level $U_1 \approx 2.5$ mV. The signal from the second PM tube was considered significant if it increased in 0.4–1.5 $\mu$s and its amplitude was $U_2 \geq 0.6$ mV. The signals from the oscilloscopes recorded during $-100$ $\mu$s before the trigger (i.e. with a lead) and during $+100$ $\mu$s after the trigger (i.e. with a delay) were entered into computer memory if they were seen in both traces.

The system was from the outset designed to detect daemons impinging on it primarily from above. Indeed, it was assumed originally that a daemon propagating through the polystyrene plate from above would capture a heavy nucleus from the ZnS(Ag) layer coating it on the back side, and emit in the process during a certain time numerous Auger electrons and the excited nucleus radiations which produce a protracted scintillation of HPS type. If this was a daemon from the SEECHO population, it would, in passing at a velocity $\approx 35$–$50$ km s$^{-1}$ in $\tau_{ex} \sim 0.1$–$1$ $\mu$s a path $\sim 0.3$–$5$ cm, cause decay of protons in the captured nucleus. Then the nucleus emits products of the proton decay (pions etc.) and, possibly, fragments of the nucleus itself. All of them also can give rise to scintillation events, which also will be detected by the top PM tube.

One can in principle conceive catalytic fusion reactions of nitrogen and/or oxygen nuclei captured in air, but the range in air of the heavy products of these reactions is $< 0.5$ cm, so that the probability of their detection after the daemon has traversed the top polystyrene plate appears low. The same applies to carbon and hydrogen, the components of the polystyrene, all the more so that in their subsequent passage through the ZnS(Ag) layer the already captured $^{12}$C or $^{1}$H nuclei would not have a good chance to react outside the plate, as they would be promoted to higher lying levels, and lost in the preferential capture of heavier nuclei in ZnS(Ag). On passing the 7-cm gap, the daemon traverses the second polystyrene plate with the ZnS(Ag) coating on its lower surface and enters the space bounded by a semi-cubic sheet-metal case, which fixes the PM tube at a distance of 22 cm from the scintillator. The presumed phenomena occurring here are similar to those taking place after the passage of the upper polystyrene plate, however there is more room (and time) for their manifestation.

When moving from below, daemon enters the chamber viewed by the second PM tube through a 0.3 mm-thick tinned iron sheet. On exiting the Sn or Fe atom, it carries away with a high probability its captured nucleus. On the capture, some liberated energetic Auger electrons are able to escape from the sheet to excite the bottom scintillator. Afterwards, in $\tau_{ex}$, the daemon releases the captured nucleus with emission of the products of nucleon decay. After this, the daemon captures a light nucleus in the air and emits Auger electrons, which also excite scintillations in the bottom plate. In traversing this plate in its motion upward, the daemon gets rid in it and in its ZnS(Ag) layer of the light nucleus captured in the air and recaptures a heavier ion (or nucleus) from
ZnS(Ag) carrying it into the polystyrene bulk. While being in the ZnS(Ag) $\sim 10$ µm-size grain during $< 10^{-9}$ s, the daemon probably has no time to force the nucleus to emit all its radiations. So it is doubtful that some particles shed in the polystyrene plate bulk would be capable of reaching the ZnS(Ag) bottom layer to excite an intensive scintillation.

When entering further the 7-cm gap between the plates or the ZnS(Ag) upper layer, the daemon (re)captures here again such nuclei with the emission of Auger electrons and nuclear radiations. These latter have to be detected by the first (upper) scintillator that triggers the oscilloscope. However keeping in mind that some of the particles are emitted after the daemon has penetrated well into the polystyrene bulk, one cannot be sure of having excited a strong scintillation.

Thus, there is a variety of conceivable processes capable of creating a scintillation at the passage of a daemon. We shall not attempt to list them all here. It is also clear that far from all of the weak scintillations are recorded. The strongest are apparently the informative events initiated at a time by numerous ($\sim 10$) Auger electrons and by nuclear particles. Therefore we can lower our electronics response level and thus we have no serious problems with numerous one-particle background event discrimination (see Fig.1 below). In any case, however, the response of our setup should be asymmetric with respect to the daemon propagation direction.

