BIAL Foundation

Project 71/06 Final Report
(March 1, 2007 – February 29, 2008)

1. Identification of the project:

Date: March 1, 2007 – February 29, 2008
Title: The correlation between ultra-weak photon emission and EEG in a study on color perception in the dark.
Project number: 71/06

2. Project leader:

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3. Summary of Activities to Date:

A study has been performed on the correlation between ultra-weak photon emission and EEG, which have been recorded simultaneously. Electrocortical activity is continuously recorded with electrodes located at C3 and C4. Spontaneous photon emission is continuously recorded with a sensitive photomultiplier in the single photon count placed over the dorsum of the hand. Both processes show large fluctuations in time. To study correlations between the two processes a series of transformations is required over pre-selected periods of recording. Both EEG spectral analysis by a Fast Fourier Transform algorithm and photon count distribution analysis were made over 5 sec periods. Such transformations decrease correlations to a large extent. With the newly developed equipment, combining both recordings, this analysis was carried out to find out the limitations in this type of research.

Subjects were recorded in the period from April till December 2007. Each experiment with one single subject was carried out in a single day. An experiment was divided in two parts because a break was required for the subject.
Commonly, each of the two parts of the experiment consisted of a continuous recording of 10 cycles with the following basic structure. After a 3 min pre-exposure, the subject was exposed to the filter for 20 s at the left ear (without touching the head). After the filter exposure, registration of UPE and EEG continued for 6 min prior to the next exposure. This 6 min period is considered as a sequence of a 3 min post-exposure and a subsequent 3 pre-exposure period for the next cycle. By this way, each experiment includes two parts, each part having 10 pre-exposure periods of 3 min and 10 post-exposure periods of 3 min.
A total of 18 experiments was carried out. In 9 of 18 experiments a color filter was placed for 20 s at 6 cm of the left ear. In the other 9 experiments no color filter was used. The

comparison between pre-and post exposure data sets was utilized to study the perception of the color filter in the dark.

Data collected in each 5 s period of a recording cycle were analysed for a.) mean photon emission (mean, SEM), b.) photon count distribution parameters (skewness and kurtosis), c.) 7-13 Hz activity, d.)mean contribution of each 1 Hz band of the EEG spectrum in the range of 7-13 Hz, and e.) laterality for each band.
In each experiment (with a single subject), 720 pretest data sets, 80 test datasets and 720 post datasets were collected. Mean photon emission data of the pre-exposure period were used for normalization data of post-exposures within each experiment and between experiments. A similar normalization was performed for the 7-13 Hz alpha activity. The fluctuations in both photon emission parameters and alpha band activities were analysed by correlation analysis.

Data demonstrated that in the color filter exposure experiments, mean post-exposure values of photon emission strength and 7-13 Hz alpha activity are increased compared to pre-exposure data. This increase is small, but statistically significant. Correlation between fluctuations in alpha activity and photon emission was estimated for each single experiment utilizing the combined set of pre-filter and post-filter data. In several, but not all subjects a correlation was observed.
This correlation was studied in more detail by taking into account the different 1 Hz broad sub-bands within the 7-13 Hz alpha band activity. Correlations become more evident and statistically more significant in sub-bands, but not in all subjects. The correlations are not explained as random events within the large dataset. Instead, the correlations showed two major characteristics. First, correlation occurs in the same experiment for both left and right alpha activities. Secondly, fluctuations in photon emission did not correlate with major alpha activity, but with the more dynamic sub-bands immediately next to it. Thirdly, correlations were observed only in subjects with a relatively high photon emission.

This research project has demonstrated novel and unique data regarding a correlation between fluctuations in the human photon field recorded at the hand and fluctuations in alpha activity. The project has confirmed and extended earlier data regarding the effect of exposure to a color filter. It has resulted in a refinement of the earlier model and new perspectives for future research in regulation of human energy.

4. Detailed Information on the Program to Date

<u>Actual start date of project:</u>
March 1, 2007

<u>Dates of this summary:</u>
March 1, 2007 – February 29, 2008.

<u>Details of research activities in this period of time:</u>

Background and objectives
Novel photonic technology has applied to study human spontaneous ultra-weak photon emission (UPE) suggesting non-classical optical features of human UPE. Photon emission could be explained by assuming photons in a quantum squeezed state. A second line of study has focused on the (physiological) effects of exposing a human subject to a red filter in the

dark. Data suggest that increased photon emission begins almost immediately at the time of filter exposure and that the response is systemic. After removing the filter, photon emission gradually returns to its original level. It suggests that human photons (by reflection from the color gelatin filter) have informational properties. The increased photon emission is indicative for a condition of stress. Preliminary data suggested a decreased 7-13 Hz activity during exposure to a color filter.

Purpose of the study
Photon count distribution fluctuations are possibly correlated with electrical brain activity in the alpha range (7-13 Hz). The main purpose of the present study was two-fold: a.) to study the effect of exposure to a filter comparing UPE and EEG alpha in the period before exposure to the filter (pre-exposure period) with data in the period after exposure (post-exposure period).

