

# Similarity of subcardian and sharp variations of the cosmic ray intensity to the heart variability

**Petropoulos B. (1)**, Mavromichalaki H.(2), Papailiou M.(2), Kelesidis K. (3) and Mertzanos G. (3)

1. Research Center of Astronomy and Applied Mathematics, Academy of Athens, Soriano Efessiou 4, 11527 Athens Greece vpetrop@academyofathens.gr, (2) Nuclear and Particle Physics Section, Physics Department, University of Athens, 15771 Athens Greece emavromi@cc.uoa.gr , (3) Cardiological clinic of the KAT Hospital , Kifissias 4, Athens Greece

(emavromi@phys.uoa.gr / Fax: 30 210 7276987 / Phone: 30 210 7276890 )

In this paper we examine the relationship between the daily variation of cosmic ray intensity, as it is measured by the Neutron Monitor of the University of Athens (<http://cosray.phys.uoa.gr>) and the average daily and hourly heart frequency of patients, with no symptoms and no hospital admission, of the cardiological clinic of the KAT Hospital. This work involves the years from 2002 to 2005, which represent the descending phase of the present solar cycle. Periodicities of 2, 3, 4, 6, 8 and 12 hours were found through Fourier analysis of the hourly data of cosmic ray intensity. These periodicities match the circular variations, for the same period, found with the method of successive approximations, in a 24hour base, in the cosmic ray intensity as well as in the average heart frequency for certain days, when Holter was used. This similarity suggests that the cosmic ray intensity variations are connected with heart frequency variations. During intense cosmic rays variations, produced by strong solar phenomena like Forbush decreases and relativistic proton events, the amplitude of the circular structure takes its minimum value in both series of data. It is shown that disturbances in the heart rate are connected with the sudden variations of cosmic rays intensity during this kind of events. The results will be extremely useful in the future study of Space Weather and its effect on human activities in space and in human health. In this investigation we are interested in how the cosmic rays and the geomagnetic field, during magnetic storms, affect the autonomous nervous system and can cause myocardial infarctions and ischemic strokes among others