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AKR Emission on Earth, Jupiter, and Saturn: A Comparative Review of Recent Results

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Auroral Kilometric Radiation (AKR) is the most powerful radio emission from planetary magnetospheres, and is a important probe of the plasma environment of the inner magnetosphere. Recent Cluster-based studies of terrestrial AKR, and Cassini studies of Jovian decametric (DAM) and Saturnian kilometric radiation (SKR) highlight many similarities, but also significant differences. While the basic radiation emission mechanism (cyclotron maser instability) appears to be common to all three planetary systems, the unique physical environment of each system results in very different observed properties. For example, the longitudinal distribution of AKR sources on the three systems is quite different, probably a result of the differing geometry of solar wind penetration into the respective magnetospheres. Likewise, the angular beaming pattern of AKR, although narrow in all three cases, may be modified by the local plasma cavity geometry at the AKR sources and/or differing electron velocity distributions (loss-cone vs. shell). Fine-scale drifting frequency structures (SAKR on Earth, S-bursts on Jupiter and Saturn) have been interpreted as evidence of upward-traveling ion solitary waves on Earth, but may be a result of trapped Alfven waves on Jupiter. The variation in observed AKR properties in our solar system allows an informed guess at scaling laws for AKR emission with planetary magnetic moment and distance from the parent star, which can inform searches for AKR emission from extra-solar planets.