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Modeling of the Atmospheres of the Galilean Satellites of Jupiter

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Study of the atmospheres of the Galilean satellites has long been one of the main science goals about the Jovian system since the historic Voyager flybys of Jupiter. Since then, numerous ground-based observations, together with data from the Hubble Space Telescope (HST), and the recently completed Galileo mission have provided scientists a wealth of information about these satellites. It has now been confirmed that each of the four Galilean satellites posses a tenuous atmosphere of it own, with SO2 being the primary species on the volcanic active Io; O2 and others water by-products being the main constituents on the three icy moons: Europa, Ganymede, and Callisto. Not only are these atmospheres scientifically interesting in their own right, but they also play an important role in the understanding of the Jovian system in general. For instance, it is believed that most of the primary ions in the plasma torus originate from ionization of species in Io's atmosphere, and that the minor species in Europa's atmosphere can provide valuable hints to the composition and evolution of the surface materials below which an ocean exists.
In this talk I will briefly summarize our current knowledge of these atmospheres and discuss the unique theoretical aspects related to modeling of these atmospheres, for they fall into a class of atmospheres that lies between being collisionally thick (continuum) and collisionally thin (ballistic).