EARTH'S RADIATION BELTS AFTER OBSERVATIONS FROM THE VAN ALLEN PROBES MISSION: MAIN DISCOVERIES MADE AND THE SCIENTIFIC CHALLENGES THAT REMAIN

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The Earth's radiation belts were discovered by the Explorer I mission late in 1958. Since their discovery, the research on the physics of charged particles trapped in the Earth's magnetic field attracted much attention from the scientific and technological community, which aspired to understand particle dynamics and also to deal with the so-called "killer" electrons traveling at geosynchronous orbit. However, the technological progress had to build-up by more than fifty years to culminate with the twin Van Allen Probes: high-level spaceborne platforms with identical state-of-the-art, radiation-hardened instruments capable of withstanding an aggressive environment such as the Van Allen radiation belts. Throughout this period, the scientific community employed efforts to understand how solar wind drives the magnetospheric physical mechanisms acting at the trapped particle populations. Thenceforth, several discoveries have been done about the physical mechanism acting on accelerating particles, creating a transient fourth-structured radiation belt, or long quiescent period of extremely low particle flux and so on. As a consequence, outstanding questions still hold without a complete solution, such as for which solar-terrestrial coupling configuration, the energetic electrons are withdrawn from the radiation belts region, or can the radiation belt particle flux be forecasted in adverse conditions, yet for where particles are sending when they are untrapped to the geomagnetic field. In this talk, we will present the basic concepts relay on Earth's magnetosphere, physics of radiation belt in Earth-like planets and we will take the advantage of Van Allen Probes mission period of flight, to present the main discoveries made so far, how the scientific groups works and finally, we will present the efforts made to get resolved the remained open questions.