Setting and experimental design
The experiment has been accomplished in cooperation with scientific colleagues, who were subject in 18 experiments. To register UPE, the subject placed the right hand in a specially designed table-top photomultiplier. The photomultiplier equipment was installed in the office. The temperature of the office was kept at 17-18°C. The subjects were comfortably situated with one hand in the equipment for photon emission recording and with the electrodes affixed to P3 and P4 as measuring sites and earlobes as grounding and reference for EEG recording. The UPE of the hand dorsum was measured. UPE and EEG are continuously recorded and include a series of consecutive cycles, indicated as pre- and post-exposure periods with intermediate exposures of the subject to a filter at a distance of 7 cm from the left ear. Twenty exposure cycles were planned for each experiment. Experiments were performed in the period April- December 2007).

Each experiment was divided in two parts each part including 10 exposure cycles. The reason for splitting the experiment is the feedback from participants in the initial phase of the research program. If the period of recording is too long, it exceeds the capacity of the participant to remain motivated and keep eyes closed during the entire experiment. Development of stress will have a negative influence both on the stability of the UPE and the alpha signal. It was learned that an entire experiment of 2.5 h was possible only, when it was divided into 2 equal parts.
The protocol of the experiment with filter exposure was therefore set as follows:

a. Subject's dark adaptation and relaxation: 45 min
b. Placement of electrodes on skull and placement of hand(s) in photomultiplier device; testing the recording techniques, including the eyes open – eyes closed responses
c. Recording: start of first cycle of 3 min (pre-exposure) + 20 s (exposure to filter) + 3 min (post-exposure); then repetition for a total of 10 cycles
d. Intermediate period (1 or several h)
e. Recording: another series of at least 10 cycles
f. Discussion with subjects about experimental set-up and experiences during the experiment

Nine experiments were without filter and recording was continued for the time that corresponds with the duration of the filter experiments.

Data collection and analysis: endpoints and measures
Data sets of 18 experiments were collected for detailed analysis. The EEG and UPE data were first examined for artefacts.

EEG data were fast Fourier transformed in 5 s epochs with spectral resolution of 0.128 Hz. The 7-13Hz part of the spectrum was utilized for the calculation of amplitudes of each 1 Hz band width within this range, resulting in amplitudes for each 5 s period of the 7-8 Hz, 8-9 Hz, 9-10 Hz, 10-11 Hz, 11-12 Hz, and 12-13 Hz bands from both left and right brain. Corresponding left and right amplitudes from the same band and time periods are utilized for the calculation of left-right laterality. Coherence was not estimated since data from 5 s periods were found not to be reliable.

Primary photon emission data were collected with a dwell time of 0.05 s. For a comparison between UPE and EEG data, 5 s epochs were utilized in the calculation of photon count distribution analysis. In each 5 s epoch 100 photon count data are available. This set of 100 data was utilized to calculate mean strength of the UPE signal (and variance, standard error of mean, skewness and kurtosis). The UPE data of the pre- and post-exposure periods were used for further comparisons and correlation analyses.

Experimental results

<u>Effect of filter exposure</u>

The effect of filter exposure was estimated by comparing of pre-post filter exposure data on alpha activity and UPE. Between experiments a large variation in both alpha activity and UPE was observed. Alpha (7-13 Hz) activities ranged between 3.2 and 73.9 (arbitrary units), whereas UPE ranged between 0.22 and 1.75 cps. Within a single experiment (between sessions) the difference is small.

The standard procedure for studying the effect of filter exposure was focused exclusively on the pre- and post-exposure periods. The number of data on alpha activity and UPE *during* the filter exposure is small (only 2 per exposure vs. 36 per pre- or post-exposure period) and not sufficient for detailed analysis. The number of pre-exposure data in each of the two sessions of a single experiment was 360. The same number of data was collected in the post-exposure period.

Data demonstrate that in a number of experiments both mean UPE and mean alpha activities were slightly, but significantly different between two sessions of the same experiment. This is expected since a break of several hours was sometimes introduced. Within a session however, pre-exposure and post-exposure periods alternate and no significant differences are expected between pre- and post-exposure data. Nevertheless, significant differences between pre-exposure and post-exposure periods were observed indicating that filter exposure has a systematic effect on UPE and alpha parameters. To estimate the effect, utilizing all available data, requires that data from different experiments have been transformed using a common normalization procedure. All UPE data were normalized with respect to the mean UPE of the pre-exposure periods. The same procedure was followed for the 7-13 Hz activities at left and right brain.

Data demonstrate that post-exposure was significantly increased compared to pre-exposure ($p=0.017$). The 7-13 Hz activity also was significantly increased in the post-exposure period compared to pre-exposure ($p=0.007$).

Control (sham) experiments include the 9 experiments without filter exposure. The data indicate that increased activities did not occur when time periods were analyzed that corresponded to the pre- and post-exposure periods in the filter-exposure experiments.

As part of the normalization procedure, the 1 Hz broad sub-bands within the 7-13 Hz range were expressed as percentage of the total 7-13 Hz band. These data are utilized in the correlation analyses.

