ガニメデ磁気圏の非MHD的特徴について：ガリレオ探査機データに基づく極冠領域における波動ー粒子相互作用の調査

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Non-MHD Aspects of Ganymede's Magnetosphere: Wave-Particle Interaction from Multi-Instrumental Observations by Galileo

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Basic characteristics of Ganymede's magnetosphere were revealed based on in-situ measurements by Galileo spacecraft during six encounters (e.g., particle dynamics by Williams et al. 1997a, b, 1998, 2001, 2004). Recently, global configuration of the magnetosphere and interaction with Jovian magnetosphere are also intensively investigated based on MHD simulations (Jia et al., 2009, 2010). However, non-MHD characteristics of Ganymede's magnetosphere have not been discussed in detail yet. For example, wave-particle interactions, ion kinetics, and polar field aligned particle accelerations excited via Jupiter-Ganymede interactions. This study addresses ion kinetics and related wave-particle interaction process in Ganymede's magnetosphere based on multi-instrumental observations Galileo spacecraft. G02 orbit was selected for investigation of Jupiter-Ganymede interactions because only during this pass Galileo went through the polar cap region where Jovian magnetosphere and Ganymede's magnetosphere are strongly connecting with each other. Observations of high and low frequency wave, particle energy spectra, and pitch angle distribution revealed large amplitude perturbation field at low frequencies accompanied by strong ion anisotropy with upward directed loss cone above polar cap. Theoretical consideration about cyclotron resonance process suggested that these perturbation fields are downward propagating ion-related wave whose Poynting flux was estimated to be comparable to that of low energy electron kinetic energy precipitating from Jovian magnetosphere. This suggests significant energy input of the low frequency waves onto the polar ionosphere of Ganymede, which could be responsible for ionospheric heating like Earth's polar ionosphere.