



Diurnal oscillations in radon decay data from a long-term (~3.5 year) directional Enhanced Confined Mode (ECM) experiment: New insights into possible extra-terrestrial influences

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Tracking gamma-ray activity of radon (^{222}Rn) using different configurations of an enclosed chamber - termed "Enhanced Confined Mode" (ECM) - have been investigated by our group since 2007. Fluctuations and oscillations on different time scales, i.e. diurnal (24-hour), around 30 days, and annual (365 days), in ^{222}Rn data have been observed and reported previously by us. The present investigation relies on a specific setup consisting of two NaI ($2\times 2''$) gamma-ray scintillation detectors placed at the ends of two cylindrical volumes (570 cc) [1]. The co-aligned cylinders and detectors are positioned in the following way: a) one (#1) in line with the Earth's axis of rotation; b) one (#2) vertical and perpendicular (90°) to setup #1. ^{222}Rn is supplied by diffusion from a commercial source (^{226}Ra ; activity: $\sim 105\text{Bq}$). A carapace of Pb shielding is enclosing the detectors and cylinders. Measurements started in June 2014, aimed to further investigate the origin of the fluctuations and oscillations.

Analysis was performed using the available ^{222}Rn data (~ 3.5 year) consisting of decay signals (from both detectors), temperature data from within the system and data of voltage fluctuations of the battery used. The present analysis focused on the amplitude modulation (AM) of the diurnal oscillation. The data were filtered and block-averaged in 24 h windows. 24 h blocks of all signals were correlated and the time-dependence of the correlations was analysed with regard to frequency and phase.

The analysis revealed that the AM of the diurnal oscillation of ^{222}Rn decay (i) varies spatio-temporally, (ii) is possibly correlated to systematic local factors (temperature, battery voltage) in a complex way, and most importantly (iii) is correlated with variations of the Sun-Earth distance, Sun's excursion relative to the celestial equator, equinoxes and the Earth's speed with respect to the Galactic rest frame.

The results demonstrate the complexity of the factors modulating the measured ^{222}Rn activity, as well as indicate that the orientation-dependence of the measured ^{222}Rn activity (anisotropy) might possibly be used to obtain information about the rotation and movement of the Earth through space.

[1] Steinitz, G., Kotlarsky, P., Piatibratova, O., 2015. Observations of the relationship between directional-ity and decay rate of radon in a confined experiment. *Eur. Phys. J. Special Topics*, 224, 731–740 (2015)