SPECTROMETER FOR NEUTRON AND GAMMA-RAY DETECTION AT THE DISTANCES LESS THAN 100 SOLAR RADII FROM THE SUN

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Solar neutrons with energies <5 MeV can't be detected in the near-Earth space due to the both its decay and decreasing of its fluxes with distance from the Sun. So solar neutron observations near the Sun compared with near-Earth ones allow studying acceleration of ions up to significantly smaller energies, what happens considerably more often. Besides that near-Sun low energy neutron observations are important for search for non-flare ion acceleration on the Sun. For project InterHelioSound we have proposed spectrometer of neutrons with energies 0.05-5 MeV. LiI(Eu) crystal 4*3 cm enriched in ^{6}Li (96%), surrounded by a plastic scintillator 1-3 cm thick loaded with ^{10}B is used as a detector. Neutrons will undergo elastic scattering with the hydrogen in the plastic. A delayed coincidence within a window of 0.1 – 10 μs in either scintillator is a signature of a neutron, with the initial fast plastic signal pulse height being a direct measure of the incident neutron's energy. A fast charged particle will produce simultaneous signals in both scintillators and will be vetoed. Gamma's with energies 0.03-10 MeV will be identified too as signals in LiI alone. Neutrons with energies >5 MeV interacting with nuclei of Li and I will be detected as signals in LiI alone too. Monte-Carlo simulation of the delayed coincidence mode of neutron detection by the instrument is performed. Response function, energy and angle dependencies of the effective area are calculated. Calculated effective area for normal neutron incidence varies from 5.6 cm^2 for 0.1 MeV to 0.3 cm^2 for 5 MeV. Estimated effective area for gamma detection is 3-12 cm^2. Mass of the instrument is not more, than 1.5 kg.