Analysis of correlations between fluctuations in 7-13 Hz activity and UPE

The normalized data were used for correlation analysis, utilizing 7-13 Hz data and UPE data from corresponding 5 s epochs.

The major analysis has focused on correlations between:

a.) Fluctuations in amplitudes of 7-13 Hz activity (and each individual 1 Hz sub-band) from left brain with fluctuations in photon strength,

b.) Fluctuations in amplitude of 7-13 Hz activity (and each individual 1 Hz sub-band) from right brain with fluctuations in photon strength

c.) Fluctuations in laterality of 7-13 Hz activity (and each individual 1 Hz sub-band) with photon strength.

Data demonstrate a weak but significant correlation between the fluctuations in UPE and 7-13 Hz activity in 4 subjects. In these 4 subjects, the correlation is observed between UPE fluctuations and the 7-13 Hz activity fluctuations of both the right and left brain. The correlation is not explained by chance.

It was tested whether the 4 subjects that show a correlation between fluctuations in photon strength and both the 7-13 Hz activity from right as well as left brain have special characteristics in either photon strength and/or 7-13 Hz activity.

Data demonstrated that the correlation was observed only in subjects with a relatively high spontaneous photon emission ($r=0.725$; $p=0.000$). Correlation was not dependent on 7-13 Hz activity ($r=0,079$; $p=0.753$).

Although the correlations in 4 subjects were significant, the correlation was negative in 3 participants; it was positive in 1 participant. The positive correlation was for both brain sides in that subject. Similarly, the negative correlations were in all three subjects for both brain sides. These data suggest a dual type of regulation.

The correlation was studied in more detail by analyzing each individual 1 Hz sub-band activity (within the 7-13 Hz range) for its correlation with UPE strength. Data have demonstrated that significant correlations of UPE strength with the 1 Hz sub-bands of alpha were mainly found in sub-bands corresponding with the shoulders of the major alpha peak(s). These major peaks could vary between subjects and consequently between experiments. The special character of these sub-bands is obvious during (replay of) EEG recordings. These sub-bands varying in width up to 1 Hz, move up and down, appearing and disappearing continuously.

Discussion and conclusions:

This research project has demonstrated novel and unique data regarding the correlation between fluctuations in the photon field recorded at the hand and fluctuations in alpha activity recorded at the left and right side of the brain. The project also confirmed and extended earlier data regarding the effect of exposure of human subjects to a color filter in the dark. It has resulted in a refinement of the earlier model and perspectives for research in human energy.

The data were obtained with a specially designed device that records low photon emissions with good signal-noise ratio at room (approximately 18°C) temperature. The photomultiplier is sensitive within a range of 300 and 600 nm. Photon counts are not due to body heat radiation in the infrared range. In fact, extensive evidence has been collected indicating the free radical origin of this radiation.

The conclusion from the present data is that a correlation can be detected under certain conditions of photon strength (probably signal-noise ratio). The correlations are not randomly scattered throughout the data matrix. Instead, correlations were systematically observed between fluctuations in photon emission and both the fluctuations at the left and the right 7-13 Hz activities. Correlations show up with specific areas in the 7-13 Hz activity. Alpha activity in sub-bands just on the sides of the main peak show the highest correlation. This is interesting, since these side areas show the highest fluctuations. Apparently, these fluctuations in EEG correlate most with photon emission of the hand. However, the correlation is rather small. This was expected for several obvious reasons. A first explanation is that photon emission intensity seems a limiting condition. Relative high photon emission levels are required to detect correlations. This is explained by the contributions of electronic noise in the recorded signal. Data suggest that signal must be at least in the same order as the signal. There is no possibility to make corrections when utilizing 5 s recording periods. In previous publications we have shown that a recording period of more than 60 s is required for a reliable mean value. Human photon emission show both fast (< 1 s) and slow (up to 15 s) fluctuations. A second explanation is a phase difference between the two processes, Such time frame shift results in lower correlations than when events are synchronous.

An interesting finding is the dual type of correlation. In the four subjects that show correlations between fluctuations in photon strength and alpha activity, this correlation was negative in 3 subjects and positive in 1 subject. This observation may be related to results reported in literature indicating that not all individuals react to an increase in alpha activity with relaxation. Instead, some react with more tension.

Originally, our experimentation started from a highly speculative point of view. We presumed that the use of a color filter in the dark was considered as a mean to influence the photon field around the head and the total body photon field. With the present knowledge it is possible to define the conditions to collect additional data more efficiently and to study more precise the effect of both exposure and withdrawal of the color filter (in dark) on two phenomena – UPE and EEG - that reflect the dynamics of human electromagnetics.

5. Outcomes and work in progress

Manuscript in preparation

Saskia Bosman, Eduard P.A. Van Wijk, Roeland Van Wijk. – Correlation between photon emission intensity and EEG activity. Manuscript in preparation.

Eduard P.A. Van Wijk, John M. Ackerman, Saskia Bosman, Roeland Van Wijk – Bio-informational aspects of the human ultra-weak photon emission field. Manuscript in preparation.