3 Some specifics of the experiment and its results

After control tests in January-February 2000, the system was put in round-the-clock operation in March 2000, with the total exposure amounting to 700 h. Altogether, $\sim 6 \times 10^5$ oscilloscope triggering events have been recorded, only $\sim 10^4$ of which contained a signal on the second trace and were entered into the computer. About 2/3 ‘single’ triggers contain a tailing signal typical of HPS. These signals are most likely due to radioactive background decays. The remaining single triggers are of the NLS type. The double events are primarily NLS signals occurring without any time delay and coinciding in shape (delays $\leq 0.2$ µs). Sometimes these signals appear simultaneously even in all four modules. We assign such events to cosmic rays and neglect them. Very infrequently, once in only about twenty–thirty of all the events recorded, one of the two signals has the HPS characteristics. Interestingly, events with two and more significant signals in one channel are very rare. Therefore, while basing on the above scenarios of the events accompanying a daemon traversal of our system, one could expect numerous signals on the same oscilloscopic trace, we began with analyzing the sweeps containing one signal only.

The number of events with shifted signals in both traces recorded during the month is 413. In the case of purely non-correlated stochastic generation of signals, no statistically significant clusters of events should appear in the time distribution of second-trace signals.

This experiment was aimed at detecting objects moving with velocities $\sim 35–50$ km s$^{-1}$. We expected signals with positive shifts $\Delta t \approx 1.5 – 2.0$ µs or slightly more. As always, reality introduced substantial corrections into our specula-
Figure 1: Distribution $N(\Delta t)$ of pair scintillation events on their time shift (relative to the upper channel events). (- - -) Similar distribution for the HPS (heavy-particle scintillation) type events only. (....) The 10-µs bin HPS distribution.

This relates to both the daemon population discovered by us and the details of the events (see Sec.2 above) accompanying daemon passage through our system.

Fig.1 shows an $N(\Delta t)$ distribution of second-trace signals in the time $\Delta t$ of their shift relative to the onset of the triggering signal on the first oscilloscopic trace. This is a fairly asymmetric and non-monotonic distribution. By the $\chi^2$ criterion, the C.L. of this being not a $\Delta t$-independent distribution is not less than 99.8%. First of all, there is no noticeable clustering of events near a few µs, as we expected to be based on the hypothesis of existence of the SEECHO population. The main feature is a maximum in the region of +30 µs for an average $41.3$ event/bin level. It contains 62 events, which exceeds by a factor of 3.22 the statistically allowable scatter $\sigma = \sqrt{41.3} \approx 6.43$. Accepting only an excess of 1.22 over $2\sigma$, this yields seven to eight events which can be assigned to nuclear-active objects crossing the detector. For its area of 1 m² and an exposure time of $2.5 \times 10^6$ s, this amounts to a total flux $f_{\oplus} \approx 3 \times 10^{-6}$ m⁻²s⁻¹.

Our initial goal was detection of the DM objects, not their flux measurement. We possibly are not able now to reveal all the daemons traversing our system due to their partial poisoning with heavy nuclei, etc. So the real flux of daemons can reach $f_{\oplus} \approx 5 \times 10^{-5}$ m⁻²s⁻¹. An absence of a symmetric to $\Delta t \approx +30$ µs negative feature in $N(\Delta t)$ distribution can be attributed to long-lasting Sn nucleus poisoning of daemons moving from below. The various cross-checks did not reveal any noticeable systematic errors in the operation of our simple measuring instrumentation.

4 An attempt at interpreting the results

An analysis of the $N(\Delta t)$ distribution displayed in Fig.1 permits certain conclusions both on the nature of the agent responsible for this distribution and on the character of its interaction with matter. While one cannot rule out a
possibility of other interpretations, we shall try to treat the results within the
daemon hypothesis. We note immediately that when compared with the 7 cm
interplate distance, the position of the maximum on the time axis (+30 µs)
indicates a fairly low velocity of the maximum-forming objects. This velocity
is about 2–3 km s\(^{-1}\) only. Taking into account the possible slope of the tra-
jectories could double the velocity at most. Initially, we attempted to explain
such a low velocity as due to its characterizing the population in geocentric
orbits intercepting the Earth surface, which was captured from the one moving
in SEECHOs [12, 13].

This interpretation meets, however, with a difficulty pointed out as far back
as 1965 by Markov [1]. The fact is that despite their giant penetrating ability
the daemons moving with a velocity of \(\sim 10\) km s\(^{-1}\) can traverse the Earth only
\(\sim 10^2–10^3\) times. Their buildup in the Earth during 4.5 Byr and interaction
with the material (even if only the proton decay with an energy release \(\sim 1\) BeV
during \(\tau_{ex} = 10^{-5}\) s is taken into account, see below) should bring about an
energy dissipation corresponding to a heat flux of \(\sim 2 \cdot 10^5\) erg cm\(^{-2}\)s\(^{-1}\). This
figure exceeds at least by four orders of magnitude the flux emanating from the
Earth’s mantle (10 erg cm\(^{-2}\)s\(^{-1}\)).

