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Access of solar wind MeV ions in Saturn's innermost magnetosphere

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During the occurence of two, large scale Solar Energetic Particle Events (SPEs) in 2005, Cassini's MIMI/LEMMS instrument measured a new element in Saturn's radiation belts, centered at the orbit of Dione ("Dione Peak"). This new radiation belt element showed enhancements in ions of 40 keV/nuc - 8 MeV/nuc, in a region where previously mostly background was measured above energies of about 1 MeV/nuc. The coincidence with the two SPEs showed that Dione Peak is originating from the solar wind, the activity of which also modulates its structure. Both appearances of the "Dione Peak" were followed by a slow decay of its total flux for two reasons: (a) the SPEs were short lived and the new radiation belt was not continuously supplied with energetic solar wind particles and (b) the ions within the "Dione Peak" slowly diffused radially inwards and they were depleted as they were crossing the orbit of Tethys. We also investigated whether MeV ions from the Dione peak can succesfully cross the orbit of Tethys while diffusing inwards and supply the innermost radiation belts with particle flux. The results show no modulation of the MeV ions in the innermost radiation belts during the occurence of SPEs, which suggests that MeV ions inside L=5 originate only from secondary products of galactic cosmic rays. Therefore the icy moons shield effectively the inner magnetosphere from energetic ions. We also briefly investigate the effects of the SPE events in the energetic ion spectral structure of the middle magnetosphere and in the intensity of the planetary ring current.