

Interactive comment on “Influence of a component of solar irradiance on radon signals at 1 km depth, Gran Sasso, Italy” by G. Steinitz et al.

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We thank the reviewer (S. Giannanco) for his detailed review and the constructive points which were raised.

Many of the main remarks parallel those made by the editor and the reader is therefore also referred to our response to the editor.

The main concern of the reviewer relates to the eventual influence of environmental factors on the radon pattern. Here we would like to make several preliminary remarks:

1. Reviewing the abundant literature on radon variation in semi-confined and subsurface situations one notices that a large span of different views exists as to eventual influence of pressure and/or temperature. The evolving picture is that this is an “unex-

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plained” issue.

2. So far no explanation has been put forward as to the specific property of radon which enables its unique behavior, especially for example when compared to other noble gas components.

3. Our experience from extensive field investigations is that variation of environmental parameters do not explain the systematic phenomena observed in radon time series at subsurface locations.

4. Recently we could demonstrate experimentally that radon signals are observed under confined conditions, and that these signals are unrelated to the local environmental variations.

In the revised manuscript we present improved examinations of the eventual link between air pressure variation and radon signals at the site. This was done by analysis in: a) the time domain - by presenting statistical tests (Kendall rank test) of the relation between pressure and radon and the gradient of pressure and radon. b) the frequency domain – by presenting spectra of pressure and radon covering the whole monitoring range

Radon time series contain wave forms of durations similar to those occurring in ambient temperature and barometric pressure. This similarity leads to difficulties in interpreting analysis performed only in the time domain or only in the frequency domain. A more indicative approach to overcome the resulting ambiguity is to analyze the features in the frequency-time domain. This we did in figures 12-16. On this issue see also the response to the editor.

The suggestion that the unique pattern of radon at LNGS is due to an influence of a component in solar irradiance is presented based on: a) failure to explain the variations by environmental factors; b) the unique patterns observed in the frequency-time domain and c) similarity with other cases – in the natural environment and in experi-

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ments.

The investigation conducted at LNGS (in 2006-7) was of an exploratory nature, i.e. to obtain information on radon signals in subsurface air using a methodology developed elsewhere, and to compare the outcome with results gained at other geological sites. The reviewer is mistaken – studying the effect of solar irradiance on radon emissions was not the target of the investigation. This activity was abruptly discontinued, before processing of the data. Only at an advanced stage of the evaluation and in parallel to developments in other investigations (experiments) we conducted did the idea of a solar influence come up. At the time the investigation was performed we did not think of neutrinos as an involved option. Nevertheless, we certainly hope that this outcome will stimulate and promote at LNGS a targeted investigation of the issue and its implications.

Specific Comments:

Reviewer: All plots for FFT spectral analysis should be carried out for the complete data set, that means for all parameters available and for the whole duration of the experiment, not just for short (and different) periods.

We revised Figure 10 and present FFT plots which cover the whole monitoring range (gamma). We used four continuous data segments (with gaps between them) which cover the monitoring interval. The outcome is representative for the whole span of the investigation.

Reviewer: Figures 12 to 16 are probably redundant and could be merged into only one figure.

We disagree – please see our response to the editor.

Interactive comment on Solid Earth Discuss., 4, 1511, 2012.

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