The assumption of the daemon velocities ranging widely in magnitude and
directions comes also in conflict with the narrowness of the maximum (20 <
\(\Delta t < 40\) µs) in the \(N(\Delta t)\) distribution. In view of the fact that this distribution
was obtained from sweeps containing only one signal, it appears that we were
too optimistic by assuming that the daemon frees itself of the captured heavy
nucleus and recovers the catalytic properties in as short a time as \(\tau_{ex} = 0.1–1\)
µs, which is shorter than the time required to cross the 7-cm gap between the
plates. As already mentioned, an analysis of the solar energetics [7, 10] allows
considerably larger values, up to \(\tau_{ex} = 10^{-5}–10^{-4}\) s. We have thus to admit that
our starting scenario of a possible sequence of events (see Sec. 2) initiated by a
daemon traversal of the detector contains excess or weakly revealing processes
capture of nuclei from the air as a result, say, of the daemon shedding heavy
nuclei during the time it crosses the case etc.). One could go still further and
assume that the capture by the daemon of a new nucleus, which is accompanied
by ejection of a large number of Auger electrons and nuclear particles, occurs in
our small system (10–50 cm) only when a new nucleus is recaptured during the
entry into a material with a larger atomic weight. In this case, all pieces of the
puzzle fall into place, and the sequence of the events accompanying the daemon
traversal of the system looks somewhat differently. To begin with, on having
crossed the roof (Fe, Zn) and the floors (Mg, Al, Si, Fe, O) of our building, the
daemon reduces the mass of the captured nucleus in \(10^{-5}–10^{-4}\) s to such an
extent that, on penetrating into the top ZnS(Ag) layer, it can already capture
a S or Zn nucleus (this is possibly the only time where we directly invoke the
hypothesis of the decay of a daemon-containing nucleon, so that for \(Z_n = 26\)
\(\tau_{ex} \approx 10–100\) µs, a figure that still can be reconciled with the estimates based
on solar energetics [7, 10]). The Auger electrons, nucleons, and their clusters
ejected in the process excite HPSs in the scintillator. Not having enough time
to reduce substantially the mass of the nucleus captured here, the ‘poisoned’
daemon enters, 7 cm thereafter, the bottom scintillator, but it does not excite
it. The NLS excitation in the bottom scintillator is triggered by the energetic
\(\sim 0.1–1\) MeV long-range Auger electrons, which are ejected at the recapture of
still heavier Sn or Fe nuclei, when the daemon reaches the lower lid of the tinned-
iron case. (If it leaves the lower part of the case through its side wall most of the recapture Auger electrons released as the daemon traverses the material move almost perpendicular to this wall, i.e., parallel to the ZnS(Ag) layer. As a result, most of the electrons ejected from the side wall do not enter the scintillator and, thus, will not excite a strong scintillation.) The above reasoning suggests also that the side walls of the upper half of the case, while "poisoning" the daemons crossing them by Sn or Fe nuclei, leave only a solid angle of $4\pi/6$ ster for the daemons to pass freely into the system (through the black paper). It thus becomes clear that the distance to be taken into account is the separation of 29 cm between the top scintillator and the lower case lid, and the angular spread of trajectories of the detectable daemons is limited by a solid angle of $\sim 2$ ster. These factors are responsible for the narrowness of the maximum at 30 $\mu$s and yield 10–15 km s$^{-1}$ for the velocity. We immediately see that the latter value is in a good agreement with the velocity of the objects falling on the Earth from NEACHOs. It appears that they are possibly transferred here through perturbations by the Earth (including traversal of its material) from the population in SEECHOs, which was captured by the Sun with the help of the Earth, and which was the initial target of our search. The concentration of the objects found by us in NEACHOs is determined by the balance between their capture and subsequent ejection 1–10 Myr later, through gravitational perturbations by the Earth, into the region of other planets action (as well as out of the Solar system altogether). Because of these orbits being close to that of the Earth, the flux of the particles of this population through the Earth should exceed the flux of the NEACHO-population replenishing SEECHO population, which is exactly what is observed.

An object impacting with this velocity cannot excite atoms. The fact that oscilloscopic traces typical of data presented in Fig.1 exhibit only one pulse shifted relative to the primary one, and that there is no pulse paired with the trigger (i.e. without a shift in time) suggests that the radiation emitted in interaction of the daemon with matter has a low penetrating power. Polystyrene 4 mm thick stops it completely. If these are electrons, their energy is $<1$ MeV.

