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Jovian electrons and magnetic traps with inner acceleration regions

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Simultaneously with 27-day variations of Jovian electrons of MeV energies, observed during the deep solar minimum in 2007-2008 in 14 consequent solar rotations, short duration (2-3 days) enhancements of the fluxes of 0.1-1 MeV electrons and protons were registered. These enhancements took place at each solar rotation simultaneously at SOHO (EPHIN and LION) and ACE (EPAM) and appeared earlier and later at STEREO B and STEREO A (SEPT), respectively, usually before the flux of high-energy Jovian electrons started to rise, so the lower energy peaks did not coincide with their maxima. The Sun was extremely quiet throughout the whole period considered (no 10.7 cm radio or soft X-ray emission) and could not be the origin of these low energy particles. We consider the hypothesis that a magnetic trap with trapped Jovian electrons, corotating with the Sun, had some specific regions - "ridges"- inside with enhanced level of turbulence capable to accelerate electrons and protons to energies up to 1 MeV. The formation of such a "ridge"is natural at the front part of the trap; differently located accelerating regions may appear under invasion of new field lines into the trap. These ridges are rather stable, much of them are observed during few solar rotations, disappear and appear again, initiating series of short-living risings of low energy electrons and protons, separated by 27-day intervals. According to this hypothesis, electrons registered during 2007-2008 solar activity minimum have two components: (a) periodic 27-day gradual Jovian-originated variations; (b) quasi-periodic short (3-4 days) increases of low-energy electrons and protons, accelerated directly inside magnetic trap. Numerical simulations to model the propagation of energetic protons and electrons in the presence of such magnetic configuration is presented.

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