In conclusion, consider the important information that can be gained by using for the $N(\Delta t)$ plot only the events containing HPSs in the first channel (Fig. 1). In accordance with the above analysis of the sequence of the events initiated by daemon traversal of our detector, most of these events ($\sim 80\%$) have NLSs in the second channel; this is a consequence of the recapture by daemons of nuclei in the bottom lid accompanied by the ejection of electrons, with most of the latter, after passing a distance of 22 cm in the air, impinge on the bottom ZnS(Ag) screen. While this distribution consists of 212 events only, the C.L. of its being different from $N(\Delta t) = \text{const}$, calculated by the $\chi^2$ criterion, becomes 99.9%. All the 39 events responsible for the maximum near $+30 \mu$s are concentrated in this distribution. This maximum exceeds the mean level by a factor 3.86$\sigma$. Fig.1 displays also an HPS distribution for 10-$\mu$s wide bins. The absence of features in the remaining NLS distribution provides one more argument for the events of interest to us here not being the result of interference or regular instrumental malfunctions.
5 Discussion and main conclusions

One usually searches for DM objects with $V = 200-300 \text{ km s}^{-1}$, which populate the Galactic halo. We were the first to look for a much denser near-Sun population \footnote{6, 7}. In choosing a method capable of their detection, we counted primarily on the specific activity of the objects of this population at the nuclear and subnuclear levels rather than on the purely collisional interactions with particles of the matter, as this is done, for instance, in experimental search for much less massive (and more numerous) hypothetical WIMPs. In these and similar experiments, the discrimination used to reveal the expected signals is so tight \footnote{14} as to practically exclude the possibility of detecting fairly infrequent but very energetic daemon signals, which become manifest in specific conditions (for instance, when entering a material with a high atomic number).

Disregarding some details in the possible interpretation of the results of our experiments, which at first glance might appear very simple, it can be maintained that we have detected at a C.L. \(\gtrsim 99.9\%\) an indication of the existence of some highly penetrative nuclear-active cosmic radiation whose objects move with low astronomical velocities ($V = 10-15 \text{ km s}^{-1}$). They appear to have an enormous penetrating power and are capable of passing near and through the Earth to populate finally NEACHOs. The main indication of the existence of this superslow radiation is the non-stochastic component in the long-time shifts of signals of two PM tubes viewing phosphor coatings on two parallel plates arranged one beneath the other. This component crowds in the 20 $\mu$s range. The simplicity of our detector system, however, is only apparent, in that in actual fact it is a result of a hard search that has been going on for many years \footnote{6, 7, 11}. The observed intense scintillations originate from a simultaneous ejection of many ($\geq 10$) energetic particles, and the events occurring in the detector, as we have seen, are very complex. The order in which they appear and the manifestation itself depend on a number of factors which might seem to be of minor importance. Revealing these factors and their effectively operating combinations has become possible due to our gradually refining understanding of the various aspects of the problem. If we had not used tinned iron sheets for the scintillator cases, which play a role of not passive but of the essential pieces of detector, or black paper for their top covers, or elements of asymmetry in the scintillator coating orientation, etc., the efficiency of daemon detection would have dropped strongly. On the other hand, the observed distribution with such a well pronounced, narrow shifted peak cannot be produced, say, by neutrons thermalized somewhere outside the detector, or by long-lived nuclear states excited, for instance, by cosmic rays. Obviously enough, because of the unavoidable dispersion in the neutron velocity or nuclear deexcitation times such a distribution would be fairly difficult to produce even deliberately. In our case, with a sweep $\pm 100 \mu$s long, these effects could at best increase slightly the average background level.

Judging from its manifestations and properties, the discovered radiation can be identified in a rather self-consistent manner with daemons, i.e. hypothetical primordial Planckian objects carrying an electric charge and moving in close to the Earth’s orbits. The primary source of this population is apparently the DM of the Galactic disk. The intermediate stage is a SEECHO population producing apparently a $\sim 35-50 \text{ km s}^{-1}$ flux at the Earth at a level noticeably lower than $10^{-4} \text{ m}^{-2}\text{s}^{-1}$, which accounts for our not having yet detected it. It is
a search for similar objects with a local concentration enhanced strongly by the
gravitational action of the Sun and the Earth that has initiated this experiment.
Several modified experiments are currently under way.

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